UNDERSTANDING SUSTAINABILITY IN THE BUILT ENVIRONMENT. A FRAMEWORK FOR EVALUATION IN URBAN PLANNING AND DESIGN

Patrizia Lucia Lombardi

T.I.M.E. Institute

Department of Surveying

University of Salford, Salford, UK

Submitted in Partial Fulfilment of the requirements of the Degree of Doctor of Philosophy, September 1999

To my brother, To my father

Contents

Tables and Figures

Acknowledgements

I wish to express my appreciation and thanks to my supervisor, Professor Peter Brandon, for his support, especially for his patience, his continuous assistance, guide and understanding in the course of this research.

I am also very grateful to Dr Andrew Basden of the University of Salford who firstly introduced to me the philosophy of Dooyeweerd which has been adopted in this study, providing a number of references and critical formative discussions on this matter.

During the process of development of this research, I took part in a number of International and European workshops on the subject of sustainability and I myself conducted a number of field studies, both individually and jointly, which have been of benefit for the development of this research.

I am also part of a European network that I have inaugurated and helped establish, named Bequest (Built Environment Quality Evaluation for Sustainability through Time). Many discussions undertaken within this network have provided relevant feed-back to this PhD study, increasing my understanding of the subject and facilitating access to relevant information. The network has itself been a base for debating and verifying many research findings throughout the process of developing this PhD study. As a consequence of this, I am also grateful to all Bequest members and particularly to its director, Steve Curwell of the University of Salford.

I finally wish to sincerely thank my relatives and friends Mary, Giulio and Cesare who put up with me and encouraged me during this period, facilitating the completion of my work.

Declaration

In the course of this thesis, some parts of the research resulted in several publications. The publications are:

1. Lombardi P.L., 1999, Aspetti di sostenibilità e approcci di valutazione. Illustrazione di un sistema decisionale di tipo multimodale, in Proceedings of the *XXIX CeSET Seminar*, Padoa, 8th October (forthcoming)

2. Lombardi P.L. and Nijkamp P., 1999, A new geography of hope and despair for the periphery. An illustration of the Border Temple Model, in Proceedings of the *Geo-Symposium of the Aegean: Geographies on/of/along the EU border*, Mytilini, 23rd – 27th June (forthcoming)

3. Lombardi P.L., 1999, Riferimenti metodologici e strumenti di valutazione per la sostenibilità urbana, in Lombardi and Micelli (eds.), *Le misure del piano*, Angeli, Milan, pp.96-114

4. Lombardi, P.L., 1998, Sustainability indicators in urban planning evaluation, in Lichfield et al. (eds.), *Evaluation in Planning*, Kluwer Academic Publishers, Dordrecht, pp.177-192

5. Lombardi P.L., 1998, Managing sustainability in urban planning evaluation, in Brandon (ed.), *Managing Sustainability: Endurance through change*, Proceedings of the CIB World Conference on Construction and the Environment, Symposium D, Gavle, Sweden, 7th – 12th June, pp. 2041-2050

6. Lombardi P.L. and Basden A., 1997, Environmental Sustainability and Information Systems, *Systems Practice,* vol. 10, n. 4, pp.473-489.

7. Lombardi P.L. and Brandon P.S., 1997, Toward a multimodal framework for evaluating the built environment quality in sustainability planning, in Brandon et al. (eds.), *Evaluation in the Built Environment for Sustainability,* E&FN SPON, Chapman & Hall, London, pp.6-21

8. Lombardi P.L. and Marella G., 1997, A multi-modal evaluation of sustainable urban regeneration. A Case-Study related to ex-Industrial Areas, in Proceedings of the Second International Conference on *Buildings and the Environment*, CIB-CSTB, vol.2, Paris, 9th – 12th June, pp. 271-279

9. Lombardi P.L., 1997, Decision making problems concerning urban regeneration plans, *Engineering Construction and Architectural Management*, v.4, n.2, pp.127-142

10. Brandon P.S. and Lombardi P.L., 1995, L'approccio multimodale per la valutazione della qualità dell'ambiente costruito nella pianificazione sostenibile, *Genio Rurale*, n.12, pp.57-63

11. Lombardi P.L., 1995, Evaluating sustainability at a local planning level, in Cole et al. (eds.), *Linking & Prioritising Environmental Criteria*, Proceedings of the International Workshop CIB TG-8, Toronto, 15th – 16th November, pp. 89-100

12. Lombardi P.L., 1995, Non-market and multicriteria evaluation methods for public goods and urban plans, in Proceedings of the International Conference on *Financial management of property and construction*, Newcastle, Northern Ireland, 15th – 17th May, pp.231-245

Abstract

It has often been recognised that planning and design can play an important role in the achievement of sustainable development of cities. However, problems still exist with regards to both a clear understanding of sustainability in the built environment and a means of evaluating it within the context of urban planning and design.

This thesis has compared different evaluation methods in urban planning, both ex ante approaches and monitoring, and their philosophical paradigms. Some significant limitations are identified and discussed in the context of sustainability, such as the reductionism within many of the approaches and the lack of holism in the evaluation. The identified deficiencies provide the motivation for the development of a new framework which is able to integrate the different dimensions of sustainability in the built environment. This is based on the Cosmonomic theory of Dooyeweerd which has proved to be more appropriate than other philosophical paradigms in achieving this task.

The theory is applied to the built environment for understanding sustainability and developing a framework in planning evaluation. The framework helps decision makers to critically identify the sustainability aspects involved in a (re)development planning project, guiding them in the evaluation on the basis of a number of problem solving methods. Some existing case studies are adopted to show the benefits of the framework in the context of regeneration programmes for cities, management policies for cultural heritage and environmental services.

The resulting framework provides a significant step forward in understanding and evaluating the built environment in the context of a sustainable urban development. It also has the potential to allow evaluation of the concept of sustainability over time.

Chapter 1.0 – Introduction

What we observe is not nature itself, but
nature exposed to our method of questioning
(W.Heisenberg)

Sustainability is a holistic concept with a world-wide scale of reference. The concept of sustainable development has received recognition by the 'collective' global community through a number of international forums and reports since the late eighties (WCED, 1987; UNCED, 1992; EGUE, 1994; EEA, 1995, UNCHS, 1996). The main principles of sustainable development outlined by these forums are:

- a need to consider, in an integrated way, the wider economic, social and environmental implications of our decisions and actions;
- a need to take a long-term rather than a short-term view when taking decisions and actions;
- a need to provide information for all citizens and the opportunity for them to participate in decision-making processes.

The World Commission on Environment and Development - *Brundtland Report* (WCED, 1987) - gave the benchmark definition of sustainable development as *meeting the needs of the present generation without compromising the ability of future generation to meet their own needs.*

As the notion gains recognition, many are offering definitions or characterisations of it either explicitly or implicitly. Implicit characterisation of sustainability occurs when a writer shows concern that some important aspect has been given too much attention or another has been given too little, and argues for the importance of the latter.

Comstock (1995) thinks that ecocentrism has been taken too far; we need an individualistic 'extensionism'. Holland (1995) believes similarly that we must reach beyond the concepts that ecology supplies and proposes a historical approach. Brennan (1995) believes that too much emphasis has been given to economic and quantitative criteria and argues for a pluralist perspective. DeWitt (1995) and Waters (1995) believe that the importance of religion has not been sufficiently recognised.

An implicit characterisation is often a side issue in a paper devoted to other issues. Because implicit characterisations point out a single missing aspect, and invite us to adopt it, they are of limited value to us on their own. To address the issue of sustainability as a whole we must seek explicit characterisations which take a broader view and seek to enumerate all the aspects that are important (Lombardi and Basden, 1997). They provide a framework within which to set the various implicit characterisations. However, there are many explicit characterisations and they differ not just in level of detail but in what aspects they consider important.

Merret (1995) suggests a definition of sustainability which is applied to society and concerns species, habitats, quality of life, economics and material and cultural needs. Voogd (1995) emphasises quality concepts, such as environmental quality and quality of life. Both authors seem critical with regards to an effective translation of the concept into practice. In particular, Merret argues there is a paradox behind the concept of sustainability, that is, the need to sustain the environment and, at the same time, sustain the flows of production and consumption necessary for the reproduction of human beings. Voogd suggests that quality concepts are more useful in guiding planning decisions since sustainability is not operational nor predictable and the emphasis on future generation needs may be misleading in planning.

Moffat and Campbell (1998) acknowledge that the concept of sustainability embodies three main spheres of interest, and specifically, Ecological, Economic and Social, and suggest focusing on those aspects that tend to be mutually supporting. Fusco Girard and Nijkamp (1997), argue that sustainability deals with four spheres, including the Institutional one, which is probably the most important. Yet, Camagni (1996) provides a distinction between the Natural Environment and the Physical-Cultural (built) Environment, thus, acknowledging five different separate spheres of interests in sustainability.

There is an "ecological economics" vision of the problem which is reflected in a definition of sustainability by Pearce (1993) as follows: "ensuring that substitute resources are made available as non-renewable sources become physically scarce, and that the environmental impacts and wastes arising from resource use do not exceed the earth's assimilative capacities". However, there is also a pragmatic view which is offered by the UK's National Sustainable Development Strategy (HMSO, 1994), as follows: 1) Most societies want to achieve economic development to secure higher standards of living, now and for future generations; and 2) They also seek to protect and enhance their environment, now and for their children.

An extensive collection of definitions is still available, e.g. in Pearce et al. (1989). More recently, Palmer et al. (1997) and Camagni (1996) have tried to classify all the definitions of sustainability according to different dimensions. The first paper uses the four sustainability principles identified by the PICABUE approach (Mitchell et al., 1995): futurity (a concern for future generation), social equity (a concern for today's poor and disadvantaged), public participation (a concern that individuals should have an opportunity to participate in decisions that affect them) and environment (ensuring that human activities do not threaten the integrity of ecological systems). The second paper by Camagni classifies all the approaches to sustainability as follows:

(a) *input* or *output* oriented approaches, according to their emphasis on, respectively, limitation in the use of non-renewal resources ('strong' sustainability), and guarantee of well-being in the long term ('weak' sustainability); and
(b) approaches based on 'substantive' or 'procedural' rationality (Simon, 1982), in relation to the scientific theory to which they refer, respectively, neo-classical economy and decision theories.

Sustainability is still a difficult notion to define in substantive terms, but if planners are to operate in such a way as to produce sustainable communities or urban development then the meaning of sustainability must be clear and agreed on.

An obstacle to this goal is the multi-aspectual nature of sustainability. ***It may remain an academic idea, a 'fuzzy buzzword'*** (Palmer et al., 1997) ***or a 'paradox'*** (Merret, 1995), ***unless we develop a clearer understanding of which dynamics and mechanisms are required to transform the sustainability principles into practice.***

1.1 Overview of the main Evaluation Approaches to Sustainability

Alongside all the varied measures deployed in the quest of sustainability, land-use planning and urban design have been assigned an important and integrating role by governments in many of the countries of the European Union.

The role of planning becomes one of contributing to the reconciliation (through its well-established channels of consultation, policy generation, land use control, constructive guidance and conflict mediation) of the seemingly incompatible but equally admirable aspirations embodied in the '*paradox*' of sustainability (Selman, 1995; Merret, 1995).

Among others, Nijkamp and Scholter (1993) have recognised that sustainable city development and sustainable land use may be two sides of the same coin, even though the interactions are not always clearly understood.

The urban form, structure and land-use are important, affecting the quality of the urban environment and the impact of urban settlement on the regional and global environment. A city's form and land-use may determine the efficient use of energy, materials, water and space (Breheny, 1992). Yet, the density and location of urban activities as well as the provision of infrastructure also affect travel patterns and petrol consumption and hence the level of emissions from urban transport (Stanner and Bourdeau, 1995).

The complex nature of land use in relation to institutional settings and various driving forces has been extensively described in a recent report by LUCC (1995). However, despite many advances in spatial-dynamic diagnostic land use modelling, many mechanisms and drivers are still poorly understood, so that also spatial forecasting becomes problematic (Mitchell, 1999a; Nijkamp and Scholten, 1999).

An understanding of the complex relationships between the different factors and functions of the built environment contributing to urban sustainability is essential to the progress of scientific knowledge and to current decision making. This should also be shared and agreed on in a public arena in order to make progress towards the achievement of well being within to local community in the long term.

The principle of sustainable development has become a yardstick of contemporary local planning and urban design (Healey, 1992; Selman, 1996; Mitchell, 1999a).

One of the main contributions to the debate on sustainability in planning and design is the particular concern for the ethical issues of preserving the *quality of the environment* and ensuring a non decreasing level of *quality of life* for current and future generations, including the possibility for all stakeholders and concerned citizens to participate in decision making processes. The above issues can be recognised in the well-known sustainability principles of intra-generational equity, infra-generational (social) equity, subsidiarity, transfrontier responsibility and the precautionary principle suggested by the Rio Declaration (UNCED, 1992).

At present, the issues related to a quality of life (such as efficiency, security, functionality, amenity, etc.) and those related to environmental quality (such as vitality, prosperity, density, etc.) are still often conflicting, particularly in planning for the built environment (Voogd, 1995).

The need for a greater integration at a level of local decision making is often emphasised in literature, via the concept of a "co-evolutionary interdependence" between the physical environment and the human environment (Pearce et al., 1990; Nijkamp and Perrels, 1994; Camagni, 1996; Fusco Girard and Nijkamp, 1997, etc.).

In the words of Capello, Nijkamp and Pepping (1999), "sustainable cities aim at achieving a balanced (co-evolutionary) development in which economic forces (e.g. efficiency), social consideration (e.g. equity and access to facilities) and environmental concerns are brought together from the viewpoint of a *green society*" (Pearce et al., 1989).

Much of the early work on sustainable cities was focused on the ecological dimension of the problem, as reflected in the policy agendas of various local authorities. In literature, this is reflected in the concept of 'metabolism' which aims at showing the demand for materials which give rise to resource depletion and pollution (Nijkamp, 1991; Capello et al., 1999). On the other hand, the softer and more 'fuzzy' dimensions of urban sustainability (e.g. political, social, cultural, aesthetic, and so forth) are still poorly addressed, yet, contemporary analytical tools do not sufficiently handle them (Bocchi e Ceruti, 1994; Nath et al., 1996; Mitchell, 1999a).

There is a serious lack of understanding regarding the complex dynamic interactions and feedback effects of socio-economic-technological activities and the earth's surface, not only in general, but also in specific circumstances (e.g. urban areas, recreation sites). Consequently, there is still the need to incorporate sustainability principles and criteria in current decision making processes (Nijkamp and Perrels, 1994; Camagni, 1996; Brandon et al., 1997; Lichfield et al., 1998).

According to Brandon (1998), the real problem is not sustainability itself but the *management* of sustainability as the latter is a dynamic phenomenoum, a process and not a status quo. This is summarised in the expression "Endurance through change" (Brandon, 1998). However, devising strategies for the sustainable development of cities is difficult nor 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 (BEQUEST, 1999).

Mitchell (1996) suggests that effective urban sustainability strategies and sustainable development plans can best be identified by ensuring that decision makers and developers are adequately briefed on sustainability issues, local characteristics and community needs.

This process can require the application of a suitable operational framework, an evaluation method or approach 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*** (Mitchell, 1996).

Within this context of sustainable development, the debate has moved slowly from the ground of conceptual definition to the problem of evaluation.

By 'evaluation', it is generally meant a technical-scientific procedure for expressing a judgement, based on values, about the impacts of a policy or of an action on the physical (natural and/or built) environment, or for assessing the effects of these impacts on the community (Bentivegna, 1997).

An example of the variety of current evaluation approaches to sustainability in planning and construction is illustrated in Brandon et al. (1997). For instance, it has been recognised that developers of assessment models for sustainability at the urban scale, such as May et al. (1997), Jones 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 (Prior, 1993) and BEPAC in Canada (Cole et al., 1993), mainly emphasise the environmental and ecological issues related to sustainability and quality of life.

Additional methods are the lists of sustainability indicators that have been suggested at different levels of government – international, national and local - in order to audit environmental performance of an urban system and to guide decision making towards the achievement of a sustainable urban development (UNCED, 1992; OECD, 1997). All these indicators are quantitative in nature and are usually classified on the basis of a reductionist view of reality, in which one aspect is given undue emphasis to the detriment of others. Such lists emphasise the distinctness of the aspects, and gives no indication of their inter-dependencies. These problems come from the empirical genesis of the lists: they are merely a compilation of people's ideas and have little theoretical, ontological foundation (see Chapter 2.0).

Approaches based on reductionism are unable to handle all the elements and components of the system, both deterministic and nominal ones, demonstrating ignorance and imbalance (see Chapter 3.0). They may also be misleading, suggesting an unbalanced path in the future developments of a town (Cogo, 1997; Lombardi, 1998a, 1998b; Mitchell, 1999a).

Recent reviews of current evaluation methods in planning and design for sustainability show a lack of holism. All the methods are constrained and limited, taking into consideration only a few of the multiple aspects required for developing sustainable solutions (see Chapter 2.0). The evaluation is 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 (Brandon et al., 1997).

A major problem with approaches based on the utility theory - which is still widely applied in spatial planning - is that because the subject is not emphasised, the effects of the action and knowledge on the subjects are often ignored (see Chapter

3.0). Opposite approaches to planning based, for example, on constructivism (nominalist) theories 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 (Voogd, 1998). 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 and Basden, 1997).

Decision-making for sustainability planning requires new approaches which are able to integrate and synthesise all the dimensions of an urban system and different point of views, in a holistic manner. Planning evaluation, in the age of sustainability, requires a change of emphasis and change in the criteria by which development is judged, moving towards environmental protection and social/economic objectives. It needs to build social consensus as well as to improve technical results (see Chapter 5.0).

Among others, Nijkamp (1991), Fusco Girard and Nijkamp (1997), Brandon et al. (1997), Lichfield et al. (1998) suggest 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) which are 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 different assessment techniques are required for different dimensions, and for the meso and macro scales, it is also clear that sustainability assessment of the urban environment may need to be more of a procedure or process using various techniques, rather than one integrated method (BEQUEST, 1999).

A number of the characteristics of the evaluation approach listed above may be theoretically included within the well-known procedure of 'Environmental Impact Assessment' (E.I.A.), which tries to answer the 'green' agenda of EU countries, since it has been extended to include economic, social and ecological issues (see Chapter 2.0). However, at the moment, E.I.A. methods are able to take a limited perspective, as they are restricted to the ecological concerns towards the environment. The analysis is usually limited to a list of technical and environmental factors which do not take into account the complexity of interdependence between the ecological and the human system and within the latter, between the social and the economic system (Wood, 1994). A further problem is that experts use a specialised and codified vocabulary which is not common for all the disciplines and stakeholders involved in the planning process. Yet, each discipline involved brings its own agenda, own classification system and own techniques to the problem (Brandon et al., 1997).

The evaluation methods are many and there is no agreement among scholars on the theoretical framework to be used (Bentivegna, 1995 and 1997). 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 which will allow a fruitful dialogue to take place (Cole et al., 1995).

This study has postulated a new scientific paradigm, named multi modal thinking based on the philosophical work of Herman Dooyeweerd (1958), mostly because it offers a pluralistic ontology of aspects that may guide the planning and design evaluation process, ensuring that all aspects of human life are present in the design. In particular, this has been used for the following:

- understanding sustainability in the built environment;
- establishing a more holistic classification system for sustainability criteria and indicators in the evaluation of the built environment at a local planning level;
- developing an integrated framework for evaluating urban (re)development in the context of sustainability.

1.2 Research Objectives

Given the previously mentioned lack of an agreed structure which can help decision making processes towards greater sustainability, the overall objective of this study was to find 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 sustainability. The proposed framework is based on a Cosmonomic Idea theory, developed by the philosopher Herman Dooyeweerd, which is suggested as being more appropriate for dealing with sustainability problems.

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 along a more sustainable development path. As previously suggested, there is a lack of a decision support system or a tool which is both comprehensive and holistic to harmonise the different aspects of sustainability in planning and design. This framework could be used by political and technical decision makers (public local control officers and/or planners or designers) to check a design or a plan in the context of sustainability and to learn from it. It should be able to assist the process of devising sustainable planning strategies, ensuring that all sustainability aspects and quality of life issues are included and nested into each other.

The general objective of this study includes the following sub-objectives:

a) to show the limitations of current assessment methods and evaluation approaches in the context of urban sustainability
b) to verify the benefits of an application of the Cosmonomic theory to the built environment to understand sustainability, as a basis for developing a suitable framework for evaluation in planning
c) to develop a holistic and integrated framework which guides users in the evaluation of sustainability in urban planning and design.

In undertaking the above objectives, the study includes:

1. An outline analysis of decision making processes and problems in urban planning and design and an identification of the factors which are critical in relation to an evaluation of urban sustainability

2. A critical review of current assessment methods and planning evaluation approaches, including the principal theoretical doctrines that underlie them

3. The development of a conceptual system to understand sustainability in the built environment which is formed by a number of relevant analytical dimensions. This is based on a multi-modal approach which rests on the theory of the Cosmonomic Idea developed by the Dutch philosopher Herman Dooyeweerd (Amsterdam, 1894-1975)

4. An identification of sustainability factors which are relevant in planning and the built environment for sustainability, on the basis of real world case-studies and planning examples with major consequences for sustainability. This leads to the organization of an initial check-list of relevant issues for the evaluation of sustainability in planning and design

5. The establishment of a specific evaluation framework in planning which is based on the integrated structure and the previously described information, taking the stakeholders viewpoint into account

6. An assessment of the vocabulary and the comprehensiveness of the aspects included in the framework by undertaking a survey using different panels of respondents from different backgrounds

7. An assessment of the framework through a literature review and through case studies.

1.3 Research Method

The main problem with the evaluation of sustainability in urban design and the built environment is the wide diversity of disciplines which are involved in the project. In a study of this kind it has not been possible to provide a detailed analysis of all the aspects and their evaluation but deal only with a less detailed level of analysis in a holistic manner, through a limited number of views, i.e. planners and community (or public decision makers). This evaluation is based on both technical and subjective values, experts' judgements and stakeholders opinions, rather than on a valuation and forecasting of a monetary value for the project, for example.

Furthermore, the methodology is limited to urban planning and design, i.e. local decision making, including regeneration programmes, renewal of districts, transformation of settlements or groups of buildings. In order to be manageable, it only deals superficially with building design, and the level of strategic planning and political decision making at the macro-scale of regional or national levels. It does not cover the activities of procurement and construction. It focuses on evaluation at a district level.

Finally, the study specifically deals with urban sustainability rather than purely environmental sustainability and with the concept of sustainable urban development at a local or community planning level, rather than on a global scale.

In this research, the two main hypotheses to be tested are:

1) ***Current methods of assessing sustainability do not sufficiently encompass all those issues which lead to confidence that sustainability will be achieved.***

2) ***An approach to understanding and evaluating sustainability based on the Cosmonomic Idea of Herman Dooyeweerd will, if adopted, overcome the problems of current assessment methods, leading to an improvement in the decision making process, to monitoring and to learning about sustainability.***

These general hypotheses are based on the view that urban sustainability is a complex issue which requires the combination of different disciplines and studies and – therefore - a philosophical framework for understanding how they interact with each other.

They included the following sub-hypotheses to be verified:

a) Sustainability in urban planning can be structured by several dimensions that correlate with the fifteen modalities of Dooyeweerd's philosophy. Each modality contributes to the development of the true long term sustainability of a built environment.

b) Dooyeweerd's modalities can be employed to understand and to evaluate sustainability in urban planning. They will be expressed in a language which is generally understood by scientists in different fields and by the general public.

c) Dooyeweerd's modalities form the base for the development of an evaluation framework in urban planning which can help decision makers to check the presence of all the aspects in a (re) development proposal, guiding progress toward sustainable solutions.

True testing of these hypotheses would probably take many years. However, an analysis of real case studies can provide a useful overview that can highlight the major threats to sustainability.

The study included a literature review of four different main scientific areas: (A) sustainability and sustainable development (reports and guidelines); (B) evaluation methods and approaches and decision support systems; (C) theories and philosophies underpinning the methods; (D) urban planning and design processes (see Bibliography). In addition, the study included a collection of various case studies and examples of planning and evaluation methods to support the hypotheses (see Chapters 5.0, 6.0 and 7.0). It also encompassed a deep-seated study of the theory of the Cosmonomic Idea of Dooyeweerd.

In particular, the study involved the following steps:

1. An overview of the problem of urban sustainability in relation to planning evaluation. It includes a critical review of current assessment methods and approaches and their classification according to different requirements (hard/soft, monetary/multicriteria, *ex-ante*/*ex-post*/monitoring).

2. A review of theories and philosophical paradigms underpinning current approaches. This stage includes a deep-seated study of the Cosmonomic Idea of Dooyeweerd and the multimodal system, which provides an alternative way of viewing society and the world in general.

3. The development of the philosophical framework within the built environment to understand sustainability through a number of disciplines, based on the previous step. This framework provides a richer, integrated and holistic view of the problem, compared to other classification systems. This stage includes a detailed analysis of the characteristics of sustainability in the built environment and an identification of their interrelationships on the basis of the theory of the modal aspects and the *enkapsis* (see Appendix B). It also involves a classification of the main sustainability themes involved in planning and a preliminary assessment of the vocabulary used within the framework, from a users perspective.

4. The development of an evaluation framework in urban planning and design that overcomes the major problems identified in step 1 and takes into account the issues recognised in the previous step by incorporating the conceptual framework developed at stage 3. The stages undertaken were the following:
   a) careful analysis of decision making problems in planning for a sustainable development of the built environment, on the basis of case studies and examples with major consequences for sustainability. This stage included a critical discussion of the role and responsibility of planning within the context of sustainability and is supportive to the previous step;

b) establishment of the aspects to be used for evaluating sustainability in planning which takes into account the issues recognised in the preceding stage and the results of the assessment developed in step 3. This stage included a new assessment of the vocabulary used to define the aspects for evaluation, from a users perspective;
c) development of a number of questions to examine sustainability and the selection of a set of assessment methods and tools. The suggested questions are linked to the four sustainability principles identified by the PICABUE approach whose benefits in gauging the degree of common commitment of societal actors and representatives of different disciplines towards sustainable development are recognised in a number of studies;
d) illustration of the framework for the evaluation of sustainability in urban planning (re)development proposals (see Appendix C). The framework takes the form of a check-list of aspects which are relevant to understand and evaluate sustainability in urban planning by decision makers. It will be used to check whether a (re)development proposal meets the 'requirements' of sustainability in the built environment, providing a guide for decision making;
e) assessment of the framework based on applications to a variety of case studies related to different decision making process and planning situations.

The result is a clear framework which has the following characteristics:

- it is comprehensive, integrating the multiple dimensions of sustainability in the built environment (test of transparency);
- it is recursive and dynamic, providing clear rules for making decisions and modifying them over time (test of replicability);
- it is helpful in learning and open to participation, using a common language between different disciplines and between experts and people (test of user friendly vocabulary);
- it provides for evolutionary development in our understanding of sustainability over time (test of the 'opening up').

In addition, the study suggests future developments and further research on urban sustainability as well as practical applications.

The following is an illustration of how this study is able to meet a list of 12 distinct *definitions of originality in a PhD thesis*. This list has been developed by E.M. Phillips from her own studies of supervisors and students. It was presented in the Seminar for PhD Supervisors held at Bristol on the 19th November 1994. Additional features of this research are illustrated in Table 8.1 (see Chapter 8.0).

1. Saying something nobody has said before

This thesis argues that an understanding of sustainability in the built environment and its evaluation in urban planning can be based on the philosophy of Dooyeweerd and his theory of modal aspects of reality.

2. Carrying out empirical work that has not been done before

This thesis analyses the built environment on the basis of a philosophical approach. It develops a framework which is applied to existing planning evaluation case studies, showing a number of critical factors for sustainability in the built environment.

3. Making a synthesis of things that have not been put together before

This thesis offers a synthesis of different scientific areas, dealing with sustainability and sustainable development, planning and design activities, scientific theories and philosophies, evaluation approaches and decision making processes. In addition, it includes a useful collection of various case studies and examples of planning and evaluation methods.

4. Making a new interpretation of someone else's material or ideas

This thesis encapsulates the ideas of several people, starting from the philosophical idea of Dooyeweerd to the Brundtland definition of sustainability, including the contribution and the research work of many experts in different scientific field (environmental economics, planning and design, etc.).

5. Being cross-disciplinary and using different methodologies

The thesis proposes a cross-disciplinary analysis of sustainability and suggests addressing the problem of evaluating sustainability on the basis of several different scientific methodologies and assessment techniques belonging to various scientific disciplines and research fields.

6. Looking at topics that people in my discipline have not done before

This study enriches planning evaluation, practices by including a number of topics which usually are not considered, or not covered, by current assessment methods and approaches, such as creativity, social cohesion, visual appeal and ethical issues.

7. Adding to knowledge in a way that has not been done before

This thesis is original in that it shows a way of addressing sustainability in planning on the basis of philosophy, adding new issues in current evaluation practices.

8. Testing existing knowledge in an original way

Existing knowledge on sustainability in planning and the built environment has been examined and challenged by using the framework developed in this study.

9. Writing down pieces of information for the first time

This thesis shows how it is possible to operationalise the principles embodied in the concept of sustainability on the basis of fifteen distinct levels of information (aspects) provided by Dooyeweerd's theory. It provides a specification and a new definition for these aspects, taking into account the stakeholders' view. And, finally, it makes the complexity of a planning process transparent and comprehensive using a language that is common to different scientific disciplines that deal with an evaluation of sustainability

10. Giving a good exposition of another's idea

This thesis clearly illustrates the well-known and generally accepted idea that urban sustainability is multidimensional and it is a process which evolves through time.

11. Providing a single original technique, observation or result in an otherwise unoriginal but competent piece of research

This study provides an original tool that is, a framework for decision making in planning. The framework contributes to understand and evaluate sustainability in the built environment.

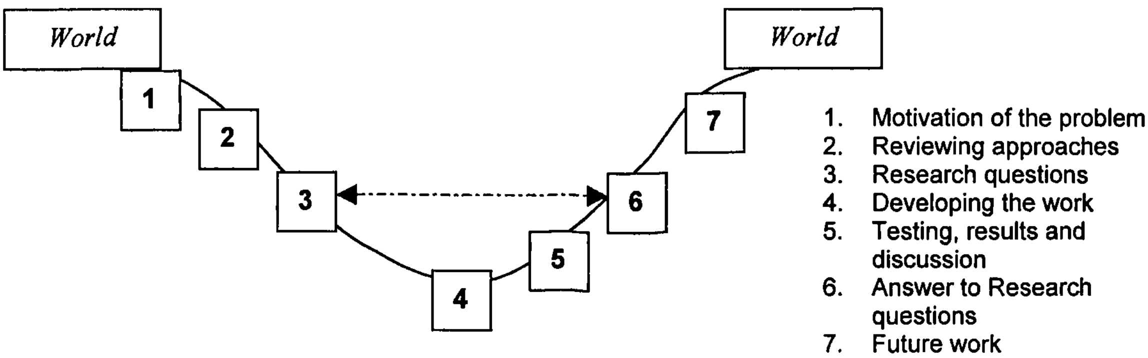
12. Bringing new evidence to bear on an old issue

This thesis brings new evidence to bear on the old issue that planning evaluation is an important activity and it may help planners and decision makers to preserve the environment and the local identities against the risk associated to contemporary economic processes.

1.4 Outline of the Thesis

The process to be followed in this research is shown in Fig. 1.1. Starting with the broad concept of urban sustainability, the thesis narrows its focus onto the underlying philosophy, on the basis of which it develops a framework for sustainability that offers significant advantages.

Figure 1.1. A schematic representation of the research method employed in this study



(Source: this scheme came out in a conversation with Dr Andrew Basden)

Chapter 2.0 - Current Evaluation Methods in Urban Planning and Design

Chapter 2.0 discusses the meaning and the main components of an evaluation approach in urban planning and design with particular emphasis on the context of sustainability. It includes a critical overview of the principal existing evaluation methods in spatial planning, classifying them in accordance to different requirements (e.g. quantitative/monetary vs. qualitative/multicriteria) and dividing them in relation to the evaluation stage: ex-ante, *ex-post* and monitoring approaches. It also discusses some major planning perspectives, in relation to an evaluation of sustainability, such as the technical-scientific ideology and the new communicative paradigm. It reviews monitoring approaches, providing a critique of the current lists of indicators used for sustainability and their classification systems. A collection and a brief description of a number of assessment methods currently used in decision making for urban planning and design is provided in Appendix A. The conclusion summarises the limitations of the existing evaluation methods and approaches in dealing with sustainability and discusses the need of a framework which can address the highlighted issues, including the possibility for non-experts and stakeholders to participate in decision making.

Chapter 3.0 - Philosophical Underpinning

Chapter 3.0 reviews the most widely accepted theoretical paradigms and schools of thought which give foundation to current evaluation methods and approaches in planning. This analysis includes both the utility theory, which forms the basis of welfare economics from which cost-benefit analysis and a number of monetary methods stem, and, the new-contractual theories and pluralistic-dialogic theories, which give support to the communicative ideology in planning. Although the rational choice theory is still the most influential and powerful doctrine in planning evaluation, the analysis shows its major limitations in the context of sustainability and, in particular, the problem of reductionism and imbalance. The epistemological foundation of the subsequent theories is challenged. In the final section, the chapter reviews the system theories, providing support for an adoption of the multimodal system thinking. The theory of the Cosmonomic Idea on which the former approach is based is briefly illustrated and the main benefits, for an evaluation of sustainability, are highlighted.

Chapter 4.0 - Application of the Cosmonomic Theory in the Built Environment for Sustainability

Chapter 4.0 specifically deals with the understanding of sustainability in the built environment, on the basis of the Cosmonomic theory. The built environment is illustrated as an *enkaptical* entity with a subject spatial-physical functioning and an object cultural functioning, provided by a variety of meaning-spheres. An analysis of the potential functions that each modality has for the true long term sustainability of the built environment leads to a classification of some major issues dealing with the functioning of the built environment. This analysis also reveals that a taxonomy of modal aspects and the theory of *enkapsis* are useful tools for analysing complex systems such as a city, an urban district, a building or other modifications to the natural environment. This observation also pinpoints the benefits that this theory has in guiding decision making, such as urban planning or design, in understanding the complex interactions between the issues involved for sustainability. A glossary of the main technical terms and neologisms is available to readers in Appendix B.

Chapter 5.0 - Decision making Problems in Urban Planning for Sustainability

This chapter focuses on the *process* for achieving sustainability based on planning and design rather than the product itself (the built environment). It identifies some major problems that current planning and design face in the quest for sustainability, on the basis of a literature review and case studies. This analysis is important as it helps to understand how planning and design may contribute to develop sustainable solutions. It makes use of the list of modalities provided by Dooyeweerd, to identify those issues which are important in planning and decision making for sustainability in the built environment The role that planning and design activities have for the achievement of sustainability in urban environments is also discussed and the responsibility of planners and all decision makers, including all stakeholders and concerned citizens, is highlighted in the light of the Cosmonomic Idea.

Chapter 6.0 - Development of an Analytical Framework for the Evaluation of Sustainability

Chapter 6.0 develops an analytical framework to understand and evaluate sustainability in urban planning and the built environment by decision makers. It analyses the various stakeholders and their views or commitment towards sustainable development and reviews the modalities and their definition for an evaluation of sustainability in planning. Each sustainability aspect is examined with the support of a suitable tool and a list of key-questions is developed with the aim of guiding users toward a holistic evaluation. This check-list is finally linked to a number of currently available and in use assessment methods. The chapter ends with an illustration of an analytical tool-kit to make decisions in the context of sustainability, as detailed in Appendix C.

Chapter 7.0 - Assessment of the framework

This chapter deals with the question of assessing the framework, considering that, at the present, there is a lack of technical information and scientific knowledge on sustainability and that in this field research usually requires joint effort, collaboration and continuous implementation. More precisely, this chapter undertakes two different assessments dealing with the following major issues: firstly, the comprehension and the understanding of the aspects for the evaluation of sustainability by users and, secondly, the relevance and comprehensiveness of the framework and particularly of the modal structure underlying it. These assessments deal with a variety of different planning contexts and evaluation stages (ex-ante, ex-post and monitoring) and with a conflicting situation among stakeholders. The findings of these assessment exercises suggest that the modal structure is robust and able to be applied in different planning problems (multi-objective), at different stages in time (multi-period), and that is generally well understood by people (multi-person).

Chapter 8.0 - Conclusion and further work

Chapter 8.0 contains the conclusions and further development of this research. All the work done is reviewed, the main contributions to the scientific community are discussed and the main weaknesses and limitations are enlightened within the context of further development of this research. Finally, a number of suggestions for future research in this field are proposed.

1.5 Main References

Bentivegna V., 1995, Il contributo della valutazione alla razionalità e legittimazione del piano, *Urbanistica*, n.105, pp.66-71

Bentivegna V., 1997, Limitations in environmental evaluations, in Brandon et al., (eds.), 1997, *Evaluation in the Built Environment for Sustainability,* E&FN SPON, Chapman&Hall, London, pp.25-38

BEQUEST - Building Environment Quality Evaluation for Sustainability through Time Network, 1999, *Report 1998-99*, EC Environment and Climate Research Programme, Theme 4: Human Dimensions & Environmental Change, Directorate D - RTD Actions: Environment - E.U. DG12

Bocchi M. e Ceruti M. (eds.), 1994, *La sfida della complessita*, Feltrinelli, Milano

Brandon P.S., 1998, Sustainability in management and organisation: the key issues?, in Brandon (ed.), Managing Sustainability: Endurance through change, CIB World Conference on *Construction and the Environment*, Symposium D, Gavle, Sweden, 7th – 12th June, pp.1739-1750

Brandon P.S., Lombardi P.L. and Bentivegna V. (eds.), 1997, *Evaluation in the Built Environment for Sustainability,* E&FN SPON, Chapman & Hall, London

Breheny M.J. (ed.), 1992, *Sustainable development and urban form*, Pion Limited, London

Brennan A., 1995, Ethics, ecology and economics, *Biodiversity and Conservation*, vol. 4, pp.798-811

Camagni R. (ed.), 1996, *Economia e pianificazione della città sostenibile*, Il Mulino, Milan

Capello R., Nijkamp P. and Pepping G., 1999, *Sustainable cities and energy policies*, Springer-Verlag, Berlin

Cogo M., 1997, *Progetto Venezia 21*, Fondazione Eni Enrico Mattei, Venice

Cole R.J., Campbell E., Dixon C. and Vrignon J. (eds.), 1995, *Linking and prioritising Environmental criteria*, Proceedings of the International Workshop CIB TG-8, 15th – 16th November, Toronto

Cole R.J., Rousseau D. and Theaker I.T., 1993, *Building Environmental Performance Assessment criteria*, Version 1, Office Buildings, The BEPAC Foundation, Vancouver

Comstock G.L., 1995, An extensionist environmental ethic, *Biodiversity and Conservation*, vol.4, pp.827-837

DeWitt C.B., 1995, Ecology and ethics: relation of religious belief to ecological practice in the Biblical tradition, *Biodiversity and Conservation*, vol.4, pp.838-848

Doyeweerd H., 1958, *A new critique of theoretical thought*, 4 vols, Presbyterian and Reformed Publisher Company, Philadelphia, Pennsylvania

European Environment Agency Task Force, EEA, 1995, *Europe's Environment: The Dobris Assessment*, Earthscan, Copenhagen

Expert Group on the Urban Environment, EGUE, 1994, *European Sustainable Cities. Consultation Draft for the European Conference on Sustainable Cities and Towns*, first annual report, Aalbourg, Denmark, 24th – 27th June, Commission of the European Communities, Directorate XI, XI/307/94-EN

Fusco Girard L and Nijkamp P., 1997, *Le valutazioni per lo sviluppo sostenibile della città e del territorio*, Angeli, Milan

Healey P., 1992, A planner's day: knowledge and action and iterative practice, *Journal of Planning Association*, vol.58, n. 1, pp.9-20

HMSO, Her Majesty's Government, 1994, *Sustainable Development: The UK Strategy*, HMSO, London.

Holland A., 1995, The use and abuse of ecological concepts in environmental ethics, *Biodiversity and Conservation*, vol.4, pp.812-826

Jones P., Vaughan N., Cooke P. and Sutcliffe A., 1997, An energy and environmental prediction model for cities, in Brandon et al. (eds), *Evaluation of Sustainability in the Built Environment*, E&FN SPON, Chapman & Hall, London, pp.53-66

Lichfield N., Barbanente A., Borri D., Kakee A. and Prat A. (eds.), 1998, *Evaluation in Planning. Facing the challange of complexity*, Geojournal vol. 47, Kluwer Acc. Press, Dordrecht

Lombardi P.L. and Basden A., 1997, Environmental Sustainability and Information Systems, *Systems Practice*, vol. 10, n. 4, pp.473-489

Lombardi P.L., 1998a, Sustainability indicators in urban planning evaluation, in Lichfield N. et al., *Evaluation in Planning*, Kluwer Academic Publishers, Dordrecht, pp.177-192

Lombardi P.L., 1998b, Managing sustainability in urban planning evaluation, in Brandon (ed.), Managing Sustainability: Endurance through change, CIB World Conference Symposium D, Gavle, Sweden, pp.2041-2050

LUCC - Land-Use and Land-Cover Change, 1995, *Science/Research Plan*, IGBP/HDP, Stockholm/Geneva

May A.D., Mitchell G. and Kupiszewska D., 1997, The Development of the Leeds Quantifiable City Model, in Brandon et al. (eds), *Evaluation of Sustainability in the Built Environment*, E&FN SPON, Chapman & Hall, London, pp.39-52

Merret S., 1995, Planning in the age of sustainability. *Scandinavia Housing & Planning Research*, vol.12, pp.5-16

Mitchell G., May A. and McDonald A., 1995, PICABUE: a methodological framework for the development of indicators of sustainable development, *Int. Journal Sustainable Development World Ecol.*, vol.2, pp. 104-123

Mitchell G., 1996, Problems and fundamentals of Sustainable Development Indicators, *Sustainable Development*, vol.4, n.1, pp. 1-11

Mitchell G., 1999a, A geographical perspective on the development of sustainable urban regions, in *Geographical Perspectives on Sustainable Development*, Earthscan (in press)

Moffat S. and Campbell E., 1998, *Vision, Tools and Targets. Environmentally sustainabile development guidelines for Southeast false creek*, The Sheltair Group inc., Submitted to Central Area Planning, City of Vancouver, 18th April

Nath B., Heans L. and Devuyst D. (eds.), 1996, *Sustainable Development*, VUB press, Brussels

Nijkamp P. (ed.), 1991, *Urban sustainability*, Gower, Aldershot

Nijkamp P. and Perrels A.H., 1994, *Sustainable cities in Europe*, Earthscan, London

Nijkamp P. and Scholten H., 1999, New interoperable planning tools for Sustainable land use, in Lombardi (ed.), Analisi e valutazione di progetti e programmi di sostenibilità urbana, *Urbanistica*, n.112 (in press)

Nijkamp P. and Scholten H.J., 1993, Spatial Information Systems: design, modelling and use in planning, *International Journal of Geografical Information Systems*, vol. 7, pp.85-96

OECD, 1997, *Better understanding our cities. The role of urban indicators*, OECD, Paris

Palmer J., Cooper I. and van der Vost R., 1997, Mapping out fuzzy buzzwords - who sits where on sustainability and sustainable development, *Sustainable Development*, vol. 5, n. 2, pp. 87-93

Pearce D., Markandya A. and Barbier E.B., 1989, *Blueprint for a green economy*, Earthscan Publications Ltd, London

Pearce D., Markandya A. and Barbier E.B., 1990, *Sustainable development*, Earthscan Publications Ltd, London

Pearce D., 1993, *Measuring Sustainable Development*, London, Earthscan

Prior J. (ed.), 1993, *Building Research Establishment Environment Assessment Method, BREEAM, Version 1/93, New Offices*, Building Research Establishment Report, Second Edition

Selman P., 1995, Local sustainability, *Town Planning Research*, vol. 66, n.3, pp.287-302

Selman P., 1996, *Local Sustainability*, Paul Chapman, London

Simon H.A., 1982, *Models of bounded rationality*, vol.2, MIT press, Cambridge, Mass

Stanner D. and Bourdeau P. (eds), 1995, *Europe's Environmnt: The Dobris Assessment*, European Environment Agency, Copenhagen, Chapter 10, The urban environment, pp.261-296

United Nations Conference on Environment and Development, UNCED, 1992, *Earth Summit '92 (Agenda 21)*, Regency Press, London

United Nations Conference on Human Settlement, UNCHS, 1996, *The indicators programme: monitoring human settlements for the global plan of action*, paper - United Nations Conference on Human Settlement (Habitat II), Istanbul, June

Voogd H., 1995, Environmental management of social dilemmas, in *European Spatial Research and Policy*, vol. 2, pp.5-16

Voogd H., 1998, The communicative ideology and *ex-ante* planning evaluation, in Lichfield et al. (eds.), *Evaluation in Planning*, Kluwer Academic Publisher, Dordrecht, pp.113-126

Waters B., 1995, Christian theological resources for environmental ethics, *Biodiversity and Conservation*, vol.4, pp.849-856

WCED - World Commission on Environment and Development, 1987, *Our Common Future (The Brundtland Report)*, Oxford University Press, Oxford

Wood C., 1994, *The environmental assessment of plans programmes and policies: a comparative review*, E.I.A. Centre, Planning and landscape Dept., University of Manchester, Manchester M13 9PL

Chapter 2.0 – Current Evaluation Methods in Urban Planning and Design

So far as the laws of mathematics refer to reality, they are certain. And so far as they are certain, they do not refer to reality
(A.Einstein)

This chapter essentially analyses planning evaluation as an activity which is required to manage the issues provided by the new agenda of sustainability. It critically reviews a number of existing evaluation methods in spatial planning with the aim of discussing their major limitations in the context of decision making for sustainability. It classifies them in accordance to the nature of the information they are able to handle and provide (e.g. quantitative/monetary vs. qualitative/multicriteria) and to the temporal stage in which they are used (ex-ante, ex-post and monitoring approaches).

Spatial planning and urban design are traditionally considered as a political instrument for public allocation of goods and services in a market economy. From a social perspective, urban planning alters the distribution of financial and environmental resources between interests, causing some to gain but others to lose (Lichfield et al., 1975). From an environmental-ecological perspective, design solutions have wide-reaching repercussions on non renewal resources (Pearce and Turner, 1990). Therefore, a primary justification for undertaking an evaluation in planning and design is that it assists the process of decision-making.

An important part of this process concerns the so called *ex-ante* evaluation of alternatives (DoE, 1992). The use of *ex-ante* evaluation methods is also determined by existing formal, legal, regulations, notably Environmental Impact Assessment. A second evaluation perspective in relation to planning process is the *monitoring/ex-post* evaluation. This is strongly emphasised in the latest planning guidance (DoE,

1996) in relation to a plan-led system advocated by the 1990 Town and Country Act, asking for more attention to the evaluation of plans in order to be more up to date, responsive and accountable (Litchfiled and Prat, 1998).

In both cases, evaluation is supposed to provide information about the effects of an urban development on both the formal decision-takers (planner, designers and urban authorities), who should devise strategies and policies (urban plans and projects) that can guide cities along a more sustainable development path forming a soundly based choice, and any members of the general public who may participate in the decision-making process (stakeholders and concerned citizens). Evaluation also generates evidence for policy-makers to use to defend their decisions as well as to aid the process of arriving at them (Benitivegna, 1995). At the moment, however, the evaluation is still weak in terms of practice, legitimacy and link with urban development processes (Lichfield et al., 1998).

This chapter discusses the main approaches in planning evaluation in the context of urban sustainability, highlighting their main strengths and weaknesses. It is structured as follows.

Section 2.1 introduces the role and the main components of evaluation in urban planning and design, distinguishing an *ex-ante* evaluation approach from monitoring and an *ex-post* approaches. Section 2.2 provides an overview of some main existing *ex-ante* evaluation approaches, classifying them into three main groups of monetary and non monetary methods and decision support systems. It compares technical and communicative ideologies in planning evaluation, providing a general critique of both approaches in the context of urban sustainability. Section 2.3 deals with monitoring approaches in planning evaluation. It specifically focuses on a critique of those sustainability indicators and their classification systems suggested by International organisations (e.g. OECD, United Nations, etc.).

Finally, Section 2.4 provides a general discussion and a critique to all the above methods and approaches.

2.1 Role and Components of Planning Evaluation

The institutionalisation of planning evaluation has followed a difficult and non-linear process since it has been developed on the basis of a variety of different scientific disciplines. For example, the social sciences (including social research, welfare economics with utility theory and management) which focus on the differences between opinions and measures, decision theories (based on sociology and statistics) which focus on decision under uncertainty, economics related to public and strategic choice theories, such as policy analysis, environmental economics and sciences, and theories of perception and language.

In literature, three main features of an evaluation are identified as follows (Patassini, 1995; Stanghellini, 1996):

1) it is action-oriented;
2) it helps to structure an understanding of processes and problems;
3) it is associated with a decision (consequently it is not purely rhetoric).

From this point of view, the nature of the evaluation is characterised as an institution of social interaction which has a relative operational autonomy.

An evaluation usually works through feed-back by means of criteria which are able to test and verify the decisions taken (Patassini, 1995). It implicitly refers to a paradigm which characterises it. Monnier (1987) has classified the paradigms into five groups as follows: logical; experimentalist, demographic, juridical, endosystemic, perceptive. Pearce and Turner (1990), however, have linked them to economic theories, such as classical economics and Marxism, neo-classical economics and humanism, institutionalism (see Chapter 3.0).

In the following, an analysis and an identification of the meaning and the main components of planning evaluation is developed with the aim of showing the complexity and the variety of this activity.

2.1.1 Meaning of an Evaluation in Planning

The first reason for undertaking an evaluation is to resolve the incompleteness and uncertainty surrounding any problem in the public domain. The evaluation aims to understand and to be comprehensive including all the different needs (McLoughin, 1969).

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, possibility of home-owner-ship and social equality, mobility, conservation. In general, public urban planning laws protect the individual corporation or citizen against disadvantages and guarantees equal chances and competitions in the real-estate market and urban development. However, in practice, there are many problems, especially communication problems, between public and private decision-makers who often do not co-operate. There are lengthy negotiations without any result. In particular, there are few shared values concerning the development of the urban area nor agreement about the measures to promote development (Ave and Corsico, 1994; Koster, 1994).

A second justification for undertaking an evaluation analysis is that it assists the process of decision-making. Clough (1984) has defined it as the process of "*making consequential choices (...) thinking in advance about what alternatives to consider and how to choose a good, better or best alternative*" (p. 185). This is necessary because most urban planning problems are complex, requiring solutions which have wide-reaching repercussions. For example, a direct repercussion is the alteration of the distribution of financial and environmental resources between interests, causing some to gain but others to lose (Lichfield et al., 1975). Methods, such as cost benefit analysis and other 'formal' techniques, have been developed and widely applied in spatial planning during the last twenty-five years to support this task. All these methods are based on the assumption that the impact of a policy proposal can be assessed for all relevant variables of the proposal (see Section 2.2).

Finally, a careful process of decision-making is often required to achieve a satisfactory policy in a complex environment (Simon 1985; Bobbio, 1960; Bruinsma et al., 1999). This often deals with conflicting targets, uncertainty and complexity (see Chapter 5.0). A wide range of support systems, with the aim of handling incomplete knowledge concerning real-world phenomena, is currently available, e.g. Decision Support Systems, Computer Information Systems and Expert Systems (Jackson 1990).

Appendix A illustrates a number of these evaluation procedures and methods currently used in planning.

2.1.2 Components of an Evaluation in Planning

Evaluation in planning has a variety of components. Components are usually distinguished in relation to the **stage** that evaluation has within the plan process. In particular, we recognise an *ex-ante* evaluation at the top of a planning process which is different from an *ex-post* evaluation placed at the end of the same process. Furthermore, there is an *in-itinere* or *on-going* evaluation which is generally used for guiding and controlling the process of development (or transformation). Finally, the *monitoring* evaluation is an administrative activity related to contingent and contextual aspects (Litchfiled and Prat, 1998).

An exhaustive typology of components in planning evaluation is given by Patassini (1995), as shown in Table 2.1. This includes all the followings: *requests; perspectives, approaches, methodologies, practices* and *techniques.*

A **request** is at the basis of any evaluation in practice. It specifies a need or a problem in planning. The following types of requests have been distinguished: Prevention (an administrative control or an audit, e.g. planning programming and budgeting system; Action (a forecasting of all the social and environmental effects of a planning proposal for resource allocation); Reaction (an *ex-post* evaluation focused on direct users, behaviour and opinions); Learning (a policy analysis focused on building knowledge and social exchange).

A **perspective** is related to the evaluation objective, driving the evaluation process into different contexts, such as the following: technical-economic; juridical-normative; political; ecological or esthetical. The perspective usually answers to a substantive demand.

An **approach** can be, respectively, a recapitulative process or an endoformative one, in relation to the level of definition of the information which is available (or required) in decision making. For example, the approach will be recapitulative if it considers objectives and expected actions as rational rather than intuitive (Simon, 1947; 1982).

Table 2.1 – Typology of components in planning evaluation.

	REQUEST	
	action-reaction-prevention-sanction-legitimisation-learning	
RECAPITULATIVE	**PROSPECTIVE**	**ENDOFORMATIVE**
APPROACH (external)	technical-economic, juridical-normative, political, ecological, esthetical	**APPROACH (internal)**
	STAGE	
	ex-ante, on-going, in-itinere, ex-post, monitoring	
STATISTIC-OPERATIONAL	**PROCEDURE**	**SOCIO-POLITICAL**
METHODOLOGY	goal-oriented, impacts, operative, free, process, pluralistic, cognitive, research	**METHODOLOGY**
	TECHNIQUE	
PARAMETRICAL *total aggregation, partial aggregation, local aggregation*		*NON-PARAMETRICAL* *decisional (analytical, cybernetic, cognitive), gaming strategic*

(Source: Patassini, 1995)

A **methodology** qualifies a particular stage of the evaluation and the information used. It is usually chosen in relation to a stage of evaluation, which can be a preliminary recognition or a real monitoring. It usually operates on the basis of the available information, which can be statistic-operative (data) or socio-political (opinions, actions). Literature distinguishes at least five different types of evaluation methodologies:

(a) Front-end analysis, which is used for selecting a type of evaluation;

(b) Evaluation assessment, which usually provides check-lists;

(c) Formative evaluation, which is used for selecting criteria and resources;

(d) Summate evaluation, which judges results;

(e) Monitoring, which is used for controlling a situation.

The evaluation **procedure** emphasises the relationships between objectives, means, results and effects, by using appropriate criteria. According to Patassini (1995), the more common ones are the following:

- Goal-oriented evaluation. This assumes goals and objectives as criteria for measuring the performances of a plan. By doing so, it encourages promoters to clarify the relationships between activities, services, and expected results in a logical manner.
- Impact evaluation. This focuses on the relationship between objective and effects. In ex-ante evaluation, it tries to measure both of them by using techniques such as the Delphi (Dalkey, 1967) and multicriteria (Voogd, 1983) techniques. In ex-post evaluation, it may be useful for collecting information (Bezzi and Palumbo, 1998).
- Operative evaluation (implementation). This focuses on efficiency and efficacy which are measured in relation to the type and the objectives of the project.
- Goal-free evaluation. This assumes objectives that are developed by needs, such as data, using ethical and political judgements for their assessment. It focuses on the effects of a project, which can be direct or indirect. The effects are compared to the needs that are previously defined by the analyst. Major emphasis is placed on the description of the project and on the direct experience within the programme. Usually it also includes unexpected effects which appear to be useful for defining new priorities, according to the inductive-holistic paradigm.
- Comprehensive evaluation. This is based on systemic theories, focusing on those processes which originate effects. The project is here considered as a dynamic entity which is flexible and can be adapted or changed in relation to the context (made by opportunities and constrains). In general, it is very costly.
- Pluralistic evaluation. This is a decision-oriented evaluation (Monnier, 1987). It focuses on the flow of information which can be developed on decision makers and their actions, in a systematical manner. By mapping all areas of uncertainty and multiple perspectives, it tries to identify the underlying relationships.
- Cognitive and visual maps. These try to find an agreed solution by ranking different options in order of priority. Examples of these types are: visual impact analysis and assessment and cognitive mapping.

Finally **techniques** may be grouped into two different types: parametric, such as sensitivity analysis and risk analysis; and non-parametric which results in a ranking or decision tree or network, such as strategic interaction systems, or game matrices.

In the following sections, a critical illustration of the principal evaluation approaches and procedures (or methodologies) is provided. For the sake of clarity, this illustration follows a classification of the methods based on the stage of the planning evaluation, i.e. *ex-ante* and *ex-post* or *monitoring*. In addition, it makes use of "methods" and "approaches" terms in an interchangeable manner. This also applies to the rest of this study. In each approach, in fact, a number of procedures and techniques belonging to both statistic-operational and socio-political methodologies may be present. Yet, a number of different procedures and techniques may occur in each stage (Bezzi and Palumbo, 1998). Therefore, the terminology must be kept flexible to avoid constant reference to Table 2.1.

2.2 *Ex-ante* Evaluation Approaches in Planning

Ex-ante evaluation generally means a technical-scientific procedure to express a judgement, based on values, about the impacts of a policy or of an action on the physical (natural and/or built) environment, or to assess the effects of these impacts on the community (Bentivegna, 1997). This implies the clarification of consequences of different choices and planning options, comparing the characteristics of various choice-possibilities in an explicit and systematic manner. Methods, such as cost benefit analysis and other 'formal' techniques, have been developed and widely applied in spatial planning over the last twenty-five years to support this task (see, among others, Lichfield et al. 1975, Nijkamp 1980, Nijkamp, Rietvelt e Voogd 1990, etc.). Thus, they are also named "problem-solving" methods.

However, considerable changes during the last decade have lead to conceive public planning as a process of facilitating community collaboration for consensus-building (Zeppetella, 1997; Kakee, 1998; Voogd 1998). New approaches are now advocated, and sometimes also followed, that suggest a fundamental break with the planning methodology of the past (Guba & Lincoln, 1989; Healey, 1995; Kakee, 1997). These focus on a permanent discussion between, or among, the parties concerned; by means of such methods all essential moments of choice should be emphasised and brought into discussion.

Section 2.2.1 discusses the implications that this shift - from a comprehensive planning model to an incrementalism in planning – has on the evaluation of sustainability. Technical ideology and communicative ideology are reviewed, and their limitations in the context of sustainability are shown.

In Section 2.2.2 a typology of techniques for the appraisal of publicly financed investment projects is provided, following the debate on monetary and non-monetary evaluation in planning (Voogd, 1983). All the methods are based on the assumption that the impacts of a policy proposal can be assessed for all the relevant variables of the proposal. They differ in the way this assessment is carried out and in the way the results are presented. However, in all cases, the point of departure is the application of scientific logic to measure the effects (Voogd, 1998). Section 2.2.2. also includes an overview of the main decision support systems currently in use.

Finally, a critical discussion of the main assessment methods in use is provided in Section 2.2.3. For a more detailed illustration of these evaluation methods the reader can refer to the list provided in **Appendix A**.

2.2.1 Comparison of Technical and Communicative Approaches

Planning evaluation is characterised by two opposite ideologies known as technical-scientific and argumentative-communicative approaches. The first one follows the logic of scientific rationality and is generally meant to clarify the consequences of different choices and planning options, comparing the characteristics of various choice possibilities in an explicit and systematic manner. The argumentative-communicative approach, on the other hand, focuses on a permanent discussion between or among the parties concerned, suggesting a fundamental break with the planning methodology of the past. Both these approaches are described in the following and a comparison is illustrated in Table 2.2.

Table 2.2 – Comparison of technical and communicative approaches in planning evaluation

Technical approach	**Communicative approach**
It focuses on analysis It uses methods for problem solving It is based on normal science (reductionism) This means to separate facts from values and to base experts' judgements on quantitative indicators and on formalised techniques which are able to verify previous hypotheses in an empirical manner Evaluation as a demonstrative verification	It focuses on language It uses methods for problem setting It is based on participation and co-operation between parties It recognises that any choice is linked to different preferences, values and interests which are often in conflict with each other and it is usually difficult to reach an agreement between the social parties for a decision Evaluation as an argumentative process
Demonstration	**Argumentation**
It is based on formal rules of inference It addresses everyone who has the knowledge to understand the language used It aims to stimulate an intellectual agreement	It is based on opinions, values and point of views - it uses dialogue It addresses a specific audience It aims to build, in the audience, a predisposition to the action for co-operation for the decision
Main limitations	**Main limitations**
It does not include values in the decisions, avoiding diversity multiplicity and conflicts It does not understand complexity It refers to an ideal public interest which is assumed as an external factor	It does not arrive at a final synthesis It does not have an external and objective reference point for rationalising It tends to ignore those who have no voice in the public arena

(Source: based on Zeppetella, 1997)

The technical-scientific approach

A technical evaluation usually provides information about the effects of proposals on both the formal decision-takers, who are interested in the social welfare consequences of proposals to help them form a soundly based choice, and any members of the general public, who may participate in the decision-making process (decision-makers).

Evaluation also generates evidence for policy-makers to use to defend their decisions as well as in the process of arriving at them. An important part of this process concerns the so called '*ex-ante*' evaluation of alternatives. A formal comparison of the alternatives aims to make the differences between them and the nature of the uncertainties more explicit and to provide information for subsequent debate. Between alternative plans there are usually conflicts of interest between groups (Lichfield et al., 1975). Conflict occurs, for example, 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. If the achievements of the preferences of certain groups are in conflict, it is usually necessary to know the comparative "strengths" of the interests in order to increase the information available to assist in the resolution of conflicts through decision.

The measurement scale used for assessing the comparative strengths of preference can be different from the cardinal one, such as ordinal, stochastic, etc. For example, in (social) cost-benefit analysis, the comparative strengths of preferences are assessed and expressed in the common unit of money, assuming the validity of the willing-to-pay criterion (Misham, 1971). However, in multicriteria analysis, a ranking of the alternatives is determined by using different evaluation criteria which express all the relevant elements of the decision-making problem (Nijkamp, 1980). Indeed, a ranking of alternative urban projects may only be made when the criteria used for trading-off conflicting objectives are made explicit (Voogd, 1983).

In comprehensive urban planning, the objectives to be formulated and adopted for planning and for evaluation are directly related to community preferences. They express intentions to attain goods and services or to avoid reductions in the amount of goods and services which are currently enjoyed, and are either acquisitive or retentive in nature (Lichfield et al., 1975).

The objectives form criteria for choosing between various built environment assets which offer different social welfare improvements. Consequently, traditional technical evaluation is directed towards the assessment of the comparative performance of urban projects in terms of the achieved levels of 'planning objectives' which are related to particular preferences of individuals (or groups) for different situations. Normally, they should be derived from a complete analysis of the fulfilment of people's preference, since planning decisions are seen to be in the interests of the public at large. However, traditionally, planning objectives are derived from the analysis of planning situations and certain 'problems' that have been identified (McLoughlin, 1969).

The technical approach generally includes the following: monetary evaluation methods, descriptive overview method, multicriteria methods and DSS-approaches

(Lichfield et al. 1975; Nijkamp, 1980; Nijkamp Rietvelt and Voogd, 1990; Fusco Girard, 1993; Voogd, 1998). All these methods differ in the way the assessment is carried out and in the way the results are presented. However, in all cases the point of departure is that of the scientific approach to measure the effects.

This approach has raised a number of critical issues (Kakee, 1998). In particular, it has brought into question the role of urban planning as a process which acts in the 'public interest'. According to many authors (see, among others, Adams, 1994 and Healey, 1995), this prospect of planners acting in the wide 'public interest' seems unlikely since it is not possible to adequately define it. In Adams's view (1994), for instance, the concept of 'public interest' has long been held up as justification for the intervention of urban planning in the development process. In other words, if the evaluation is intended to draw out the implications of the alternatives for the general public it would only be valid to approach decision-takers if there are grounds for supposing that they do have knowledge of, and act in, the interests of the public at large.

A strong theoretical tradition has, therefore, emerged in recent years which views urban planning as a process of mediation between competing interests rather than as the elusive pursuit of the public interest Such an approach sits uneasily with the official line that the system is designed to regulate the development in the public interests and that all interested parties benefit equally from the planning process (Lichfield et al., 1998, Healey, 1997).

The argumentative-communicative approach

Following the economic and political climate of the last decade, there has been a considerable change in public planning. Planning is now understood as a process of facilitating community collaboration for consensus-building. The argumentative-communicative approach reflects this fundamental break with the planning methodology of the past. The shift is from a comprehensive planning model to an incrementalism in planning (Healey, 1992; Voogd, 1998; Kakee, 1998; Simin, 1999).

Community activists were among the first who criticised comprehensive urban development. They suggested including participation in the planning process, rejecting the view that elected politicians and their expert advisers could readily determine what was in the best interests of those most directly affected. Later, New Right theorists, contended that the likelihood of government failure was far stronger and more dangerous than that of market failure. Subsequent writers sought to expose the questionable intellectual validity of New Right thinking in urban planning and argued that government failure can be tackled directly, for example, by expanding public participation and by eliminating paternalistic attitudes in the bureaucracy. For example, Healey (1992) argues that New Right thinking proved unable to meet renewed concern in the early 1990s about environmental quality and sustainability and about social and community welfare.

Most academic planners are now convinced that planning should be a process of facilitating community collaboration for consensus-building (Voogd, 1998). Major attention is placed on evaluation as a learning and participate process which provides and, in turn, obtains information and the factual basis of the issues for decision to and from the various participants in the planning process. It may cope with issues of large financial investments, with impacts on the environmental quality, with changes in social-spatial functioning, with uncertainties and risks, etc. Consequently, it becomes a subject of extensive public discussion with all the members of the general public who are likely to be affected by the planning proposals.

The role of a planning evaluation becomes that of increasing information and knowledge and improving public participation in environmental decision making. This is characterised by discussion and good communication among the parties, qualifying language and argumentation as a tool for reaching a final and agreed solution between different points of view (see also Chapter 5.0).

Many authorities have found it necessary to use marketing and communication techniques to attract private investments, e.g. urban marketing (Ashworth and Voogd, 1988; Ave and Corsico, 1994). Often, monetary economic and multicriteria methods are also adopted in this context, with the aim of stimulating discussion among parties (Zeppetella, 1997). All essential moments of choice should be emphasised and brought into discussion by means of such methods (Guba and Lincoln, 1989; Fischer and Forester, 1993; Zeppetella 1997; Kakee 1998; Voogd, 1998; Lichfield et al., 1998).

However, some handicaps do exist in relation to the applicability of current evaluation methods within the new framework of communicative ideology, as discussed in Voogd (1998) and Kakee (1998). In particular, there is the problem of 'how best to organise the form of discourse, to develop inclusionary argumentation and to build interrelations'. This requires the application of a suitable operational framework, an evaluation methodology or an approach that is able to guide decision makers, and particularly planners, to understand the problems implied in a planning decision (see also Chapter 5.0).

On the basis of a literature review, the next sections shows that the methods currently used in planning are inadequate for this aim and that such a framework is not available at the moment.

2.2.2 A Classification of *ex-ante* Evaluation Methods

This section presents some current valuation methods, such as cost benefit analysis and other 'formal' techniques, which have been developed and widely applied in spatial planning over the last twenty-five years. These methods are usually classified into two main groups, corresponding to the alternative approaches which have been suggested in the face of the complexity of ecological interdependence and uncertainties surrounding environmental resources (Voogd, 1983; Pearce and Turner, 1990; Fusco Girard, 1987; Barbanente, 1989; Rizzo, 1989; Roscelli, 1990; etc.):

1. A cost-benefit framework, utilising monetary valuations but also incorporating explicit recognition of uncertainty and irreversibility;
2. A fixed standard approach named environmental (and/or strategic) impact evaluation which would operate as a binding constraint, limiting the scope of cost-benefit analysis to cost effectiveness analysis.

The first group includes those techniques of straightforward cost-benefit analysis (CBA) (Dixon et al. 1986), and it is the most common procedure of project appraisal. CBA is concerned with setting the costs of construction, maintenance, renewals and other servicing costs over the life of a development against the benefits of function, convenience and appearance (Mishan 1971). It is specifically used to determine which of the possible projects should be financed in order to maximise the return from a given amount of capital or public resources (for a more detailed illustration see Appendix A).

The following techniques based on CBA share the same concerns, that is, to help decision makers to chose the best return on capital projects. Their selection by decision makers is influenced by many factors including the effect to be valued and the availability of data, time and financial resources. Some of these (changes in productivity; loss of earning; opportunity-cost; cost-effectiveness analysis; preventive expenditures) use market prices to determine values. The implicit assumption, therefore, is that these prices reflect economic scarcity and hence are economic efficiency prices. If there are distortions in the market prices, then appropriate adjustments, commonly called 'shadow prices', will be required (Winpenny 1991).

Additional techniques are those, called cost analysis techniques, which assess the magnitude of potential expenditures (replacement and relocation costs; shadow projects) and those which use surrogate markets to determine values (property and land-value approaches or hedonic pricing; travel costs).

Lastly, contingent valuation methods which are used to place values on the environmental impact of development projects in the absence of data on market or surrogate-market prices (bidding games; take-it-or-leave-it experiments; cost-less choice; Delphi techniques) and macro-economic models (input-output models and linear programming models) which may be used to examine the interaction between the environment and large scale economic growth.

An improvement of the cost benefit scheme was developed by Nathaniel Lichfield during the 1960's and further improved during the 1980's with particular attention being paid to the assessment of the impacts that a development may have on the societal groups of actors in a community (Lichfield, 1988). This is called "Community impact evaluation" and it has been widely applied in the context of cultural built heritage, urban regeneration projects, new transport system and airports, and urban plans in different countries and regions, including London and Manchester in the UK, New York in the USA, Naples in Italy and Israel.

The second group includes those techniques of straightforward environmental impact analysis (E.I.A.), including the descriptive overview method and multicriteria analysis (MCA).

Environmental Impact Analysis is a comprehensive procedure which involves different dimensions of a planning problem, such as social, administrative and physical. Thus, it has been widely applied to planning processes which have strong environmental implications. Experience has shown that project level E.I.A. is feasible, that E.I.A. has altered decision-making to give more weight to the environment and that E.I.A. costs very little in relation to the costs of implementing the actions assessed.

More recently, the United Nations Economic Commission for Europe has recommended the extension of E.I.A. principle to policies, plans and programmes (Therivel et al., 1992). The European Commission has long espoused the desirability of extending E.I.A. from projects to higher tiers of actions and began consultations on a Strategic Environmental Assessment (S.E.A.) directive in 1991. This is a consequence of the growing belief that project E.I.A. 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, utilising a form of S.E.A. that is basically similar in nature to that employed for projects.

As with project E.I.A., the skill of the assessor comes to bear in selecting an appropriate mix from all the different approaches, tools and techniques available. In the context of E.I.A. (and S.E.A.), the adopting of techniques that are able to rank projects objectively on the basis of the impact each project will have on the environmental eco-system is justified, among other reasons, by the requirement for the team of multi-disciplinary experts to put their study of environmental impact before the community and to substantiate the results and the reliability of the opinions expressed. Procedures of this type, named multicriteria methods, have the merit of providing a unique information synthesis that can be a valuable aid for the final decision-maker, on conclusion of the assessment process.

At the present time, there are many MCA methods available. They have been developed since the end of 1960 (Nijkamp, 1980; Voogd, 1983; Fusco, 1987) to evaluate the environmental qualities of a landscape. All these techniques have been classified into two main groups (Voogd, 1983): discrete and continuous ones, in relation to the number of elements - limited or unlimited - which it is possible to include in the evaluation process. In general, the discrete type is widely applied to solve planning problems, since the number of alternative plans is always limited to three or four. These last techniques are described in Appendix A.

A second classification of MCA techniques is related to the nature of the information they are able to manage, as quantitative/hard and qualitative/soft or mixed (Roscelli, 1990). The Goal Achievement Matrix (Hill 1968), the Environmental Evaluation System and the Systeme de Evaluation des Logements (Voogd, 1983) belong to this first group. The following: the expected-value method; the effectiveness-matrix; the lexicographic method (Fusco Girard, 1989) belong to the second group. Lastly, new multicriteria methods have recently been developed which are able to take into account all the impacts, quantitative and qualitative, which a project can have on the environment. A concise overview of some operational assessment techniques of straightforward MCA are presented in Appendix A and more specifically the following three procedures: Concordance-Discordance Analysis (Roy, 1985); Analytical Hierarchy Process (Saaty, 1980); Regime Analysis (Hinloopen et al., 1983).

A last group of methodological approaches to the evaluation of planning or design situations includes Decision Support Systems, Computer Information Systems and Expert Systems. (Brandon et al., 1988; Janssen 1991; Rostirolla 1992, Giaoutzi M., Nijkamp P., 1993). These approaches are built on mathematical research techniques and aim to handle incomplete knowledge concerning real-world phenomena, yielding new knowledge via a proper treatment of data and/or information (Nijkamp et al., 1999). Generally, these approaches try to answer the problem of making decisions based on uncertain or imprecise information (Nijkamp and Scholten, 1993).

For example, at the level of building, the ELSIE system (Brandon et al., 1988) was designed to be used by quantity surveyors on behalf of clients who wanted initial advice on building projects. One part of the advice that ELSIE helped the surveyors to provide concerned the likely cost of the proposed building. The system came into widespread use before the recession of the early 1990s hit the UK construction industry.

Other more recent decision models, at the urban and regional scale, have been developed in order to help decision making in the context of sustainability, such as the spider model, the meta-regression analysis, the flag model, and the rough set analysis. All these share, as a common base, a multiple objective assessment approach. Nijkamp et al. (1999) provides an illustration for them as follows. "The spider model is a simplified version of a multi-criteria analysis that is able to examine quantitative and qualitative data. Meta-regression analysis may be used to summarize and classify large data sets of numerous case studies that singularly cannot depict general results. In the flag model we have shown the possibility of expressing 'fuzzy' and overlapping ranges of values for the decision processes, as well as the capacity to represent the results with various devices, thus giving a friendly structure to the program. Rough set analysis, finally, has the unique quality of being able to synthesize, classify and order the information available for the decision-makers. "

At the level of building and architectonic design, several different methods and tools - some of them specifically developed for environmental labelling of buildings, such as the BREEME (Prior et al., 1993) and the BEPACT (Cole et al., 1993) schemes - are also available which are based either on the first group of Cost Benefit analysis or on the second group of multicriteria analysis.

Other, world-wide recognised useful methods are product Life Cycle Assessment (Ryding, 1992), which considers the potential impacts of a product's life cycle breaking down the particular properties of the site where the product is used, and Life Cycle Cost (Ferry and Brandon, 1994), which involves the process of translating the impacts of resource transformation into money value, as this facilitates interpretation and understanding by decision makers (Moffat, 1995). Additional more recent methodologies are the Eco-scarcity method, based on the idea to weight and prioritize environmental impacts, in terms of the "ecological scarcity" associated with a given environmental impact; the Weighted Environmental

Theme method, based on the idea of classifying emissions to certain environmental categories or themes such as global warming, acidification, eutrophication, etc. for which there exist scientifically approved methods of comparing the impact of the emissions of different substances; and finally the EPS method, which explicitly considers emissions and resource usage by a separate index (Aho, 1995).

As already mentioned, **Appendix A** illustrates a number of the above mentioned methods, both monetary and non monetary, including some recent developments of the benchmarking approach. The latter compares various alternatives in order to reach those with the best performance (Ruddock, 1999). Such a method, although having wide applications in the management field, does not have a methodological framework able to develop an assessment procedure for policies.

Table 2.3 classifies some of these approaches in relation to both the nature of the data and information these are able to manage - hard or soft - and to the use of monetary or non-monetary indicators. In the following, a discussion and a critique of these methods is provided in the light of an evaluation of sustainability in planning and design.

Table 2.3 – A classification of current evaluation methods

Monetary ↑		**Monetary/hard** *Methods which use quantitative information and translate it into monetary terms*
Cost-effectiveness Shadow-projects Community Impact Evaluation	Cost-Benefit Analysis Opportunity-cost Travel Cost Method Hedonic Price Method Contingent Valuation Methods	**Monetary/soft** *Methods which combine monetary with qualitative information without translation into a common measurement unit*
← ***Soft***	***Hard*** →	
Spider model Flag model Frequence Analysis Regime Analysis Analytic Hierarchy Process Other soft multicriteria methods	Input-Output Model Linear Programming Model Meta-regression analysis Rough set analysis Concordance Analysis Goal Achievement Method Lexicographic method System d'Evaluation de Logement Other hard multicriteria methods	**Non-monetary/hard** *Methods which use quantitative information and translate the qualitative one into cardinal data* **Non-monetary/soft** *Methods which use qualitative information and translate the quantitative one into ordinal data*
Non-monetary ↓		

2.2.3 A Critique of Current Evaluation Methods

As previously mentioned, CBA is concerned with which alternative gives the best return on capital. The rate of discount affects the weight given to the items. The higher the rate, the less weight is given to costs and benefits arising well into the future. This tends to lead to the choice between alternatives being based on short-term considerations. The lower the rate of discount the more weight is given to items in the future. At zero rate of discount, equal weight is given to initial costs and benefits and to those in the future.

As far as possible each cost and benefit is evaluated in money terms. Problems arise in obtaining a cash value for the intangible. The benefit side is extremely important in assessing environmental projects. The problem of predicting or forecasting the environmental impact is that impacts arise in the more or less distant future. This prediction process will not result in firm figures for a number of reasons: the unknowns in the data input within any forecasting method; dispute over the forecasting method to be used, and lack of knowledge about the ways in which environmental impacts are generated. Ranges for scale and timing of the predicted impacts are more likely than single figures and, for some types of impact, it may not even be possible to give any figures. Even when the scale and timing of impact can be identified, problems remain as to assessing the environmental significance of the impact and its incidence in the future (Pearce et al., 1989; Rydin 1992).

There is therefore a need for money measures of utility change caused by 'commodities' that can be viewed as public goods or externalities, and for a method for the practical evaluation of such money measures. Although there has been a great deal of development in the theory as well as the measurement of environmental benefits and costs (Johansson 1993), this analysis remains imperfect for use in decision-making. Some of the existing limitations to the economic measurement of sustainability and environmental effects are as follows (Lichfield et al., 1998, Winpenny, 1991):

- Income distribution (infra-generation equity). One of the assumptions that underlies CBA is that a society will be economicly efficient in its use of resources when net monetary social benefits - that is the difference between total monetary benefits and total monetary costs measured in socially desirable prices - are maximised. Efficiency is measured without regards to whom the benefit and costs accrue and irrespective of whether society considers the prevailing distribution of income to be desirable.

- Intergenerational equity. Both the choice of project selected and the discount rate to be used will affect the inter-temporal allocation of resources and thus have implications for intergenerational equity. In fact, the impacts of many projects will be felt for long periods of time, and not all future impacts will be positive. Discounting results can mean less attention being given to successive generations.
- Risk and uncertainty. All projects face some degree of uncertainty. The most common way of dealing with this is to use 'expected values' for prices, quantities and other variables whose precise values cannot be known in advance. Essentially, each potential outcome is weighted by the probability of its occurrence, and the weighted outcomes are then summed to arrive at a mean, or expected, value. Alternatively, it is possible to use 'sensitivity analysis', in which the project analysis is modified to examine the effects of different assumptions about key variables, and their effect on the project's overall profitability.
- Irreversibility. Many projects entail the modification of natural areas, reducing the supply of these and endangering the continued existence of plants or animal species, causing irreversible consequences.
- Incrementalism. This is the term used to denote problems which arise from making decisions on an individual project basis without consideration of the cumulative effect of many such decisions.
- Cultural, historical and aesthetic resources. Losses of these resources are difficult to quantify and express in monetary terms because the perceptions of these losses depend on cultural traditions and value systems.

Multicriteria methods have often been used as an alternative approach to cost benefit analysis. The attack against CBA is based on the argument that the standard value judgements, that underlie the concept of a Pareto optimum, command wide assent and this consensus renders them 'objective'. Pearce and Turner (1990) specify that multi-criteria analysis does undoubtedly involve a trade-off of greater comprehensiveness against loss of precision.

Compared with cost-benefit analysis, in MCA the measure of benefits is not related to the concept of willing to pay but to the achievement level of the set goals (or preferences). In other words, the benefits are the outcomes from a project which are evaluated positively in relation to one or more criteria (Albers and Nijkamp, 1989; Nijkamp et al., 1999).

MCA is also suggested to be a applied within a communicative ideology in planning evaluation since it requires, on the part of the decision-makers, an explanation of the individual preferences assigned to the various objectives-criteria calling for decision (see Glasser, 1998). Therefore, discussion and negotiations should be made available where exponents of different groups of opinion, political currents and lobbies, as well as the promoters and executors of the proposed actions, may be represented (Zeppetella et al., 1992; Zeppetella, 1995).

However, there a number of methodological problems associated to non-monetary methods and, more generally, to E.I.A. procedures, such as the following: difficulties of predicting impacts, lack of definition, monitoring of on-going environmental change, absence of specific S.E.A. methods and consultation and participation (see also Therivel, 1992; Wood, 1994; Zeppetella, 1997). Wood (1944) suggests the following steps to overcome these problems: increasing the general understanding of S.E.A.; clarifying procedural issues and methodological issues (including E.I.A. methods); strengthening the capacity for the practical application of appropriate S.E.A. methods; reviewing existing environmental data sources to assess their potential use in S.E.A. and prioritising measures for correcting any deficiencies.

At the moment, the analysis is usually limited to a list of environmental factors which do not take into account the complexity of interdependence with the human system. This may guide planners to put more emphasis on certain issues than others and towards a general unbalanced output. The major problems are still the utilisation of only deterministic and quantitative measures of the built environment, the difficult question of prioritising environmental and technical criteria of different nature, and finally the question of language in sharing a common vocabulary, knowledge and information among experts. Each discipline involved in decision making usually brings its own agenda, own classification system and own techniques to the problem (Brandon et al., 1997; Cole et al., 1995).

2.3 Monitoring Activities and Sustainability Indicators

Monitoring evaluation is strongly emphasised in the latest planning guidance (DoE, 1992). This is reflected in the 1991 Planning and Compensation Act which introduces the so-called plan-led system. The aim is to make the planning system "simpler and more responsive, reducing costs for both the private sector and local authorities and making it easier for people to be involved in the planning process" (DoE, 1992, 1.10).

Monitoring activity is strongly related to contingent and contextual aspects and the methods tend to reflect the administrative character of this activity (Lichfield and Prat, 1998). A major problem with this activity is the selection of the right indicators that are able to represent the situation under study. An indicator or an index can be defined as a means devised to reduce a large quantity of data down to its simplest form, retaining essential meaning for the questions that are being asked of the data (Ott, 1978).

At the moment there is a great demand for indicators which are able to measure sustainable development as a prerequisite to promoting a sustainable society. This demand arose as a consequence of the UN Conference on Environment and Development (UNCED, 1992) which stated that 'indicators of sustainable development need to be developed to provide a solid basis for decision making at all levels and contribute to self regulating sustainability of integrated environmental and development systems'.

The European Community's Fifth Environmental Action Programme 'Towards Sustainability' (CEC, 1993) also notes that 'there is at present a serious lack of indicators and environmental assessment material' and this has added to the demand for effective sustainability indicators. However, according to Mitchell (1996), ***despite the considerable attention devoted to sustainability indicators, no set has emerged with universal appeal.***

There are a number of limitations related to both current sets of urban sustainability indicators and their classification systems. In the following two sections, a short overview and discussion is provided.

2.3.1 A Critique to current Lists of Indicators and their Classification Systems

As already mentioned, the interest in statistical indicators in the environment and urban sustainability has become increasingly apparent in recent years. Among other recent contributions, it is appropriate to cite International organisations such as the United Nations World Bank and OECD, the European Commission through Directorate General XVI, Regional Policy and Cohesion, EUROSTAT as well as the Committee of the Regions of the European Union; the National Ministero dell'Ambiente and some official statistical institutions such as ISTAT and Istituto Ambiente Italia (1997). In 1997 DG XVI called for an Urban Audit, in order to establish the necessary environmental and urban indicators.

All these organisations and institutions have promoted the need to count upon rigorous statistical indicators of the quality of urban life and sustainability. In recent years, they have developed a number of sustainability indicators which illustrate current environmental problems, identifying their causes and effects, in order to improve decision making processes at all levels, local, national and international. All the selected indicators are quantitative and statistical in nature. For example, nationally, there are some well developed sustainability indicator programmes, such as Sustainable Seattle (1993) and some have been given a lead by existing State of the Environment (SoE) reporting programmes (e.g. SoE Canada, 1991).

At the city scale, many Local Agendas 21 have been developed by local authorities following the Aalboorg 1994 Conference (European Sustainable Cities, 1994). At this level, the development of sustainability indicators specifically aims to: audit the urban development, evaluate the performance of policies and decision-making processes and assist local administration to find possible solutions and correct strategies for environmental and social problems. These indicators should represent both a vehicle for improving communication with the local community and an efficient technical tool for supporting decision making processes (see also Mitchell, 1996; Lombardi, 1999a).

In accordance with Agenda 21 (UNCED, 1992), the selection of indicators should be operated through a bottom-up approach where citizens play a crucial role in identifying the more appropriate ones. However, many European countries have adopted a top-down approach, leaving the responsibility of this choice to experts (Cogo, 1997).

A major problem with current sustainability indicator sets is that sustainability principles are not consistently applied within all indicator programmes (Mitchell, 1996). For example, the UK Government strategy on sustainable development (HMSO, 1994) fails to address the principle of social inequality and their sustainability indicators are likely to be deficient in this respect.

A number of sustainability indicator sets can be found in literature that reveal the multidimensionality of sustainability notion as composed by dimensions related to different quality concepts and the etherogeneity of factors involved (Lombardi and Basden, 1997; Mitchell, 1999a). Although useful, these lists of indicators cannot be relied on to be complete. Such lists emphasise the distinctness of the aspects, and give no indication of their inter-dependencies. According to Lombardi and Basden (1997), these problems come from a list's empirical genesis: it is merely a compilation of people's ideas and has little theoretical, ontological foundation.

At the present, comprehensive and effective lists of indicators that can assist local administrations to find possible solutions and correct strategies for environmental and social problems, have not been achieved.

A major limitation of all the above sets of indicators is the focus on the environment rather than sustainability. Most of the indicators are related to a description of the environment as such, without an identification of the multiple effects this state has on human and natural resources. This may often lead to immediate and short term solutions rather than to a prevention of negative effects. A second problem, linked to the previous one, is the unique utilisation of quantitative measures to describe sustainability in the built environment. This is a very narrow way of representing the problem which does not sufficiently cover a number of fundamental aspects, such as spatial (morphological indicators for describing urban form), analytical (related to teaching and learning, such as educational programmes and incentives), lingual (the role of communication and the Media in development processes), and aesthetic (the beauty of a living environment), just to mention a few. In addition, the seeming comprehensiveness of some of these lists can be misleading, and they are likely to be unbalanced, putting more emphasis on certain issues than others.

Elevation of aspects, and consequent imbalance and ignoring of others, is a particular danger in decision making for sustainability, particularly in planning, because it places heavy reliance on specialist knowledge (see Section 2.2.1). It may also be misleading, suggesting an unbalanced path in future developments of a town (Cogo, 1997; Lombardi, 1998a, 1988b and 1999a; Mitchell, 1999a).

Mitchell (1996) notes that effective sustainability indicators can best be identified by ensuring that personnel in organisations with the responsibility for their development are adequately briefed on sustainability issues and the indicators' characteristics. This process however, requires the assistance of a suitable method or a framework which is able to guide developers through the process of indicator identification. The method named PICABUE (Mitchell et al., 1995) has been indicated as suitable for this use. It is later illustrated in more detail and adopted in this study (see Chapter 6.0).

A different problem is related to the possibility of comparing sustainability situations, between regions and countries. This has been tackled by devising systems which aim at harmonising selected lists of indicators. Different international and European organisations have contributed to the establishment of a common agreed classification system for sustainability indicators with the aim of improving the evaluation of urban developments and policy decisions. A short critical overview is here provided.

The Organisation for Co-operation and Economic Development (OECD, 1994) has proposed a linear model based on three main groups of classification for indicators:

a) *State,* describing environmental resources quality or depletion;

b) *Pressure,* describing the carrying capacity of environmental resources;

c) *Response,* describing public policy-programmes and private behaviour.

A similar classification system has been developed by the United Nations (1995) entitled "*Driving force-Sate-Response*" where more emphasis is placed on the effects that human actions and processes have on the natural environment. These indicators are grouped within four main sustainability issues, i.e. social, economic, environmental and qualitative aspects. However, there is not a specific integration between them in practice.

The list of indicators which was selected among 72 European cities by the Task Force (EEA,1995) is specifically concerned with the built environment. This includes 55 quantitative indicators classified in relation to:

i) urban structure (population, land occupation, number of journeys for mode, etc.);
ii) urban performance (water consumption, energy consumption, number of waste disposals, etc.) and
iii) urban quality (e.g. number of days in which there is an exceeding of environmental standards).

A different method for harmonising the selection process of sustainability indicators, named ABC-indicator-model, is illustrated in "The European Sustainability Index Project" (International Institute for Urban Environment - IIUE, 1995). This is based on a classification of indicators in three main groups:

a) *area specific indicators*, developed by local organisations or administrations, and related to specific problems or characteristics of the area;
b) *basic indicators*, which support the following indicators (c), clarifying the context and specifying the results;
c) *core indicators*, represents the principal ones, providing the more essential and fundamental information for measuring local sustainability.

This project included twelve European cities; it represents a way forward in the development of a common understanding of sustainability and towards a homogeneous method for the development of sustainability indicators (Cogo, 1997).

A major problem with the previous classifications is that they fail in their aim to integrate all the dimensions of urban sustainability, i.e. environmental, social and economic. One reason for this problem is that rigidly defined classifications usually lead to difficulties in defining interactions and relationships between sub-systems. A second reason is related to a difficulty in defining sustainability in substantive terms. This assumes different meanings in relation to different contexts or to different approaches, a bottom-up approach, improving participation or top-down approach, based on expert opinions.

Considering the multi-dimensional nature of sustainability at a local level, a number of relevant aspects should be taken into consideration for the true long term sustainability of any built environment and its community (Lombardi and Basden, 1997). These aspects pertain to our functioning as individual and social human beings; even though we are not always aware of them. Unfortunately, the availability of specialist knowledge of an aspect tends to elevate that aspect, and thus results in less than "healthy" living (Dooyeweerd, 1958). For example, the emphasis at the present time is placed mainly on the economic and biological aspects of the urban sustainability, as suggested not only by a comparison of sustainability indicator lists of Local Agendas 21 (Lombardi, 1988b; 1999b) but also by the amount of specialised literature on the implication of economic activities on the environment and vice versa (in the field of environmental economics, among others, see: Bishop and Haberlain, 1979; Nijkamp, 1980; Bishop, 1982; Pearce et al., 1989; Pearce and Turner, 1990; Costanza, 1991; Grillenzoni, 1993; Stellin and Rosato, 1998).

Another suggested view (see among others Brandon et al., 1997; Cole et al., 1995; Mitchell et al., 1995) could be that a useful classification system for sustainability objectives and indicators at a local planning level is the one that is able to:

- recognise specific and definite relationships between the components of an urban system;
- be comprehensive of all the technical-deterministic and non-technical-nominalist variables such as those in the social, cultural and political realms;
- handle all the above variables which are essential to the progress and management of a sustainable society.

2.4 Summary and Conclusions

This chapter has provided an overview of the problem of urban sustainability in relation to planning evaluation with the aim of identifying the main limitations of current assessment methods on the basis of a literature review.

It has firstly discussed the different meanings and roles of an evaluation in planning. This activity is related to a variety of factors and contexts. It may be adopted to improve the management of political programmes, demonstrating the feasibility of a project in a technical and economic manner, i.e. verifying effects of actions on the social and environmental systems. Alternatively, it may assist an administrative behaviour (Simon, 1972), providing a context of rationality to legitimise public decisions. Finally, it may improve public participation and discussion among parties (Bentivegna, 1997).

Successively, it has critically reviewed a number of methods and approaches within two major evaluation stages, i.e. *ex-ante* and *ex-post* or monitoring. The *ex-ante* planning evaluation methods have been divided into two main groups of monetary and multicriteria evaluation, in relation to the information they are able to handle and provide. This classification is in accord with the structure illustrated by Voogd (1983) and other experts in this field (Fusco Girard, 1990; Roscelli, 1990; Grittani and Grillenzoni, 1994). A brief discussion of each group of methods has been provided with particular emphasis on the benefits and the disadvantages that each provides in the context of planning for sustainability. A more detailed illustration of each method is also offered in Appendix A.

With regards to monitoring activity, the critical discussion developed in this chapter has highlighted the problem of selecting appropriate indicators as a prerequisite to measure sustainable development. It has also been noted that, despite the great demand for sustainability indicators, "no set has emerged with universal appeal" (Mitchell, 1996).

A number of the 'problem solving' methods analysed in this chapter are widely applied within a comprehensive rational model which still pervades the planning realm. The latter is based on unreal assumptions, such as the following: ends and means can be separated; decision makers can (and do) identify all the possible alternatives available to them; they can (and do) survey comprehensively all these alternatives with respects to all of their possible consequences; they are fully cognisant of all of their objectives and with a completely defined preference function that is capable of aggregating all of these objectives, which can enable them to choose the alternative or sets of alternatives that maximise their overall utility (Glasser, 1998). These assumption are rarely true in practice. Consequently, most of the methods which follow the technical-scientific approach remain imperfect for use in decision-making involving sustainable urban development.

A more recent communicative ideology has been adopted in planning. It emphasises participatory forms based on "inclusionary" argumentation (Voogd, 1998). The objective is to acquire commitment and consensus among all stakeholders rather than arrive at a determinative policy agenda or evaluation outcome. In evaluation methodology this corresponds to a change towards a responsive *risk society* approach to sustainability (see Simin, 1999). According to many experts in this field (Lichfield et al., 1998), however, a fundamental problem with the communicative ideology is 'how best to organise the form of discourse, to develop inclusionary argumentation and to build interrelations' (Voogd, 1998). In the words of Simin (1999), " future planners need to acquire appropriate skills, such as how to interact and be socially responsive to other people's ideas, and more importantly how to intervene and influence the decision-making processes".

The above issues implies a problem of language and of a common vocabulary between stakeholders within the decision making process (see also Chapter 5.0). They pinpoint the need for an educational tool which "brings unity within diversity" (Lombardi and Basden, 1997), taking into account the different views and interests necessary to assess a built environment.

The BEQUEST *Report* (1999) emphasises that sustainability assessment of the urban environment may need to be more of a procedure or process using various techniques, rather than one integrated method since different assessment techniques are required for different dimensions, and for the meso and macro scales. This process needs to assist stakeholders in selecting, from a range of alternatives, those options that help move towards Sustainable Urban Development rather than away from it.

A major limitation of existing assessment methods is the focus on the empirical measurements of specific effects, economic as well as environmental ones, rather than an identification of the multiple effects the project has on human and natural resources. This often leads to immediate and short term solutions rather than to a prevention of negative effects. A second problem is that very often the non-technical issues are not addressed, or insufficiently covered, in the evaluation. Although MCA methods have often proved able to provide a guide for selecting suitable planning and design solutions in evaluation (Voogd, 1983; Saaty and Kearnes, 1985; Saaty and Vargas, 1987; Fusco Girard, 1987; Roscelli 1990; Fusco Girard and Nijkamp, 1997), they lack content and a conceptual framework or a theoretical guide that can help designers and decision makers to structure the problem of sustainability in the built environment. Consequently, this selection is often developed on an intuitive basis or in a non optimal manner (Albers and Nijkamp, 1989; Bentivegna et al., 1994; Lombardi, 1997).

One of the aims of this research is to overcome the above limitations by developing a framework or a mechanism which integrates the assessment of natural, economic, cultural and social aspects of the built environment at a district level. This research also aims to draw conclusions for the development of technologies which may aid the decision making process. In undertaking these objectives, the next chapter includes:

- a comparison of different philosophical approaches;
- an illustration of Dooyeweerd's philosophy which is the basis of the multi-modal system thinking approach and could provide a useful theoretical foundation for developing a new framework for evaluation in planning and design.

2.5 Main References

Adams D., 1994, *Urban Planning and the development process,* UCL press, London

Aho I., 1995, Theoretical and Pragmatic Aspects of the Priorization of Environmental Criteria for Buildings, in Cole et al. (eds.), *Linking & Prioritizing Environmental Criteria,* Proceedings of the CIB TG-8 International Research Workshop, Toronto, Canada, 15th – 16th November, pp.5-10

Albers L., Nijkamp P., 1989, Multidimensional analysis for plan or project evaluation. How to fit the right method to the right problem, in Barbanente (ed.), *Evaluation Methods for Urban and Regional Planning,* IRIS-CNR, vol.6, Bari, pp.29-46

Ashworth G.J. and Voogd H., 1988, Marketing the city: concepts, processes and Dutch applications, in *Town Planning Review,* 59, pp.65-79

Ave G. and Corsico F. (eds.), 1994, *Urban Marketing in Europe,* Torino Incontra Edizioni, Turin

Barbanente A. (ed.), 1989, *Evaluation Methods for Urban and Regional Planning,* IRIS-CNR vol.6

Bentivegna V., 1995, Il contributo della valutazione alla razionalità e legittimazione del piano, in *Urbanistica 105/95,* pp.66-71

Bentivegna V., 1997, Limitations in environmental evaluations, in Brandon et al., (eds.), 1997, *Evaluation in the Built Environment for Sustainability,* E&FN SPON, Chapman&Hall, London, pp.25-38

Bentivegna V., Mondini G., Nati Poltri F., Pii R., 1994, Complex Evaluation Methods. An Operative Synthesis on Multicriteria Techniques, in Proceedings of the IV International Conference on *Engineering Management,* Melbourne, Australia, April, pp.1-18

BEQUEST - Building Environment Quality Evaluation for Sustainability through Time Network, 1999, *Report 1998-99,* EC Environment and Climate Research Programme, Theme 4: Human Dimensions & Environmental Change, Directorate D - RTD Actions: Environment - E.U. DG12

Bezzi C. e Palumbo M. (eds.), 1998, *Strategie di valutazione,* Gramma – Linee di ricerca sociale, Perugia

Bishop R.C. and Heberlein T.A., 1979, Measuring values of extramarket goods: are indirect measures biased?, in *American Journal of Agricoltural Economics,* December, pp.926-932

Bishop R.C., 1982, Option value: an exposition and extension, in *Land Economics,* n.1, pp.1-15

Bobbio L., 1996, *La democrazia non abita a Gordio,* Angeli, Milan

Brandon P.S., Lombardi P.L. and Bentivegna V. (eds.), 1997, *Evaluation in the Built Environment for Sustainability,* E&FN SPON, Chapman & Hall, London

Brandon, P.S., Basden, A., Hamilton, I. and Stockley, J., 1988, *Expert Systems: Strategic Planning of Construction Projects,* The Royal Institution of Chartered Surveyors, London, UK

Bruinsma F., Nijkamp P., Vreeker R., 1999, Experts at Arm's Length of Public Policy-Makers. A Case Study on Utrecht (forthcoming)

Clough D.J., 1984, *Decisions in public and private sectors: theories, practices and processes,* Prentice-Hall Inc., New Jersey

Cogo M., 1997, *Progetto Venezia 21*, Fondazione Eni Enrico Mattei, Venice

Cole R.J., Rousseau D. and Theaker I.T., 1993, *Building Environmental Performance Assessment criteria,* Version 1, Office Buildings, The BEPAC Foundation, Vancouver

Cole R.J., Rousseau D. and Theaker I.T., 1993, *Building Environmental Performance Assessment criteria,* Version 1, Office Buildings, The BEPAC Foundation, Vancouver

Costanza R. (ed.), 1991, *Ecological Economics,* Columbia University Press, New York

Dalkey N.C., 1967, *Delphi*, Rand Corporation, New York

Dixon J., Carpenter R. and Fallon L., 1986, *Economic analysis of the environmental impacts of development projects*, Earthscan, London

DoE - Department of the Environment, 1992, *Assessing the impact of urban policy*, Inner Cities Research Programme, HMSO, London

DoE - Department of the Environment, 1996, *City Challenge Interim National Evaluation*, Regeneration Research Report, HMSO, London

Dooyeweerd H., 1958, *A new critique of theoretical thought*, 4 vols, Presbyterian and Reformed Publisher Company, Philadelphia, Pennsylvania

European Environment Agency Task Force, EEA, 1995, *Europe's Environment: The Dobris Assessment*, Earthscan, Copenhagen

European's Fifth Environmental Action Programme, 1993, *Towards Sustainability,* Commission of the European Community, CEC.

Expert Group on the Urban Environment, EGUE, 1994, *European Sustainable Cities. Consultation Draft for the European Conference on Sustainable Cities and Towns,* first annual report, Aalbourg, Denmark, 24th – 27th June, Commission of the United Nations Conference on Environment and Development, UNCED, 1992, *Earth Summit '92 (Agenda 21),* Regency Press, London

Ferry D.J. and Brandon P.S., 1991, *Cost Planning of Buildings*, VI edition, Blackwell Science Ltd, Oxford

Fisher F. and Forester J. (eds.), 1993, *The argumentative turn in policy analysis and planning,* Duke University press, Durham

Fusco Girard L and Nijkamp P., 1997, *Le valutazioni per lo sviluppo sostenibile della città e del territorio,* Angeli, Milan

Fusco Girard L. (ed.), 1990, *Conservazione e sviluppo: la valutazione nella pianificazione fisica,* Angeli, Milan

Fusco Girard L. (ed.), 1993, *Estimo ed economia ambientale: le nuove frontiere nel campo della valutazione. Studi in onore di C.Forte*, Angeli, Milan

Fusco Girard L., 1987, *Risorse architettoniche e culturali,* Angeli, Milan

Giaoutzi M. and Nijkamp P., 1993, *Decision support model for regional sustainable development*, Avebury, Aldershot

Grillenzoni M. (ed.), 1993, *Valutazione delle risorse ambientali*, Edagricole, Bologna

Grittani, G. and Grillenzoni M. (eds.), 1994, *Estimo: teoria, procedure di valutazione e casi applicativi*, Edagricole, Bologna

Guba E.G. and Loncoln Y.S., 1989, *Fourth Generation Evaluation*, Sage, London

Healey P., 1992, A planner's day: knowledge and action and iterative practice, *Journal of Planning Association*, 58, n. 1, pp.9-20

Healey P., 1995, The communicative turn in planning theory and its implications for spatial strategy formation, *Environmental and Planning B: Planning & Design*, v.23, n.2, pp.217-234

Healey P., 1997, *Collaborative Planning*, MacMillan, London

Hill M., 1968, A goals-achievement matrix for evaluating alternative plans, *Journal of the American Institute of Planners*, vol.34, n.1, pp.19-28

Hinloopen E., Nijkamp P. and Rietveld P., 1983, Quantitative discrete multiple criteria choise models in regional planning, in *Regional science and urban economics,* v.13, pp.77-102

HMSO - Her Majesty's Government, 1994, *Sustainable Development: The UK Strategy*, HMSO, London.

IIUE - International Institute of Urban Environments, 1995, *The ABC Approach*, Delft

Istituto di Ricerche Ambiente Italia (ed.), 1997, *Ambiente italia. Rapporto annuale 1997,* Edizioni Ambiente, Milan

Jackson P., 1990, *Introduction to Expert Systems*, Addison-Wesley, New York

Janssen R., 1991, *Multiple Decision Support for Environmental Problems,* Kluwer Academic Publishers, Dordrecht

Johansson P.O., 1993, *Cost-benefit analysis of environmental change*, Cambridge University Press, Cambridge

Khakee A., 1997, Evaluation and planning process: methodological dimension, in Brandon et al. (eds.), Evaluation of the Built Environment for Sustainability, E&FN SPON, Chapman & Hall, pp.327-343

Khakee A., 1998, The communicative turn in planning and evaluation, in Lichfield et al., *Evaluation in Planning*, Kluwer Academic Publishers, Dordrecht, pp.97-111

Koster A., 1994, Urban marketing – A new approach for town planning and a chance for reactivation of sites in old-industrial regions, in Ave G. and Corsico F. (eds.), 1994, *Urban Marketing in Europe*, Torino Incontra Edizioni, Turin, pp. 662-667

Lichfield N. and Prat A., 1998, Linking *ex-ante* and *ex-post* evaluation in British town planning, in Lichfield et al. (eds.), 1998, *Evaluation in Planning. Facing the challange of complexity*, Kluwer Acc. Press, Dordrecht, pp.283-298

Lichfield N., 1988, *Economics in Urban Conservation*, Cambridge Univ. Press., Cambridge

Lichfield N., Barbanente A., Borri D., Kakee A. and Prat A. (eds.), 1998, *Evaluation in Planning. Facing the challange of complexity*, Kluwer Acc. Press, Dordrecht

Lichfield N., Kettle P. and Whitbread M., 1975, *Evaluation in the planning process*, Pergamon Press Ltd, Oxford

Lombardi P.L. and Basden A., 1997, Environmental Sustainability and Information Systems, *Systems Practice*, vol. 10, n. 4, pp.473-489

Lombardi P.L., 1997, Decision making problems concerning urban regeneration plans, in *Engineering Construction and Architectural Management*, v.4, n.2, pp.127-142

Lombardi P.L., 1998b, Managing sustainability in urban planning evaluation, in Brandon (ed.), *Managing Sustainability: Endurance through change*, CIB World Conference, Symposium D, Gavle, Sweden, pp.2041-2050

Lombardi P.L., 1999b, Agenda 21 e monitoraggio dello sviluppo urbano sostenibile, in Lombardi, Analisi e valutazione di progetti e programmi di sostenibilità urbana, *Urbanistica,* n.112, (in press)

Lombardi P.L., 1999a, Riferimenti metodologici e strumenti di valutazione per la sostenibilità urbana, in Lombardi and Micelli (eds.), *Le misure del piano*, F.Angeli, Milan, pp.96-114

Lombardi, P.L., 1998a, Sustainability indicators in urban planning evaluation, in Lichfield et al. (eds.), *Evaluation in Planning*, Kluwer Academic Publishers, Dordrecht, pp.177-192

MacLoughlin J.B., 1969, *Urban And Regional Planning: A Systems Approach*, Faber and Faber, London

Mishan E.J., 1971, *Cost-benefit analysis*, George Allen & Unwin, London

Mitchell G., 1996, Problems and fundamentals of Sustainable Development Indicators, *Sustainable Development*, vol.4, n.1, pp. 1-11

Mitchell G., 1999a, A geographical perspective on the development of sustainable urban regions, in *Geographical Perspectives on Sustainable Development*, Earthscan (in press)

Mitchell G., May A. and McDonald A., 1995, PICABUE: a methodological framework for the development of indicators of sustainable development, *Int. Journal Sustainable Development World Ecol.*, vol.2, pp. 104-123

Moffat S., 1995, The missing ingredients: a look at how to improve methods for linking and prioritizing environmental criteria for assessing buildings, in Cole et al. (eds.), *Linking & Prioritizing Environmental Criteria*, Toronto, Canada, 15th – 16th November, pp.115-120

Monnier C., 1987, *Evaluation de l'action des pouvoirs publics*, Economica, Paris

Nijkamp P. and Scholten H.J., 1993, Spatial Information Systems: design, modelling and use in planning, *International Journal of Geografical Information Systems*, vol. 7, pp.85-96

Nijkamp P., 1980, *Environmental Policy Analysis*, Wiley, Chichester

Nijkamp P., Bal F. and Medda F., 1999, A survey of methods for sustainable city planning And cultural heritage management (forthcoming).

Nijkamp P., Rietveld P. and Voogd H., 1990, *Multicriteria evaluation in physical planning,* North Holland Publ., Amsterdam

OECD, 1994, Report on *Environmental Indicators*, OECD, Paris

Ott W.R., 1978, *Environmental Indeces: Theory and Practice*, Ann Arbour Science, Ann Arbor

Patassini D., 1995, Paradigmi e strategie di valutazione di piani, programmi e politiche, *Urbanistica* n.105, pp.50-59

Pearce D. and Turner R.K., 1990, *Economic of natural resources and the environment,* Harvester Wheatsheaf, Hamel Hempstead

Pearce D., Markandya A. and Barbier E.B., 1989, *Blueprint for a green economy*, Earthscan Publications Ltd, London

Planning and Compensation Act 1991

Prior J. (ed.), 1993, *Building Research Establishment Environment Assessment Method, BREEAM, Version 1/93, New Offices*, Building Research Establishment Report, Second Edition

Rizzo F., 1989, *Economia del patrimonio architettonico e ambientale*, Angeli, Milan

Roscelli R.(ed.), 1990, *Misurare nell'incertezza,* Celid, Turin

Rostirolla P., 1992, *Ottimo economico: processi di valutazione e di decisione,* Liguori, Naples

Roy B., 1985, *Mèthodologie, multicritére d'aide á la dècision*, Economica, Paris

Ruddock L, (ed.), 1999, *Information support for Building Economics*, proceedings of the CIB-W55 Building Economics International Workshop, Salford, 1st – 5th September, CIB publication n.210

Rydin Y, 1992, Environmental Impacts and the Property Market, in Breheny M.J., (ed.), 1992, *Sustainable Development and Urban Form*, Pion London, pp.217-241

Ryding S.O., 1992, *Environmental management Handbook*, IOS Press, Amsterdam.

Saaty T.L. and Kearnes K.P., 1985, *Analytical Planning*, Pergamon Press, Oxford

Saaty T.L. and Vargas L.G. (eds.), 1987, The Analytic Hierarchy Process. Theoretical developments and some applications, *Mathematical Modelling*, v.9, n.3-5, pp.161-395

Saaty T.L., 1980, *The Analytic Hierarchy Process*, McGraw Hill, New York

Simin D., 1999, Sustainability: A new vision for the British planning system, in Lombardi (ed.), Analisi e valutazione di programmi e progetti di sostenibilità urbana. Alcune esperienze, *Urbanistica*, n.112 (in press)

Simon H. A, 1947, *Administrative Behaviour*, The Macmillan Co, New York.

Simon H., 1985, *Casualità, razionalità, organizzazione*, Il Mulino, Bologna

Simon H.A., 1982, *Models of bounded rationality*, vol.2, MIT press, Cambridge, Mass

SoE Canada, 1991, A report on Canada's progress towards national set of environmental indicators, *SOE Reports* 91-1

Stanghellini S. (ed.), 1996, *Valutazione e processo di piano*, INU n.7, Allinea Ed., Florence

Stellin G. and Rosato P., 1998, *La valutazione economica dei beni ambientali*, Utet, Turin

Sustainable Seattle, 1993, *1993 Indicators of a Sustainable Community*, Sustainable Seattle Network and Civic Forum, Washington

Therivel R., Wilson E., Thompson S., Heaney D. and Pritchard D., 1992, *Strategic Environmental Assessment*, Earthscan, London

United Nations, 1995, *Work Programme of indicators of Sustainable Development of the Commission on Sustainable Development*, Paper United Nation Department for Policy Coordinator and Sustainable Development

Voogd H., 1983, *Multicriteria evaluation for urban and regional planning*, Pion, London

Voogd H., 1998, The communicative ideology and *ex-ante* planning evaluation, in Lichfield et al. (eds.), *Evaluation in Planning*, Kluwer Academic Publisher, Dordrecht, pp.113-126

Winpenny J.T., 1991, *Values for the environment*, HMSO, London

Wood C., 1995, *The environmental assessment of plans programmes and policies: a comparative review*, E.I.A. Centre, Planning and landscape Dept., University of Manchester, Manchester M13 9PL

Zeppetella A., 1995, *Retorica per l'ambiente*, Angeli, Milan

Zeppetella A., 1997, Environmental assessment in land use planning:a rethorical approach, in Brandon et al. (eds.), Evaluating of the Built Environment for Sustainability, E&FN SPON, Chapman & Hall, pp.344-362

Zeppetella A., Bresso M., Gamba G., 1992, *Valutazione ambientale e processi decisionali*, La Nuova Italia Scientifica, Rome

Chapter 3.0 – Philosophical Underpinning

All science starts and ends in philosophy
(I.Kant)

The overall objective of this study is to find an integrating mechanism or a framework which is both comprehensive and holistic to keep together the different aspects of sustainability in planning and design. This requires further analysis of evaluation methods and a discussion on their philosophical origins.

The plurality of evaluation methods, which have been illustrated in Chapter 2.0, illustrates the lack of a conceptual framework among scholars in this field (Bentivegna, 1997). A more important aspect concerns the philosophical doctrines from which these basic theories derive. As Merkhofer (1987) suggests, "first, the theories serve as a source of (implicit) philosophical rationales for most decision-aiding approaches. Second, the procedures used in the various approaches are, to a considerable extent, natural derivations from the fundamental theory. Third, the criteria by which approaches are evaluated as 'right' or 'wrong' must stem directly from a philosophical judgement of the appropriateness and usefulness of the theories".

In this chapter the most widely accepted theoretical paradigms and schools of thought which provide a foundation for current evaluation methods and approaches (many of which have been described in the previous chapter) will be described and analysed within the context of evaluating sustainability in planning and design. The aim is to select the most appropriate theoretical approach as a basis for developing an analytical framework in planning evaluation.

In particular, two main groups of theories and schools of thought in evaluation and decision theories will be reviewed with an emphasis on the philosophical doctrines backing them up, i.e. utility theory vs. pluralism, rational mechanistic vs.

constructive thinking. This classification is in accord with the structure proposed by Hargreaves et al. (1992), by Bentivegna (1997) and others. The first group includes: economic theory, theory of games and normative decision theory. The issues associated to this group are: rational choice and rational behaviour. Section 3.1 deals with this first group and specifically with utility theory, which forms the basis of welfare economics from which stem both cost-benefit analysis and all derived monetary methods. This section provides an overview of several economic paradigms associated to this theory. Particular emphasis is placed on how economic theory is able to take into account the divergence between market prices and social values, recognising that the market price of goods and factors of production do not always reflect their social value or costs.

The second group includes new-contractual theories which refer mainly to cognitive and information doctrines. These theories are briefly illustrated in Section 3.2 as a support for communicative ideology in planning (Rawls 1971). Important issues, here, are the notions of social justice, democracy, complexity and integration. Particular emphasis is placed on issues which are relevant for the subject under study, such as rationality vs. complexity, subject-object relationship vs. democracy and participation. Section 3.2 also provides a comparison of the two fundamental paradigms used as a reference in the above doctrines: a rational mechanics paradigm and a constructivistic paradigm.

The above discussions leads to the systemic paradigm which arose in the middle of 1970s, integrating the two complementary paradigms of structuralist and cybernetic (Eriksson, 1996). Thus, section 3.2 concludes with a comparison of the two schools of thought in system science: the French school Systemic of Le Moigne and the Swedish (Scandinavian) school Multimodal System Thinking (MST) of de Raadt. The philosophical foundations of the MST, i.e. the 'Cosmonomic Idea of Reality' by Herman Dooyeweerd is finally illustrated in more detail in Section 3.3. This section also illustrates a comparison with a more popular and widely referenced theory in management and construction, the theory of Maslow, providing reasons for an adoption of the former in the development of an evaluation approach in planning for sustainability.

Section 3.4 provides a summary of the above discussion and some major conclusions.

3.1 Economic Utility Theories

In the words of Clough (1984, p.188), "there are two distinctly different and apparently incompatible utility theories in literature". One arose from the *classical economic theory* and has become the underpinning of the *economic theory of exchange* (equilibrium supply and demand). The other arose from *probability mathematics*, and has become the major basis of the *subjective school of modern decision theory*. Its origins can be traced back to 1738, thanks to the work of Daniel Bernoulli. He outlined an 'expected utility' theory of the analysis of a gambler's choices, combining both personal utility and probabilities for outcomes. In addition, he introduced the idea of 'risk aversion'. The theory was further developed in 1944 by John von Neumann and Oskar Morgenstern and is still applied in many decision problems.

The main difference between the above two utility theories is that only this second one incorporates outcome probabilities. Both the theories have a strong influence on current evaluation methods in planning.

As already stressed by Pearce and Turner (1990), utility theory is by far the most fundamental and influential philosophical doctrine in the field of social science and it is at the root of welfare economics. The fundamental theory of the welfare economy tries to legitimise the rational behaviour of the individuals as social worth and it justifies interventions by the State while looking to an improvement of the conditions in which individuals can make their own choices.

In the following two sections, a synthetic overview of some main economic paradigms associated to the neo-classical model will be provided and the main weaknesses of this model in the context of decision making for sustainability will be emphasised. The aim is to show that this theory is inadequate as a base for developing a comprehensive framework in planning evaluation.

3.1.1 Overview of Economic Paradigms

The fundamental paradigm of current evaluation in planning is still the neo-classical model which arose in 1870. This represents a real revolution in comparison to the previous two paradigms in economic thinking: *the classical paradigm* and *the Marxist paradigm.*

There is a massive amount of literature in this field. Basically, the pre-1870 theory was objective in the sense that empirically measured input costs were believed to be predictors of the market exchange prices of output commodities. The post-1870 theory is subjective in the sense that the unobservable personal values (utilities) of producers and consumers are believed to determine the exchange prices of commodities (Clough 1984, p.189)

Synthetically, classical economics is a theory of labour-value, sometimes called the cost-of-production theory, where the labour is the only source for the net economic product. This was mainly a *logical* theory whose hypotheses cannot be directly tested through observation. It includes thinkers such as Adam Smith, Thomas Malthus and David Ricardo. These thinkers were all pessimistic about the perspective of long term economic growth, identifying the constraints of the environment with the scarcity of productive land supply and, consequently, with the presence of decreasing rates (profit) in agricultural production (Grittani and Grillenzoni, 1994).

John Stuart Mill's conception of economic progress was a game between technical change and the presence of decreasing rates in agriculture. However, he was more optimistic regarding technological progress and the satisfaction of human and social needs. Karl Marx shared the idea of a general value-labour theory with classical economists. In his opinion, however, the capitalistic economic organisation should be placed within the right historical context. His aim was to establish a general productive model of goods in which production is characterised as a social relation.

From 1870 onwards, *neo-classical thinking* started to be developed as the dominant economic thought and to be used by professional groups, completely replacing the previous value-labour theory. This thinking considers the price of a goods as an indicator of its scarcity (the scarcity-value theory). From a methodological point of view, the neo-classical economists developed a new approach for analysing price and market structures, based on marginal calculation (Marglin, 1967).

According to the modern *marginal-utility theory* (Jevons, Menger, Walras), market exchange prices are not determined by the costs of production but by the personal valuations (utilities) of the traders. Utility is considered as a measure of the value which individuals place on goods. It is defined as the capacity of a good to produce pleasure, to satisfy a need. The rational choice criterion is to maximise the aggregated utility, or individual preferences, by means of an aggregated balance of utilities (Fishburn, 1970; 1982).

The so called *Pareto optimum* expresses a social state in which it is impossible to improve the position of some individuals without decreasing the well-being of others, where 'improving' means 'to put in a preferred situation' (Misham, 1971).

One of the key features of the neoclassical utility theory in economics is called *diminishing marginal utility*. It is assumed that the individual utility function of each producer and consumer has this feature (Rostirolla, 1992; Ruddock, 1992). The aim of neo-classical economists was to define a set of laws governing economic activity similar to those established by Newton in physics. They believed this market theory was neutral. For this reason, it has often been defined as "social engineering" (Hargreaves et al., 1992).

The *humanist* theory represents a minor position within the economic field. It refuses the model of the rational economic agent in favour of a behavioural psychology approach. This emphasises the existence of a hierarchy of needs instead of a whole range of substitutive needs. Preferences and tastes are not static but interdependent, changing through time according to the culture. For the whole the neo-classical theory, tastes are exogenous to the model, consequently they cannot be spliced from the needs (Fusco Girard, 1993; Bentivegna, 1997). The humanists criticised the neo-classical theory of rationality, supporting the idea of an *extended rationality* where group interested actions are prevalent. This may be analysed in terms of multiple ranking (or rating) of preferences, coexisting within the same individual – the first aiming to satisfy his personal interest and the other attempting to satisfy his contribution to a group (Pearce and Turner, 1990; Lichfield, 1996).

A last minor theory which arose at the beginning of the 20th century is the *institutional* theory. A process-oriented paradigm underlying this theory considers economy as a dynamic process. In the idea of institutional theorists the *cultural determinism* may explain the socio-economic change. Individual, named cultural agents (instead of rational agents), acquire their culture through time, learning by means of institutional agreements. Individual preferences are *learned preferences* which change through time. In addition each agent has, not only individual preferences, but also collective ones (Bentivegna, 1997).

From 1970, an *environmental* emphasis arose from the constant depletion of natural resources, and started to grow as an economic and political force within the social system. Four different visions can be distinguished, from the extreme 'Cornucopian' vision which is directed at economic growth for depleting environmental resources to less extreme forms of growth with a major respect for nature to the deep ecology which alternatively suggests a complete preservation of all ecological systems (Pearce and Turner, 1990).

An approach which is in opposition to the neo-classical and also the extreme steady-state economics viewpoint is the so called *ecological economic* approach (often called *sustainable model*) which emphasises the goal of a sustainable use of environmental resources (Costanza, 1991). It acknowledges the existence of conflicts in people' interests and of different objectives and values in economic development. However, it still faces the problem of translating (reducing) all policy (and planning) effects in monetary terms, by adopting an extended concept of value.

This has been defined as *"Total Economic Value"* (T.E.V.) and expresses the overall benefits of the various subjects involved in the transformation-use process. It is composed of user values which derive from the use of the environment by current generation and future generations, plus non-use values or intrinsic values, which are un-related to use. The use value can be direct (*"actual use value"*) when it refers to the profitability resulting from consumer functions, and indirect (*"option value"*) when it is related to the aesthetic, visual or recreational uses of the resource.

In particular, the following indirect use values may be identified: "Option value" which expresses the potential or future use of environmental resources by the individual; "Vicarious value" which expresses the benefit that the individual receives from knowing that a resource is protected in order to be enjoyed by other individuals of his own generation; "Bequest value" which expresses the benefit that the individual receives from knowing that a resource is protected in order to be enjoyed by other individuals of future generations. Lastly, intrinsic values, named "*existence values*", express a less anthropocentric and utilitarian vision of the world, since they recognise that nature has its own worth beyond any economic utilisation of nature. These existence values are certainly fuzzy values (Pearce et al., 1989; 1990). The final equation for the T.E.V is, therefore, the following:

T.E.V. =Actual use value + Option value + Existence value.

Although considerable progress has been made (Costanza et al., 1997), economic research into the monetary valuation of externalities and environmental resources has not yet completely solved the valuation problem of the existence value. In the absence of a demand curve and market price for many environmental commodities, a number of non-market methods for estimating value have been devised such as the contingent valuation method, travel cost method and the hedonic pricing method (see Section 2.2 and Appendix A).

3.1.2 Discussion and Final Remarks

For several decades, there has been a wide debate over market mechanism versus planning as a means for resource allocation and a great deal of literature is still available on this subject (see among others, Costanza, 1991; Thrilwall, 1994).

The fundamental point of this theory is that many of the services provided by environmental resources, since they are public, are "free of charge"; or rather, they are worthless in terms of price because there is no market in which their value can be assessed by transactions between suppliers and purchasers.

The neo-classical paradigm to planning (also named, *market-based approach*) emphasises the goal of the efficient use of the environment and considers market failures to be the main, and perhaps only, cause within a market economy of difficulties in allowing for environmental concerns in economic development (Costanza, 1991).

Market failure can be traced to the intrinsic nature of land as a social rather than a private commodity, to the existence of monopolies and imperfect information among consumers. Unfortunately, the strong presence of externalities which characterise environmental resources and public goods reveals the existence of information costs (i.e. the information required in order to enter into a market as consumer or supplier) which are too high for both, expressing the total economic value of goods and services by the pricing system and allowing a resources-efficient market allocation (Arrow 1951; 1987). Information and its costs prove to be central factors in the decisions regarding market or non-market allocation of resources. In fact, most of the time the information available is lacking and imprecise. It negatively influences the evaluation process and, consequently, the final decision. Furthermore, the information is conditioned by the subjective situation and aspirations of decision-makers.

In terms of temporal aspects, a judgement of a property-market decision usually involves an assessment of the overall time-scale within which such decisions are taken, hence the number of years within which costs and benefits are considered. It requires an assessment of the weights that are placed on future as opposed to imminent impacts, and the ways in which appraisal techniques that inform decision-making may have implicit weighting (Dasgupta et al., 1972).

Externalities and public goods are two of the main reasons for market failure; according to Winpenny (1991), another is the failure to take the interests of future generations fully into consideration when taking present decisions. The role of discounting procedures is here relevant (Pearce and Turner, 1990).

The utility theory has been and still is extensively applied to planning evaluation in practice. At the moment, however, it is subjected to a number of criticisms particularly in relation to the comprehensive rational model of choice widely applied in spatial planning until recently. In the words of Glasser (1998), utility is a highly aggregated "super"-criterion that is unobservable and immeasurable.

As illustrated in Chapter 2.0 of this thesis, comprehensive rationality encounters some major restrictions: it avoids the problem of redistribution in planning; it reduces a number of problems related to the sphere of justice to a simple and unrealistic economic calculus; it does not take into account that decisions are constrained by ethical arguments, such as altruism, benevolence, moral values, etc. and these cannot be separated from the observed and 'objective' facts; it does not recognise that complex policy problems are multidimensional problems and mathematically ill-defined (Lichfield et al., 1998).

A possible way out is offered by the new-contractual theories (Rawls, 1971) which recognise a tension between economics and ethics, postulating the following:

- social justice does not coincide with efficiency, i.e. they are not equivalent;
- decision makers are not neutral toward preferences but identify those preferences which belong to the most disadvantaged groups in relation to the allocation of social goods.

A controversial problem with this last theory is how decision makers can "define those who are disadvantaged when income or wealth do not represent the only dimension by which disadvantages have to be measured" (Bentivegna, 1997, p.28).

This problem has been tackled by recent pluralistic-dialogic theories because of their concern for a plurality of preferences in a diachronic and spatial sense and the emphasis on the informative and communicative aspects of choice, as illustrated in the following section.

3.2 Constructivism Paradigm and System Theories

All the previously illustrated theories of economic rationality reflect a specific paradigm that arose at the end of the 19th century with the name of rational mechanics. This is based on the Cartesian' deterministic idea that objects (things, phenomena or entities) can be explained on the basis of their internal structure, which, in turn, is determined by their function (Descartes, 1637). It postulates full reversibility of effects and the possibility to explain relationships of cause and effect in a mechanical manner.

This paradigm is founded upon the strong but not universally verified hypothesis that a scientific inquiry always results in objectivity, rationality, logical rigor, formal quality, analysis and absolute truth.

The Cartesian doctrine belongs to the *realism approach* to reality which attempts to make a phenomenon intelligible by an analysis based on reductionism. Knowledge acquisition of the subject is viewed as passive reflection; external reality is considered as objective. Such a process implies detection of regularities, which in a camera like fashion results in a map of the perceived reality in our brain. Scientific laws are said to be discovered where science describes reality (Bocchi e Ceruti, 1984).

Subsequent studies of the nervous system, originating from scholars such as Maturana and Varela (Maturana and Varela, 1980; 1987; Varela, 1992), showed that a perception cannot be distinguished from a hallucination in any absolute way. The nervous system is a closed system without direct access to any phenomena other than the nervous activity itself. All knowledge is a comparison of the communicative (linguistic) domain within the nervous system with the experimental domain within the nervous system. The external world as it is known to any individual is merely emotions of nervous activity. Therefore we can never be certain that our ideas are correct, they merely fit (not match) our experience thus being more or less adequate. Different experiences may lead to different adequacies.

Other important authors such as Simon, Morin and Piaget and the final systemic work of Le Moigne (1990; 1994) have led to a new way of thinking which is in opposition to the realism and the reductionistic approach of the Cartesian doctrine. This states that "ideas are not learned but constructed". This phenomenological hypothesis of construction of actions, for instance, accompanies Simon's distinctions of bounded rationality and procedural rationality (Simon 1947; 1982; 1985), the latter being the argument of constructivism.

Constructivism views knowledge as an active construction of potential models where knowledge is built up completely by the cognising subject. This is achieved through internal schemes which calibrate themselves in order to achieve coherence. Each individual builds a personal reality which fits his/her experience. Consequently, scientific laws are not 'objective' but are devised in order to explain regularities in our experience.

This approach is based on *nominalist philosophies,* which pervade post-modernity (Lyon, 1995) and, in scientific circles, constructionist and interpretivist paradigms of which existentialism is an extreme form. It is in opposition to the previous realism approach to reality since the object is denied, leaving only the knowing and acting subject. Unlike realism, it rejects the notion of a direct verification of knowledge that can be accomplished by comparing the constructed model with the outside world. Realist philosophy drives its adherents to reducing all types of laws to one, such as the laws of physics, of logic, or evolutionary biology, etc. Nominalist philosophy drives its adherents to a denial of all laws (Lombardi and Basden, 1997).

Constructivism finds integration and inter-communication difficult. For example, a fundamental question faced by constructivism theories is the following: *How can the subject choose between different constructions in order to select the right one?* Without a criterion of choice, the theory may fall into the so-called 'absolute relativism', assuming that any model may be adequate (Eriksson, 1996).

A second attempt at dealing with complexity, overcoming the limitations of the Cartesian reductionism approach, is known as the Cybernetic paradigm which was developed by Ashby (1976) and Beer (1967; 1981). This turned up-side-down the modelling perspective, interpreting the behaviour of a structure (organic structure or mechanics) in permanent reference to its contextual environment.

The systemic paradigm arose in the middle of 1970s as an integration between cybernetic and structuralism paradigm. The latter is complementary to constructivism and, as Piaget (1968) expressed, is a method for describing an object in its totality, functioning and evolving, by taking a global perspective. This recognises a structure as formed by elements whose laws are distinct from those of the structure as a whole.

The theory of general systems which integrates the previous two paradigms is based on the work of L. von Beralanffy (1971) who proposed an open system theory, i.e. an object possessing functions, structure and evolving. This work was later developed by Le Moigne (1994). Although this approach has the relevant feature of recognising the importance of information and organisation in making social sciences intelligible, as Eriksson (1997) noted, the approach may fall into relativism because the function of cognition is adaptive and does not tell us what kind of knowledge is constructed.

A second school of system thinking is the Multimodal System (MS) by de Raadt (1991; 1994; 1997). This aims to make complex systems intelligible by escaping the traditional Cartesian approach on the basis of comprehensive philosophical studies of multi-level perspectives.

Compared with the previous system school, the MS approach maps systems according to two axes, a multimodal one (vertical) and a systemic one (horizontal). Specifically, this approach is founded on the Cosmonomic philosophy of Herman Dooyeweerd (1958) and cybernetics as developed by Ashby and Beer. Adapting and modifying these two foundations, MS has shifted focus of systems design and usage onto a number of levels of functioning (named *modalities*) in which systems operate instead of the systems themselves.

The main similarities and differences between the two systemic schools of le Moigne and de Raadt are shown in Table 3.1.

3.2.1 Discussion and Final Remarks[1]

In Section 3.2, two main streams of theoretical thinking - still pervading current planning practice - have been reviewed: Realism and Nominalism. These have often emphasised the artificial (but time-honoured) separation of subject and object which is at the core of many of the problems of sustainability.

Traditional realism emphasises the known and acted-upon object and de-emphasises the knowing, acting subject. A problem with planning based on realist philosophy is that because the subject is de-emphasised the effects of the action and knowledge of the subjects are often ignored. A prime example of this is, of course, road-building, where the objects are the transport system and traffic volumes while

[1] The author acknowledges the contribution of Dr Andrew Basden of the University of Salford in the development of Section 3.2.1 and Sections 3.3.1 and 3.3.2.

the subjects are those who drive, and until recently the traffic generating effect of road-building has been ignored and even denied (Lombardi and Basden, 1997).

Table 3.1 – A comparison of the two schools of system thinking

COMMON GROUND	SYSTEMIC APPROACH (LE MOIGNE)	MULTI MODAL SYSTEM (DE RAADT)
Both promote a re-conception of science in a personal relation denying the objective, independent notion Both consider the quaint 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 multimodal 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)

Healey (1992) stresses that neither positivist nor Marxist approaches can fully reveal how interests in land actually arise and therefore are not helpful in identifying the (already mentioned) concept of 'public interest' (see Section 2.2.1).

The opposite approach to realism is the nominalist one which claims to avoid the dangers of reductionism by acknowledging the views and wishes of all and sundry. While it has some success in this, there are three problems. No external reference point is acknowledged or even allowed. Second, when the wishes and views of different people or groups appear inconsistent there is no standard by which to arrive at consensus. Third, 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. Therefore, while less reductionist than approaches based on realist philosophies, there is still no guarantee of sustainability (Lombardi and Basden, 1997).

Unlike nominalist approaches, the Multimodal System based on the philosophical work of Dooyeweerd (1958) acknowledges an external reality that is independent of the acting and knowing subject. We are affected by it but also affect it and have views and desires concerning it. A comparison of Dooyeweerd's theory with the previous theories is illustrated in Table 3.2.

Table 3.2 – Comparison of philosophical approaches

	ASSUMPTIONS	**CONSEQUENCES**
Realism	It assumes the existence of an objective reality with its own substance, outside the observer. Realist philosophy drives its adherents to reducing all types of laws to one, such as the laws of physics, logic, or evolutionary biology, etc.	In the extreme versions the relevance of the subject is denied, leaving only the object. This has always tended towards a narrowing of focus in scientific investigation and resultant action in the personal, economic or political arena, often resulting in a reductionism.
Nominalism	The object is denied, leaving only the knowing and acting subject. It acknowledges the views and wishes of all and sundry. Nominalist philosophy drives its adherence to a denial of all laws.	There is no standard by which to arrive at consensus when the views are inconsistent. In addition, there is the danger that 'those who shout loudest get heard', while less articulated groups and those who cannot represent their rights tend to get ignored.
Cosmonomic	This approach depends on the fundamental assumption that the universe is ordered and this order encompasses the totality of natural phenomena and human life. It acknowledges an external objective reality that is independent of the acting and knowing subject. We, acting and knowing subjects, are part of the objective reality that is independent of us, rather than separate from us. We are affected by it but also affect it and have views and desires concerning it.	According to the above assumption, it is also possible to make a distinction between theoretical and pre-theoretical (every-day) thinking. In every-day thinking we are responding to many of the aspects of our daily lives all the time, such as economic, social, spatial, physical etc., while in higher theoretical thoughts, we isolate and abstract one or other of the aspects of reality and give special attention to it, thus we have physics, biology, psychology, economics, etc. as separate sciences. 'Healthy' existence and living can only be achieved if we understand the nature of the laws that govern both us and all reality that is independent of us.

(Source: based on the work of Lombardi and Basden, 1997)

Compared with the open system theory of Le Moigne, in multimodal thinking, this external reality (objects of experience, things, events, relations, people, etc) are spoken of as existing or functioning "in a modality" or "under the laws of a modality". The modalities can be seen as the framework of *Meaning* in which all systems operate, and which thereby provide their individual meaning (Basden, 1994; Strijbos, 1997).

In the words of Basden (1994), "focusing on modalities reflects a radical shift in system thinking away from the old assumption that *Existence* is the fundamental property of things, towards one that takes *Meaning* as the fundamental property. *Existence* is then a result of *Meaning*, not the other way round".

This apparently abstruse distinction in fact has enormous repercussions in the context of this study on urban sustainability for the way we see, know, act, live and be, and in particular for the relationship between subject (urban actors, planners and stakeholders) and object (the built environment).

A deeper explanation of this theory is provided in the following section, with the aim of showing the benefits that it is able to offer to the problem of decision making for sustainability.

3.3 Dooyeweerd's Theory: The Cosmonomic Idea of Reality

The groundwork of the MS approach is the science methodology of Herman Dooyeweerd, a Dutch philosopher, 1894 – 1975. This is known as the "Cosmonomic Idea of Reality" which acknowledges an external reality which 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. It is based on the fundamental notion that nothing, not even theoretical thought, is absolute, but 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".

The results of his work are included in three main Volumes (1953-55). For a general description, see Clouser (1991), and Kalsbeek (1975) and for full theoretical treatment, see Dooyeweerd (1958) and Hart (1984). The following discussion makes copious references to the expositions made by de Raadt (1991; 1994; 1997) and Basden (1994; 1996; http://www.basden. demon.co.uk/Dooy/summary.html).

In particular, Section 3.3.1 introduces the fundamental distinction between entities and modalities, which will be further developed in the next chapter with regard to an analysis of the built environment for sustainability. Section 3.3.2 clarifies the importance of the concept of modality for analysing complex systems, particularly in theoretical thinking. The relevance of this concept in the context of this study will soon appear clear. Section 3.3.3 deals with the order of the modalities within the hierarchy, clarifying some controversial opinions of experts. Finally, Section 3.3.4 provides a comparison of this theory with the one developed by Maslow, since there are clear similarities between the two. **Appendix B** illustrates a glossary of the main terms and neologisms used in multimodal thinking.

3.3.1 Entities and Systems

The Cosmonomic theory of Reality 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 government, a symphony, a town. The Law Side concerns modalities in which entities operate, e.g. physical, social, biotic, ethical, technical.

The two sides can be seen as orthogonal: an entity crosses several modalities. 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. That is, when we analyse reality we should study the Law Side, not the behaviour of entities. It is the Law Side that expresses the fundamental *Meaning*, and it is the Law Side that enables entities to 'exist'. However, *Existence* is not denied. Rather, it is seen as essentially dependent and Meaning-bound.

Dooyeweerd speaks about *individuality structures* which operate within the *Meaning* framework of modalities; they can be seen as 'things' or 'entities'. There is also the transient entity that is, as we shall see, the result of human beings making distinctions and drawing boundaries. According to Dooyeweerd, the environment and society are not entities in the same way, except in the last sense.

Entities (or systems) can function, and, if the entity is a person, this *functioning* can include knowing, acting, believing, loving, communicating, worshiping, etc. Dooyeweerd acknowledges (some kinds of) entities as separate beings, but emphasises their dependence rather than their independence.

There are two types of relationship. There is the type that we form of our own will - for instance the author communicates with the reader in this thesis - but these are transient and contingent. And there is the type that is necessary, necessary for whole and complete being - for instance, a snail and its shell; neither is complete without the other. But there is also a third type that seems to be special to Dooyeweerdian thought: *enkapsis*.

This is explained as the relationship that closely links two distinct things (e.g. *individuality structures*) where there is a degree of meaningful independence. For example, the enkapsis between marble and a statue is discussed. The statue is qualified by the aesthetical modality; the marble by the physical modality. Two distinct individuality structures, but with an enkaptic relationship between them. The same is applied to a number of examples in nature.

The concept of enkapsis has to be clearly distinguished from the part-whole relation, in which the part has no meaning apart from its whole (e.g. an arm which is part of a human body). Dooyeweerd discusses several types of enkapsis (Kalsbeek, 1975): Foundational Enkapsis (marble - statue); Subject-Object Enkapsis (snail - shell); Symbiotic Enkapsis (clover - nitrogen-fixing bacterium); Correlative Enkapsis (community - person); Territorial Enkapsis (city - its university). In these enkaptic relationships, however, there is a degree of meaningful independence.

Kalsbeek (1975) emphasises that the concept of enkapsis provides *a key to precise distinctions necessary in an investigation of complex realities in every scientific discipline and interdisciplinary research* (p.273).

Following Kalsbeek' suggestion , this study develops an evaluation framework in planning and design by taking the theory of the Cosmonomic Idea as a foundation for real cooperation between scientists and scholars.

3.3.2 Modalities and their Functions

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, etc.- which not only guide but enable entities (people, animals, etc.) to function in a variety of ways.

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 equivalence in 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 ethical and juridical, the laws are more *normative* since their fulfilment is contingent to people's inclination to follow these laws and they cannot be described through the harder modalities' determinative rules. In particular, the laws of the earlier aspects are more determinative while those of later aspects are more normative.

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 (*sphere universality*), which allows an entity to function in a coherent rather than fragmented manner.

An entity, such as a sheep or a person, acts as a subject in a number of these aspects and as object in others. While human beings can act as subject in all aspects, animals have a more limited range in which they function as subject. A sheep might act as an economic object, for instance, but not an economic subject.

There is an interrelation between the modalities which define their position. The economic modality is in fact dependent on the social, the social on the lingual, the lingual on the historical, and so on. Thus the Philosophy of the Cosmonomic Idea has not placed the fifteen modalities in an arbitrary order, but the earlier aspects serve as foundations for the later (Dooyeweerd calls it "the cosmic order of time"). Section 3.3.3 comes back to this issue.

The correspondence between the orders of different modalities allows one modality (named *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 which 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 sciences) when compared with the homomorphism that exists between the hard modalities themselves (see Section 7.3).

The above concept of *analogy* is explained by Kalsbeek (1975) in terms of anticipation and retrocipation (see *Glossary* in Appendix B). For example, art movement, historical movement, etc. are phenomena which refer back to, and are retrocipation to, the sphere of movement (kinematic modality). Here, the kinematic analogy appears in the aesthetical and historical modalities as *meaning-moment.*

In both the anticipation and retrocipation, a distinction can be made between direct and indirect, depending on whether or not the analogy is with the meaning-nucleus of an aspect which it immediately precedes or follows. In addition, an analogy can be simple or complex (Kalsbeek, 1975). The complexity of an analogy increases with the number of aspects found between the aspect, where it originates, and the aspect of whose meaning-nucleus it is an anticipation or retrocipation.

3.3.3 The Modal Order

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 are listed in Table 3.3. They were derived by taking every large-scale kind of property which 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 he does not include aesthetic. In addition, he places analytic between historical and communicative, as a foundation for the informatory function. 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 to the social modality. Kalsbeek (1975) discusses the meaningfulness of including kinematics within physical as part of it.

After having taken account of all the above suggested changes, this study maintains the original structure provided by Dooyeweerd in the development of a framework for understanding sustainability in the built environment. There are a number of reasons supporting this choice. The first main reason is that we do not have enough evidence, at this stage, to decide whether the original structure should be more conveniently changed or not. At a first assessment, Dooyeweerd's scale seems more consistent than the others. For instance, the aesthetic modality cannot be excluded in an analysis of the built environment as it helps explain the visual appeal of a settlement or a building. And it is extremely meaningful in architecture and design (Ruskin, 1849; Lynch, 1960). The epistemic aspect can be conveniently included within the communicative modality (with the meaning of lingual) while the aspect of production can be seen as part of the economic modality in the field of planning and the built environment. The analytical modality is a fundamental and unavoidable basis for developing planning schemes which are cultural-formative-historical developments of the present environment (see Section 4.2). Therefore, it should be left earlier in the scale.

Table 3.3 - Modalities and modal order

Modalities	*Nuclei of meaning*
Quantitative	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
Credal	Faith, commitment, trustworthiness

(Source: Lombardi and Basden, 1997)

3.3.4 Comparison with Maslow's Hierarchy of Needs

In the context of this study, it may be worth comparing Dooyeweerd' theory of modalities with the theory of needs developed by Abraham H. Maslow. One reason is that there are clear similarities between the hierarchy of modalities and the list of needs. A second reason is that the theory of Maslow has been widely applied in management and construction. Therefore, it might also be useful in this study, as an alternative approach to Dooyeweerd's theory.

Synthetically, Maslow suggests that human needs are structured on an ordered scale, named hierarchy of needs (Clough, 1984). This has different levels. The lowest level includes all physiological needs for human biological subsistence, such as eating, drinking, etc. These basic need must be satisfied before the following ones, which are still material but higher, such as the need for security and for order. Then, human beings pay more attention towards social needs, particularly those related to the feeling of belonging to a group. Finally, there is the highest need of self-realisation which comes from the creative search for truth and meaning of life.

The possibility of people progressing along this hierarchy is very much determined by material conditions in society. However, it is also possible for individuals to concentrate on the lowest levels, without elevation, even in a context of material resource abundance.

As already mentioned, there are evident similarities between the scale of needs and the hierarchy of modalities. Both are structured on the idea that human beings tend to follow a process of elevation, from the lower levels of physics to the higher levels of aspiration, vision and interests. Both put the physical issues at the bottom and the non material/philosophical issues at the top. Nevertheless, the two theories are very different.

The theory of Maslow focuses only on human needs, while the theory of Dooyeweerd covers all entities and "individuality structures" (such as men, animals, plants, buildings, etc.), therefore it is more comprehensive and general. The Cosmonomic theory of Dooyeweerd does not conceive man as driven by egoism or needs, but rather by faith, as being part of a unique enkaptical totality which is the cosmos. On the contrary, the theory of Maslow is based on utility conception which has proved unable to cope with the principles of sustainability (see Section 3.1).

Initially, this theory received extensive references, primarily as a motivating mechanism in industry. Nevertheless, it has recently received strong criticism, particularly as it provides a simplistic view of the relationships between individuals while empirical studies do not often support it (Coeterier, 1994).

In conclusion, it seems more profitable that this study should follow Dooyeweerd's idea, particularly in the development of a framework which is required to handle the complexity of issues provided by the concept of sustainability in planning and the built environment. A final advantage of the Cosmonomic theory, in fact, is that the hierarchy of aspects is richer and better structured than Maslow's and it is also able to encapsulate the meaning of each modality.

The next chapter shows the benefits of an application of this theory to the built environment, clarifying many issues which have only briefly been illustrated in this section.

3.4 Summary and Conclusions

This chapter has reviewed the most widely accepted theoretical paradigms and schools of thought which give foundation to current evaluation methods and approaches in planning. It has been noted that the rational choice theory is still the most influential and powerful doctrine in planning evaluation. This is based on a philosophical approach to reality, named Realism (objectivism or positivism) which started with Aristotle and Descartes in philosophy, followed by, Newton in physics and Smith in economics. It assumes the existence of an objective reality with its own substance, outside the observer.

Positivism, and other approaches based on realist philosophies, separate the knowing and acting subject from the known and acted-upon object. Although approaches based on positivism assume that people know and express what they want, neither explain how individual interests are influenced by society nor account satisfactorily for those interests not always articulated in the planning process, such as ethnic minorities in inner cities. Instead, the Marxist approach, which considers that interests are imposed on individuals by a given mode of production, presents a simplistic view of the relationship between capital and labour in an advanced society and ignores socio-cultural factors such as gender, religion and attachment to location, each of which may determine attitudes to land-use (Healey, 1992). In the extreme versions, the relevance of the subject is denied, leaving only the object. This has always tended towards a narrowing of focus in scientific investigation and resultant action in the personal, economic or political arena, often resulting in reductionism.

The opposite approach to reality is the so-called Nominalism or subjectivism (see, in particular, Kant, 1988), of which existentialism is an extreme form (e.g. Sartre, 1979). This pervades post-modernity and, in scientific circles, constructionist and interpretivist paradigms. In these last approaches the object is denied, leaving only the knowing and acting subject (D'Agostini, 1997). There is the danger in practice that only articulate groups are able to take part in a planning decision. In addition, there is no objective reference or a standard outside decision making by which to achieve consensus.

Compared with the limitations that both approaches present, with regards to sustainability (see Section 3.2), the science methodology of Dooyeweerd offers a more holistic and integrated perspective to the problem by supplying a law framework which governs creation and links, integrating subjects and objects.

The Cosmonomic Theory provides a comprehensive structure for understanding the various different relationships between levels of human existence. This shows two major elements. Firstly, each modality has some essential characteristics which are irreducible to any other. Dooyeweerd defines this as *nucleus momentum.* Thus, the multimodal approach is not reductionist. Secondly, reality is rich and various, since it is organised in such a way to explicitly show different interrelations between irreducible parts. This correspondence between the modalities is defined as *analogy momentum.* Such analogy is the basis for symbolic representation of knowledge in computers (de Raadt, 1994).

In the words of Basden, "it seems to easily answer some problems that conventional thinking cannot, and it seems to accord with people's natural or intuitive grasp of what is around them, and thus can be relatively easy to pick up. But we will not know until it has been properly understood, developed and applied, all three processes happening simultaneously so that they enrich each other" (http:// www.basden. demon.co.uk/Dooy/summary.html).

3.5 Main References

Arrow K. J., 1951, *Social Choice and individual Values*, John Wiley & Sons. Inc., New York

Arrow K.J., 1987, *Equilibrio, incertezza, scelta sociale*, Il Mulino, Bologna

Ashby W.R., 1976, *An Introduction to Cybernetics*, Methuen, London

Basden A., 1994, *A multi-modal approach to knowledge based system*, Information technology Institute, University of Salford, UK (unpublished)

Basden A., 1996, Towards an understanding of contextualized technology, in Proceedings of the International Conference of the Swedish Operations Research Society on *Managing the Technological Society: The Next Century's Challenge to O.R.*, University of Lulea, Sweden, 1st – 3rd October, pp.17-32

Basden A., *Cosmonomic Philosophy (with special relevance to Information Technology)*, (http://www.basden. demon.co.uk/Dooy/summary.html)

Beer S., 1967, *Decision and control*, John Wiley & Sons, Chichester

Beer S., 1981, *Brain of the firm*, John Wiley & Sons, Chichester

Bentivegna V., 1997, Limitations in environmental evaluations, in Brandon et al., (eds.), 1997, *Evaluation in the Built Environment for Sustainability*, E&FN SPON, Chapman&Hall, London, pp.25-38

Bocchi M. e Ceruti M. (eds.), 1994, *La sfida della complessita*, Feltrinelli, Milan

Clough D.J., 1984, *Decisions in public and private sectors: theories, practices and processes*, Prentice-Hall Inc., New Jersey

Clouser R., 1991, *The Myth of Religions Neutrality*, University of Notre Dame, London

Coeterier J.F., 1994, *Liveliness in Town centres*, in Neary et al. (eds.), *The Urban Experience. A people-environment perspective*, Proceedings of the 13th Conference of the Int. Assoc. for People-Environment Studies, Manchester, 13th – 15th July, E&F SPON, London, pp.297-310

Costanza R. (ed.), 1991, *Ecological Economics*, Columbia University Press, New York

Costanza R., d'Arge R., de Groot R., Farber S., Grasso M., Hannon B., Limburg K., Naeem S., O'Neill R.V., Paruelo J., Raskin R.G., Sutton P. and van den Bely M., 1997, The value of the world's ecosystem services and natural capital, in *Nature*, n.387, vol. 15, pp.253-260

D'Agostini F., 1997, *Analitici e continentali*, Cortina Editore, Milan

Dasgupta P.S., Sen A. and Marglin S.A., 1972, *Guidelines for project evaluation*, United nations Industrial Development Organisation, Vienna de Raadt J.D.R., 1991, Cybernetic Approach to Information Systems and Organization Learning, *Kybernetes,* v.20, pp.29-48

de Raadt J.D.R., 1994, Expanding the Horizon of Information Systems Design, *System Research,* n.3, vol.2, pp.185-199

de Raadt J.D.R., 1997, A sketch for human Operational research in a technological society, *System Practice*, vol.10, n.4, pp.421-442

Descartes R., 1637, *Le discours de la méthode pour bien condure sa raison et chercher la vérité dans les sciences,* Paris

Dooyeweerd H., 1958, *A new critique of theoretical thought*, 4 vols, Presbyterian and Reformed Publisher Company, Philadelphia, Pennsylvania

Eriksson D., 1996, System Science: A guide for postmodernity? A proposition, in Proceedings of the International Conference of the Swedish Operations Research Society, *Managing the Technological Society: The Next Century's Challenge to O.R.,* University of Lulea, Sweden, 1st – 3rd October, pp.57-71

Fishburn P.C., 1970, *Utility theory for decision making*, Wiley, New York

Fishburn P.C., 1982, *The foundation of expected utility*, Reidel Publ. Co., Dordrecht

Fusco Girard L. (ed.), 1993, *Estimo ed economia ambientale: le nuove frontiere nel campo della valutazione. Studi in onore di C.Forte*, Angeli, Milan

Glasser H., 1998, On the evaluation of "wicked problems". Guidelines for integrating qualitative and quantitative factors in environmental policy analysis, in Lichfield et al. (eds.), *Evaluation in Planning*, Kluwer Academic Publisher, Dordrecht, pp.229-250

Grittani G. and Grillenzoni M. (eds.), 1994, *Estimo: teoria, procedure di valutazione e casi applicativi*, Edagricole, Bologna

Hargreaves H.S., Hillis M., Lyons B., Sugden R. and Weale A., 1992, *The Theory of Choice. A Critical Guide*, Blacwell Publishers, Cambridge

Hart H., 1984, *Understanding our world*, Univ. Press of America, USA

Healey P., 1992, A planner's day: knowledge and action and iterative practice, *Journal of Planning Association*, 58, n. 1, pp.9-20

Kalsbeek L., 1975, *Contours of a Christian Philsophy*, Wedge Publishing Company, Toronto

Kant I., 1988, *Critique of pure reason*, J.M.Dent & Sons Ldt., London

Le Moigne J.L., 1990, *La modélisation des systèmes complex*, Dunod, Paris

Le Moigne J.L., 1994, *La théorie du systeme géněral*, PUF, Paris

Lichfield N., 1996, *Community impact Evaluation*, UCL Press, London

Lichfield N., Barbanente A., Borri D., Kakee A. and Prat A. (eds.), 1998, *Evaluation in Planning. Facing the challange of complexity*, Geojournal vol. 47, Kluwer Acc. Press, Dordrecht

Lombardi P.L. and Basden A., 1997, Environmental Sustainability and Information Systems, *Systems Practice,* vol. 10, n. 4, pp.473-489

Lynch K., 1960, *The image of the City*, The Technology Press & Harvard University Press, Cambridge

Lyon D., 1995, *Postmodernity,* Open University Press, U.K.

Marglin S., 1967, *Public investment criteria: benefit-cost analysis for planned economic growth,* MIT Press, Cambridge

Maturana H and Varela F., 1987, *The tree of knowledge*, Shambhala, Boston

Maturana H. and Varela F., 1980, *Autopoiesis and Cognition*, D.Reidel, Dordrecht, Holland

Merkhofer M.W., 1987, *Decision Science and Social Risk Management*, D.Reidel Pub. Co., Boston

Mishan E.J., 1971, *Cost-benefit analysis*, George Allen & Unwin, London

Neumann J.. von and Mongerstern O., 1944, *The theory of games and economic behaviour, University Press.*, Princeton

Pearce D. and Turner R.K., 1990, *Economic of natural resources and the environment,* Harvester Wheatsheaf, Hamel Hempstead

Pearce D., Markandya A. and Barbier E.B., 1989, *Blueprint for a green economy*, Earthscan Publications Ltd, London

Pearce D., Markandya A. and Barbier E.B., 1990, *Sustainable development*, Earthscan Publications Ltd, London

Piaget J., 1968, *Le Structuralism*, PUF, Paris.

Rawls J., 1971, *A theory of justice*, Harvard UP, Cambridge

Rostirolla P., 1992, *Ottimo economico: processi di valutazione e di decisione,* Liguori, Naples

Ruddock L., 1992, *Economics for Construction and Property*, Edward Arnold, London

Ruskin J., 1849, *The Seven Lamps of Architecture*, London.

Sartre J.P., 1979, *Il muro*, Oscar Mondadori, Milano

Simon H.A, 1947, *Administrative Behaviour*, The Macmillan Co, New York.

Simon H.A., 1982, *Models of bounded rationality*, vol.2, MIT press, Cambridge, Mass

Simon H.A., 1985, *Casualità, razionalità, organizzazione*, Il Mulino, Bologna

Strijbos S., 1997, Wisdom, Ethics, and Information Technology: Some Philosophical Reflections, *System Practice*, vol.10, n.4, pp.443-457

Thrilwall A.P., 1994, *Growth and Development*, MacMillan, London

Varela F.J., 1992, *Un know how per l'etica,* Laterza, Turin

von Beralanffy L., 1971, *General System Theory*, Penguin, London

Winpenny J.T., 1991, *Values for the environment*, HMSO, London

Chapter 4.0 - Application of the Cosmonomic Theory to the Built Environment for Sustainability

The heavens shew forth the glory of God; and the firmament declareth the work of his hands
(Psalm, 18:2)

Note: For the sake of both clarity and completeness, some major philosophical terms and concepts of the Cosmonomic Idea are given in the glossary of **Appendix B**. The reader is recommended to refer to it to understand the terms and neologisms used in the analysis developed in this chapter.

The Dooyeweerdian philosophy of the Cosmonomic Idea has been postulated in a number of recent studies related to cybernetics, information systems and organisation learning basically because it offers an extremely useful check-list to guide systems development and usage, ensuring that not only one, but all aspects of human life, from the numerical to the credal be present in the design (Checkland, Forbes & Martin, 1990; de Raadt, 1991, 1994; Graham and Bergvall, 1994; Basden, 1994; 1996; SWEHOL, 1996). In addition, it has been studied and developed in recent years by other contemporary authors, such as Griffioen and Balk (1995), Clouser (1991) and Hart (1984), who have illustrated some of its benefits to understand and explain how social systems and institutions work.

Although the similarities between the design of an information system and urban design in the context of environmental sustainability have been recognised by Lombardi and Basden (1997), this theory has never been fully applied to the context of urban sustainability. This study aims to address this issue by developing a conceptual framework to understand sustainability in the built environment which will form the basis of a decision support system in urban planning and design (see Chapter 6.0).

More specifically, this chapter deals with a detailed analysis of sustainability aspects and their main relationships within the built environment, identifying meanings and functions on the basis of the Cosmonomic Idea. This theory maintains that both the properties and laws of a modality exist in mutual correlation. Thanks to this correlation and to a co-ordination between modalities, the *functioning* of the built environment can be described in a coherent manner.

Particular emphasis is placed on the fifteen modalities of Dooyeweerdian's theory and their meaning in the built environment for sustainability. The aspects are a reality that is independent of us, and thus they pertain to all our functioning; even though we are usually not aware of them, or only tacitly, yet they still pertain. It is in this 'everyday' ('pre-theoretic') thinking and acting that we integrate them (Kalsbeek, 1975).

The theory of the Cosmonomic Idea shows some distinctive and useful features for this study, and specifically that the *theory of the modal aspect* and the *theory of enkapsis* are able to explain complex systems. The theory illustrates that each modality has some essential characteristics which are irreducible to any other, and that reality is rich and various, since it is organised in such a way as to explicitly show different interrelations between irreducible parts.

The above mentioned two issues will be at the root of an analysis of the urban environment, as illustrated in this chapter. This application will make use of some specific terms developed in the 'Cosmonomic Idea' philosophical system (see Note). Some of them have already been introduced in Section 3.3., but they now require a fuller and more contextual explanation. The first section, in particular, is a synthetic illustration of philosophical concepts applied to the context of the built environment. These terms are described in the glossary of Appendix B. More comprehensive explanations of each concept, however, can be found in Kalsbeek (1975), Hart (1984) Clouser (1991), Griffioen and Balk (1995) and Basden (http://www.basden.demon.co.uk/Dooy/summary.html).

This chapter is structured as follows. Section 4.1 describes the built environment as a complete entity, an artefact or end-product of some planning and construction activities. Although we can distinguish all the modal aspects in the urban system, they never appear in isolation but in an inseparable and mutual coherence (Kalsbeek, 1975). Section 4.2 develops an extensive analysis based on the fifteen modalities with the aim of recognising the main factors which characterise the built environment for sustainability. It also tries to highlight the main links and the critical interrelationships between those modalities which are relevant to the *functioning* of the built environment for sustainability. Section 4.3 illustrates a final typological system for sustainability aspects within the context of decision making in planning. It also provides an initial discussion and specification of both the principal subject-object relationships and the enkapsis relationships of the built environment. This helps to clarify some of the main problems that decision makers (planners and stakeholders) may encounter in integrating different sustainability aspects.

Finally, Section 4.4 illustrates a summary of the above discussion and some main conclusions.

4.1 The Built Environment as a Multi-aspectual System

The built environment, including the cultural heritage, represents a meaningful sub-set of urban sustainability (Brandon, 1998). It is part of the physical system and it is intrinsically linked to both the environmental system and the human (economic and social) system. Thus, 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 functioning in an integrated and coherent manner (Nijkamp, 1991; Camagni, 1996; Fusco Girard and Nijkamp, 1997). This is important if we aim to achieve a non-decreasing level of well-being for the local community in the long term (quality of life) and a reduction of negative effects in the biosphere (environmental quality) (Merret, 1995).

As a physical entity, the built environment has a spatial extension, a 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, etc. Its fundamental characteristics are the building materials and components, the layout and form of the building, the structure of the ground on which it is built etc. In the Cosmonomic Idea these are all issues of the spatial and physical modalities.

The built environment represents the physical context in which individuals spend their time living, dwelling, working and recreating. Despite other man-made products, it is unequivocally linked to the land. This makes a building unique, and therefore an object of economic and juridical interest. In addition, it has social and cultural properties since it is useful to satisfy a number of, both material and non material human needs (see Section 3.3.4).

In terms of the Cosmonomic Idea, we could conclude that the built environment, as a concrete system, is qualified by the physical modality. This is what Dooyeweerd calls the *qualifying function* of the built environment, i.e. the specific aspect which guides and regulates the internal organisation or development of a system.

Although the built environment as a concrete system (Dooyeweerd would call it *individuality structure*) is characterised by the physical modality, it functions in all the other modal aspects, maintaining different relationships with them (Dooyeweerd, 1968). For example, an urban district is usually formed by a number of houses, offices, banks, schools, roads, etc. (numerical modality), placed in it according to a particular layout (spatial modality). Within an urban district there is usually a constant movement of people, cars, bicycles, animals and goods (kinematics modality) which need energy in order to function (physical modality). People and other living creatures also need food, water, and air to breath, houses for shelter and hospitals for health (biotic modality). They display emotions and feelings in their relationships within a group (sensitive modality). Furthermore, people have an intrinsic logical dimension that results in the discerning of entities, etc (analytic modality). They build their houses on the basis of past experience and technological knowledge (historical modality) and they communicate between 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). This built environment can be beautiful and attractive for both the people who live there and tourists (aesthetic modality). A group of laws regulates the use of land and property (juridical modality) and there are often discussion on topics like environmental pollution caused by modern city life (ethical modality), but at the end, there is usually a strong belief in science and technology as the solution to modern society's ecological problems (credal modality).

The previous description has made use of the fifteen modalities of Dooyeweerd's Theory to reveal the complexity of an urban environment as a system (an individuality structure) and its multidimensional meaning (Lombardi and Brandon, 1997). We have already realised this in our pretheoretical thoughts.

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 to their individual natures to distinguish each aspect from the others, making it irreducible to the others (Kalsbeek, 1975).

Some basic questions arise: What characterizes an urban environment as an *entity*? What characterizes *modal aspects* as being distinct from the entities?

The answer is that aspects provide the *universal framework* within which entities *function*. In this sense the modal aspects relate to the *how* of things - although we should not see modal aspects merely as *aspects of things* (Strauss, 1995). As *modes of existence*, the aspects of reality concern questions about *how*. The *what*-question refers to the dimension of entities.

Suppose we have answered a question such as: what is this? by identifying the objcct referred to as a car park or a house. We can then proceed by asking *how* it is: is it close (spatial)? Is it comfortable (sensitive how)?, is it expensive (economic how)?, and so on. Thus the modal aspects not only serve as points of entry to reality in a scientific analysis but also conditions our *experience* of reality.

The diversity within creation presupposes the uniqueness of every aspect and every *kind* of entity. The general idea of *uniqueness* is captured by the expression *sphere sovereignty* that Dooyeweerd took from Kuyper's studies in social domains (Kalsbeek, 1975). The sphere sovereignty is what distinguishes one aspect from another, making it irreducible to the others. The character, the element that guarantees the maintenance of its sphere sovereignty in each modality can be isolated but it involves considerable theoretical abstraction.

There is a *mutual relationship* between the modal aspects related to a built environment. This has basically been defined by Kalsbeek (1975, p.71) as: "multisided coherence in irreducible distinctiveness".

In speaking of the mutual relationships and the origin of the modal aspects, Dooyeweerd (Dooyeweerd, 1958) uses the image of "a prism which breaks up unified light from the sun into the seven colours of the spectrum which we perceive". The colours depend on the unrefracted light. At the same time, they are mutually independent and irreducible to one another. Similarly, the aspects are a result of a refraction of the one undivided fullness of meaning into a diversity of meanings. "The prism which breaks this fullness of meaning into a diversity of meanings is the cosmic order of time" (Kalsbeek, 1975, p.108).

In the next section we try to analysis this *multi-faced coherence* that we defined as "built environment", by separating each modal aspect, just like the prism, and clearly identifying each *sphere sovereignty*. In doing so, we need to go beyond pretheoretical thinking to theoretical thinking (Kalsbeek, 1975).

The separation between theoretical and pretheoretical thinking is a specific feature of the Cosmonomic Idea (see also Section 4.3). Only in higher abstraction are we able to open up each aspect and make explicit (scientific) knowledge of its laws available to the human community. In 'everyday' ('pre-theoretic') thinking and acting, however, we integrate them.

Starting from the sphere sovereignty of each modal aspect, the main relationships of *retrocipation* and *anticipation* between the modalities related to the built environment *(sphere universality)* can be identified (Griffioen and Balk, 1995).

4.2 The Modal Aspects related to the Built Environment

What is *sphere sovereignty* of the modal aspects related to the built environment as a coherent (sustainable) system? A description of the structure of the modal aspects related to the built environment is provided in this section, following the specific order defined by Dooyeweerd as *cosmic order of time.*

As already noted in Section 3.3., this cosmic order provides a particular position for each aspect. The modal aspects are so constituted that the earlier aspects serve as a foundation for the latter. This order, in fact, is not reversible.

Kalsbeek (1975) specifies that the foundational modal aspects are called *substratum spheres*, and those which are based on them are called *superstratum spheres*. For example, the physical modality which characterises the built environment is a superstratum sphere, with respects to the kinematic, the spatial and the numerical. But it is a substratum sphere, itself with respects to the biotic, the sensitive, and so forth. Only the numerical and the credal cannot have the above spheres; therefore these two are called terminal spheres.

In each modal aspect, both the *meaning nucleus* and all sorts of *meaning moments* (anticipations and retrocipations), which correspond to the meaning nuclei of the other aspects, can be observed.

Because of all these meaning moments, each aspect mirrors all the others. Dooyeweerd calls this *sphere universality*, because the meaning moments in each modality are qualified by the meaning nucleus of that modality in a way which is completely peculiar to it. In this way, the sphere sovereignty (i.e. the irreducibility of each aspect) is maintained (Kalsbeek, 1975)

In the following, a cursory look is taken at all the fifteen aspects and their meaning-nuclei (or kernels), with a specific attention to the 'role' that each of them plays within the context of the built environment for sustainability. It should again be emphasised that these meaning-nuclei of the modal aspects always indicate a *how*, a manner in which, a *modus quo*, and never a concrete something, a *what*.

4.2.1 Illustration of the Modal Aspects related to the Built Environment

The **numerical** modality means a discrete quantity, arithmetics, awareness of how much of things. It is a substratum for all the next modalities related to the built environment. Some well known examples in construction are: the number of hectares of ground on which a building is placed (spatial), the amount of resources which are required for the construction (physical), the number of living creatures (sensitive) who occupy a building etc.

The numerical modality can only display an analogy with the nuclei of the later aspects. This analogy is an anticipation. It is often used by scientists as an idiom to represent and analyse real phenomena. For example, planners and social scientists often identify a spatial area in terms of quantitative measurements, e.g. square metres (or ha) of land or population density or other quantitative statistical indicators (operating in the numerical modality).

The **spatial** modality refers to "continuous extension". It is one of the most fundamental ones for this study, since it qualifies spatial differentiation (Zevi, 1973) and all the following relevant issues: building shape and layout, terrain shape, location, geographical position, proximity, area topology and form (Lombardi and Basden 1997). It is the superstratum sphere of the quantitative aspect, and it is substratum for all the later modalities, providing a number of anticipations. For example, the accessibility to a site or to a building is an issue of the kinematics aspect.

The meaning kernel of the **kinematics** aspect is movement. According to Dooyeweerd, Galileo's definition of uniform motion and the principle of inertia refer to this pure movement. The aspect is a superstratum sphere with regards to the spatial and numerical modalities. It characterises the movement of people and goods within an open or a closed space, a city or a building. It qualifies mobility in towns and regions. It helps to explain concepts such as "bottleneck" in transport and communication infrastructures. This can be defined as a barrier which hinders interaction through an imbalance between the actual capacity of transport facilities and the desired capacity (Geenhuizen et al., 1995). More often the kinematics aspect is a substratum sphere for later modalities, providing anticipations, such as the art movement (aesthetic) which characterises a particular decoration or architectonic style on the facades of buildings.

The **physical** modality has its kernel meaning in energy and mass. It qualifies different elements of our living environment, dealing *inter alia* with energy, water, air, soil, natural materials, and resources (Capra, 1989). It is superstratum sphere with respects to the aspects proceeding it, i.e. the kinematics and spatial aspects. Its kernel meaning qualifies physical (natural) elements, such as building materials, the ground on which to build, and also those natural barriers to the spatial development of regions, such as the Alps, the Dead Sea, 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 (Lombardi and Nijkamp, 1999). Finally, the physical modality characterises all built (urban) environments which are recognised as systems with a finite *carrying capacity* (Rees, 1992). The physical sphere is substratum with respects to all the later aspects and particularly to the biologic.

The **biologic** modality has its kernel meaning in organic life, vital functions. In terms of the built environment, it has been recognised that buildings have an impact on the ecosystem as they are produced, consumed, and continue to exist. This can be expressed by the concept of *ecological footprint* which is defined as the area of land required to biologically produce all the resources consumed by a community and to assimilate its waste, indefinitely (Wackernagel et al., 1993). It expresses the impacts of a construction on the natural environment, in biological terms. These can be associated to 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 (Bresso, 1982). There is a need to know the types of information available and the problems which arise in assessing the existing situation, analysing past trends and projecting future ones.

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 if this is an industrial plant. Bio-diversity 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 expansion of cities (Dixon et al., 1986). 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 of all the urban complex (Cadman and Payne, 1990). On the other hand, the biological issues can provide direction, for example, the importance of a "green" design, a green oriented shape and form of a building, as well as a good location in terms of reduction of pollution produced by a building (Pearce et al., 1989; Wilson and Malin, 1995). All these examples illustrate that the biological modality is the superstratum sphere with respects to the physical and spatial modalities.

Biological is the substratum sphere of the later modalities. For example, the presence of pollution and the lack of bio-diversity of a site are able to influence the perception that people have towards the environment. The latter is an issue of the **sensitive** modality. This has its meaning nucleus in the feeling, which is a quality belonging to every experience. Because feeling is irreducible, defining it is as difficult as defining the other meaning nuclei (Kalsbeek, 1975).

The feelings of comfort, safety and privacy, comfort or, alternatively, the noise level all play a large role in the quality of living for human beings. If we do not feel safe in a place, we would certainly not stay there long and would prefer to change our living environment. However, feelings of privacy and security, comfort and the feelings engendered by living there, can make our living more satisfactory and qualitative (Bonnes, 1993; Neary et al., 1994).

Not only the biological issues, but also the spatial and the physical characteristics of the built environment, such as the layout, shape and the location of the building, generally contribute to determine the quality of living to a large extent (Voogd, 1995). This means that sensitive is the superstratum sphere with regards to all the modalities preceding it (physical, spatial, etc.) .

Human feelings and perceptions are at the basis of the logical process of analysis and discernment between the parts constituting a building, the inside from the outside etc. (Nath and Taly, 1996). Therefore sensitive is the substratum sphere with regards to the analytical modality.

The meaning kernel of the **analytical** modality is logic and distinction. This usually helps decision makers to recognise a good construction from a bad one, and the quality of analysis which has been used in that building design (Brandon and Powell, 1984; Ferry and Brandon, 1991). 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 this analytical function. This explains why the spatial and the physical modalities are substratum spheres of analytical. But the latter is itself a *foundational* (founding) aspect, and thus a substratum sphere, with respects to the historical modality. Education and the ability to rationalise and discern between elements forms the base for developing a knowledge and a cultural background for construction. These are issues related to the **historical** modality whose core meaning is *formative power*.

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 which make use of analysis (Brandon et al., 1988). The relation of the historical sphere with the meaning kernel of the analytical modality is particularly explicit here.

As specified by Kasbeek (1975), this aspect concerns the specifically *cultural* mode of formation, whose agent is man. For example, the production of the built environment entails the use of natural materials, the consumption of energy, and localised impacts on habitats. The historical sphere 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. It is the superstratum sphere for all the spatial, kinematical, physical and analytical modalities.

However, historical is a substratum sphere with regards to the later modalities. 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. By being a modification of present layout, it communicates symbols and messages to the community (Lynch, 1960). This is an issue of the **communicative** modality whose meaning kernel is, in fact, symbolic meaning.

A building is usually able to inform people about the functions which are held within it. We can easily recognise a hospital as different from a station or from a bridge just from its external form and layout. Therefore communicative is the superstratum sphere with respects to spatial and physical but also to historical (Hugo, 1832).

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 esthetical viewpoint (aesthetic). In these last examples, communicative is the substratum sphere with regards to the higher modalities.

A direct anticipation with the meaning-nucleus of the social modality is the message of welcoming that a house or a site may provide to its visitors (Russell and Grammenos, 1995). The building is usually a gathering place for people. A meeting point for friends can be a bar or a club, but also in offices and other buildings can we have relationships with colleagues or other people.

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 to 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, thereby conditioning it (Wong, 1994; Russell and Grammenos, 1995). In fact, the spatial, physical, sensitive and all the aspects preceding the social modality are the substratum spheres of this aspect.

The use that a community makes of a building anticipates the destiny of this construction in economic terms and its economic value in the real-estate market. The social modality is the substratum sphere with regards to the **economic** modality. The link between the two spheres is very strong, as mentioned in Chapter 3.0 when the utility theory was discussed (Hargreaves et al., 1992; Marglin, 1967).

A number of economic issues occur in a construction activity and a number of decisions are taken in relation to the initial, limited amount of resources which are available to developers and builders for construction (Brandon et al., 1988; Skitmore, 1989). 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 (Brandon, 1992).

The spatial, physical, sensitive, analytical and all the other earlier modalities are the substratum spheres of the economic modality. Many economic decisions relating to buildings are determined by the biological health of the site, the perception that people (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 (Ferry and Brandon, 1991; Sinopoli, 1997).

In literature, an existing interdependence is recognised between the economy and the environment which encompasses also social and cultural values (see among others, Pearce et al., 1989; Costanza, 1991; Pearce and Warford, 1993; etc.). On one hand, environmental quality influences economic performance and, on the other hand, the economy affects the environment. 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 to natural landscapes, to sites of historical, architectural or cultural interest, to local traditions, customs, etc. (Lichfield, 1988; Coccossis and Nijkamp, 1995).

The economic modality is the substratum sphere with respects to the later modalities, representing a key issue for sustainability of the built environment. For example, the use that people make of a building has an impact on the harmony (aesthetic) of the urban complex (Lynch, 1990; Francescato, 1991). If the users of this 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, then the harmony of the whole urban area might be threatened and sustainability is low (Lombardi and Basden, 1997)

The concept of harmony (Valéry, 1991; Zeleny, 1994) 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 message underpinning the building, the use made of the built environment by the community, the cost paid and other economic choices that occur during planning, design and building. Aesthetic is the superstratum sphere of all the earlier aspects.

The particular architectonic style and the decoration (Ruskin, 1849) of a building possess an aesthetic meaning-side. The beauty of a building can be recognised not only by inhabitants but also by neighbours and tourists (Simon, 1947; Allwinkle and Speed, 1997). For example, a qualitatively high image of an urban area not only meets the requirements of the citizens, but it also attracts new investors, drawing firms that intend to re-locate and becomes a 'model' to be followed by other Local Administrations (Ave and Corsico, 1994). Many effects of well-being 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, people's contribution to education and training, etc. (Pearce and Turner,1990; Roscelli, 1990; Lombardi 1997)

The building can be in harmony with its surrounding or, alternatively, be in contrast. These relationships between a building and its surrounding are usually regulated by technical and planning legislations (DoE, 1992). The latter is an issue of the **juridical** modality which is the superstratum sphere of the aesthetic aspect, specifically in the case of norms regulating the esthetical development of the building.

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 1990 Town and Country Planning Act (amended and revised in 1991) and in contrast to other Member States of the European Union there are fewer provision 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 (EGUE, 1994; EU, 1997).

The building has several repercussions also in terms of properties and use of land (Stanghellini and Stellin, 1996). 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 is not only the superstratum sphere of the aesthetic modality but also of all the earlier ones, the economic, social, sensitive, and so forth. In particular, the relationships between the juridical and the biological modalities need to be emphasised in terms of urban sustainability (Turner, 1988; Costanza, 1993; Costanza et al., 1997), for example, the environmental pollution provided by a building such as a factory or a waste disposal plant. In the juridical modality, the producers of pollution (users or owner of that building) are responsible, in juridical 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 users) pays" (Baumol and Oates, 1988; Barbier, 1993). 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 initial place and this provides an obstacle to the application of this principle (Breheny, 1992). Often the administrative boundaries (juridical) do not correspond to the natural (spatial and physical) ones (Giaoutzi and Nijkamp, 1993; Clementi et al., 1996).

In its role of substratum sphere for the **ethical** aspect, the juridical modality provides a fundamental contribution to our understanding of sustainability in the built environment. The ethical modality refers to a particular attitude towards the others, both living creatures or inanimate ones, which is governed by love and morality (Schultz, 1996). In the context of this study, it specifically suggests that citizens (particularly building and land owners) go beyond mere duty in consideration of ownership and responsibility and that those who live nearby should go beyond the traditional NIMBY (not in my back yard) defensiveness (WECD 1989; UNCED, 1992; Lombardi and Basden, 1997).

The ethical modality is the superstratum sphere with respects to all the earlier modalities. For example, we can think of the social conflicts arising from the decision to locate a waste disposal, an airport or a railway nearby (Brennan, 1995; Lichfield, 1996). The spatial modality (in terms of location) and the biological modality are substratum spheres for this aspect. However, other examples can be found in our every-day experience with regards to the wide repercussions that a legislative act may (juridical) have on the morale of a community (Granaglia , 1988).

Finally, the concept of equity - which is fundamental in a study of sustainable development (UNCED, 1992) - is an ethical issue. Although this concept 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 certainly based on humanitarian love for one's neighbour, love of nature, and so forth, in the well known expression of the Bruntland report (WECD, 1989): "a respect for the needs of future generations". This last definition clearly refers to the futurity perspective of sustainability (Mitchell et al., 1995), emphasising a credal dimension in sustainability (DeWitt, 1995).

The ethical aspect is the direct substratum sphere of 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 (such as the presence of crime or of new immigration from under developed countries), people have no commitment towards their environment and no development is possible (Bonnes and Bonaiuto, 1993; Coeterier, 1994; Wong, 1998).

The meaning nuclei 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 Christians or other religions. The contents and the directions of faith differ with different people (Dooyeweerd, 1979; Griffioen and Mouw, 1983; Griffioen, 1995). For example, belief can be directed towards God or towards an idol of whatever modern form ("I shop therefore I am").

What is finally the link between this credal aspect and the built environment?

The built environment is, at the end of the day, a reflection of what we think it has to be (Lombardi and Basden, 1997). 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 esthetical and ethical characteristics of our built environment are just a reflection of a simple but fundamental credal issue: *who we are, where we aim to go as individuals or as a community.*

4.3 The *Enkaptical* Structure of the Built Environment

As already mentioned, a specific feature of the Cosmonomic Idea Theory is the separation between theoretical and pretheoretical thinking. In everyday living we function in all modalities, without thinking about them explicitly (see *tacit knowing* discussed by Polanyi, 1967). It is in this 'everyday' ('pre-theoretic') thinking and acting that we integrate them. But at times we can become aware of them as separate areas of reality. In higher abstraction, however, we open up each aspect and make an explicit (scientific) knowledge of its laws available to the human community.

Scientific knowledge can then be used in our everyday living, but usually requires the services of specialists. The modalities give rise to specialist disciplines, as scientific knowledge is put to use.

In our theoretical analysis of the modal aspects related to the built environment, a number of issues, urban activities and functions have been identified and described in the context of urban sustainability.

We have encountered both concrete objects (e.g. roads, water, green areas, built heritage etc.) and concepts or human or cultural modes of being (e.g. creativity, collaboration, efficiency, etc.). All these can easily be found in literature or experienced in every-day-life.

We can also recognise urban institutions, such as Census statistical offices, archives, library, car parking, hospitals, schools, etc. These elements (individuality structures or systems) derive from the different functions and the various uses that people make of their built environment (Stone, 1989). They are still characterised as built environments, but are more specified in their function within the built environment.

Each of these systems displays a specific function which may be different from the sphere sovereignty of the modal aspect which qualified it (*qualifying function*). For instance, a hospital is still a physical entity but it is qualified by the biological aspect. In this it displays its (*object*) function. This point is discussed again at the end of this section. For the time being, it is important to recognise the variety of institutions and issues (both concrete objects and conceptual issues) related to the built environment. Table 4.1 lists a number of these material and non material issues according to the modal order in association with the meaning kernel of each aspect.

We may recognise that some of the listed issues do not display a unique or mono-aspect characterisation but are multi-faceted. They could be associated to more than one modality. The present association with a single modal aspect follows an understanding of the problem based on currently available literature on the subject area (see Bibliography). Thus, for example, efficiency has been seen as an issue of the economic modality, particularly in the context of planning evaluation (Hargreaves et al., 1992); but it clearly possesses also a historical meaning-side in the context of management and organisation (Simon, 1982).

The reason for establishing this check-list is that it is useful to identify the aspectual issues which are relevant for sustainability in the built environment as a basis for establishing a common framework and understanding between different scientific fields and experts. This will be further developed in Chapter 6.0.

Meanwhile we have reached the point where we can clarify the distinction previously introduced with regards to the qualifying function and in Section 4.1. We have observed that a building is qualified by the physical aspect. Nevertheless, it displays all fifteen modalities (see the analysis Section 4.2).

In the Cosmic Idea, as already mentioned, all that is concrete in temporal reality has some functions in each of the aspects. However, not all the modal aspects can be treated alike. From just a simple observation we can recognise that a building has a number of physical features, takes up space, but does not display vital functions, does not see, feel, analyse, does not buy or sell. Yet a building can be the object of seeing, analysing and it could be bought or sold. In other words, a building appears as subject in the modal aspects up to the physical, and as an object in the modal aspects which follow the physical. It has a *subject-function* in the first four modalities and an *object-function* in the rest (Kalsbeek, 1975). Only man functions as a subject in all modal aspects.

For example, people often buy houses in order to sell them on the real-estate market. For these people, the house's object-function in the economic aspect is the most important. A house, however, is not qualified by the economic aspect but by the social (as animal refuge and asylum would have been the sensitive aspect). This aspect does not stop its function during the selling-buying period but it is only 'latent' at that time (Kalsbeek, 1975). It comes to the fore again as soon as the house is occupied by some people.

It can be observed that the higher subject-function of the house is the physical aspect but the house has also an object-function in the social and several other latent object-functions, e.g. economic (on the real-estate market), esthetical (within a tourist context or an architecture exhibition), etc.

Table 4.1 – Examples of sustainability 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, Statistical Census Offices
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 Viability, 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
Biotic	Food Shelter, Housing, Air and air quality, Water and water quality, Hygiene, Green areas, Pollution, Soil quality, Biodiversity, Habitat diversity and quality, Resilience of ecosystem (ability to recover from imbalances), Health and health services, Hospitals, Gyms
Sensitive	Feelings engendered by living there, Feeling of well-being, Comfort, Fitness Noise, Security, Safety, Privacy, Provision of peaceful surroundings e.g. Motorway noise that prevents bird song operating , Counselling Services, Asylums, Houses for domestic animals
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
Formative cultural, historical, technological	Encouraging creativity in the community, Creativity when facing problems, Heritage, History of the community and area, Technology employed, Museums, Archives, Built Heritage
Lingual Communicative	Ease of communication in the community, Quality of communication (truthfulness etc.), Lingual networking, Symbols transferring, Information provision, Monuments, Signs, Advertising, The Media
Social	Social relationships and interaction, Recreational places, Social climate, Cohesion, Plurality, Competitiveness, collaboration, Authority structures, Social Register, Clubs and societies
Economic (frugality, use and care of resources)	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
Aesthetic (harmony)	Beauty, Visual amenity and landscape, Architecture and design, Architectonic Style, Decoration, Social harmony, Ecological harmony and balance, Art galleries, Theatres
Juridical (what is due)	Laws and law-making, esp. with regards to property, Ownership, Regulation and other policy instrument, Contracts, esp. for building, Rights, Responsibilities, Inequities, Property-market interests, Democracy, Participation, Tribunals, Administrative offices, Legal Institutions, Political structure
Ethical	General demeanour of people towards each other; Goodwill, Neighbourliness, Solidarity, Sharing, Equity, Health of the family, Voluntary centres
Credal Pistic	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

(This table has been developed in collaboration with Dr Andrew Basden of the University of Salford).

Note: This. list can only be indicative and cannot be exhaustive because of the complexity and richness of the urban environment

The same concept can be applied to hospitals or other urban institutions. A hospital is qualified by the biological, but this is just its object-function. The subject-function of the hospital is again the physical aspect. If we want to argue that the hospital functions actively in the biological sphere, we should demonstrate that the hospital possesses some vital functions of biology which it does not have.

All the above examples illustrate that the built environment is not self-sufficient. This relatedness to man emphases the role and responsibility that man (as an authority) has in the achievement of urban sustainability. Chapter 5.0 specifically discusses and clarifies this crucial element.

In the following, a further examination is developed with regards to the structure of the built environment with the aim of explaining and finally identifying the enduring factors that guaranty its identity throughout all its alterations and changes or the variety of its components.

This analysis requires the introduction of new concepts, such as the *enkapsis* (see also Section 3.3.1). As also reminded by Kalsbeek (1975), the theory of the modal aspects alone cannot solve the problem of understanding individuality structures. It needs enkapsis.

4.3.1 The Built Environment as a Cultural Entity

In Section 4.2 we have recognised that the built environment is subjectively qualified by the physical. This is the highest modal aspect that characterises the internal structure of a building (*subject-function*). The object-function of the built environment, however, is hard to identify without a specification of the function displayed by each building within it.

This problem has already been introduced in the discussion on the subject-object function of the built environment (houses, hospitals, schools, etc.).

As stated above, Table 4.1 illustrates some of these functions and classifies them according to the qualifying function they display within the context of the urban environment. We should note that only occasionally is there a correspondence between the subjective function of a thing and its qualifying function. This happens, for example, for the biological aspect with regards to green areas, but even gardens are often created not for vital functional use but for aesthetical or social reasons. In other words, all these urban 'entities' are qualified by an objective function which is "man-driven".

This emphasises two elements. On the one hand, the role of subject or 'agent' that people have in the built environment; on the other hand, the complexity of the system under study, which is reflected in the variety of the "functions of destination" of the built environment when it is desired, designed, produced, used, adapted and re-used. A fundamental question arises:

Can an urban environment exist without people (developers, planners, builders, citizens or tourists)?

The answer is certainly no because the built environment is the end product of some planning, procurement and construction activities and it has an intrinsically user oriented destination. (If we answer yes, we probably refer to some dead unused undiscovered ruins of many centuries ago).

As we examine a building (but the same holds true for a settlement or an urban district), we observe an assemblage of things which we do not find existing as such in nature. Man has processed and fabricated the original, natural raw materials into manufactured and semi-manufactured products.

For example, in the case of a typical British home, we may recognise bricks, slates, walls, roofs, doors, windows, and other technical (or art and craft) products etc. The objective foundation functions of these elements is the cultural historical aspect.

The natural individuality structure of their raw materials (land, wood, etc.) is *enkaptikally* bound in the structure of a semi-manufactured product. But this is just a first layer of enkapsis. In the same building, we notice a second layer of enkapsis in the structure of these semi-manufactured products (and other manufactured products) which is *enkaptically* bound by the individuality structure of the house, the finished product.

As the house-builder processes these materials, he brings the designer's conception to completion in a complete building. The historical-technical function can again be indicated as the foundation function in the structure of this cultural product. *By what aspect is the house qualified?*

The house is an object in *human social intercourse* (Kalsbeek, 1975); here it is qualified by its social object-function.

Other questions therefore arise at this point:

Can these semi manufactured products (building components) be threatened as individuality structures? Should the relation between the semi-manufactured components of the house and the house itself be considered a part-whole relationship? Or, alternatively, *should it be considered as an enkaptical structural interweaving between two (or more) distinct entities?*

Dooyeweerd reserves the part-whole relationship for situations in which the part has no meaning apart from its whole (as with my arm), while in the above enkaptic relationships there is a degree of meaningful independence (see Section 3.3.1). Therefore these are regarded as phenomena of *enkapsis*.

There are other more specific and important types of enkapsis in the theory of the Cosmonomic Idea for this study. One is certainly the *territorial enkapsis*. This explains most of the relationships we observe between the separate individuality entities that form an urban context. Examples of this type of enkapsis, in the context of the built environment, are: a building and the ground on which it is built; a University and its city; an urban community and its environment; citizens and their city; tourists and the cultural site, a local authority and the multiplicity of social (public) structures located within its territory (under its administrative jurisdiction), and so forth.

We can conclude that the built environment is a *complex enkaptic interlacement of cultural structures*, each of them qualified by a specific modal aspect.

In the context of this study, this concept of enkapsis is helpful because it allows a complete investigation of a planning problem based on a precise distinction among the aspects which are important for sustainability in the built environment. It also suggests interdisciplinary research and real co-operation between decision makers (experts and social actors). The next chapter specifically deals with these issues.

4.4 Summary and Conclusions

In this chapter, the Cosmonomic theory has been applied to the context of sustainability in the built environment and urban planning (including design).

This theory assumes that there are two 'sides' to reality as we know it: a Law Side and an Entity Side. The latter concerns objects, systems, and, in fact, anything that does something: e.g. a person, a house, a bridge, a town. The Law Side concerns modalities in which entities operate, e.g. biotic, physical, technical, social. The two sides can be seen as orthogonal: an entity crosses several modalities. 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. That is, when we analyse reality we should study the Law Side, not the behaviour of entities. It is the Law Side that expresses the fundamental Meaning, and that enables entities to 'exist' (Basden, 1996).

In our analysis of the modal aspects related to the built environment, we have recognised that the built environment has a subject-function in the spatial and physical spheres while it has an object-function in all the later modalities. A list of issues has been identified and explicitly associated to their object-functions according to the modal order (see Table 4.1). These issues will be re-examined in Chapter 6.0 in the context of a planning evaluation for sustainability.

Moreover, this application of the Cosmonomic Idea has offered a way for identifying integration between aspects and a theoretical foundation for understanding the relationships between entities and aspects. It has also show that there is mechanism that “brings unity within diversity” (Lombardi and Basden, 1997). The modal aspects and their relationships allow a system (a building, an urban district or a design) to function in a coherent rather than fragmented manner.

In the context of this study, the taxonomy of modal aspects and the theory of enkapsis have offered a useful tool for analysing the complex interrelations within the aspects of sustainability in urban systems, including the variety of buildings and structures, or other modifications to the natural environment, and in activities such an urban planning or a design. The next chapter will take this further.

The theory specifically recognises an interrelationship between theoretical and everyday ('pre-theoretical') thinking and (human) functioning which is particular relevant in decision making. Thanks to the application of the modal aspects to the built environment, we have better articulated and enriched the list of issues to be considered in an evaluation of planning initiatives, encapsulating their 'Meaning'.

Though thoroughly theoretical in nature, this approach has suggested to be a useful tool in analysis of real world situations (Kalsbeek, 1975; Hart, 1984, Clouser, 1991; de Raadt, 1994; Winfield and Basden, 1996; Lombardi and Brandon, 1997; Lombardi and Basden, 1997).

4.5 Main References

Allwinkle, S.J. and Speed, C.E., 1997, Sustainability of the Built Environment - Tourism Impacts, in Brandon et al. (eds), *Evaluation of the Built Environment for Sustainability*, E&FN SPON, Chapman & Hall. London, pp.263-275

Ave G. and Corsico F. (eds.), 1994, *Urban Marketing in Europe*, Torino Incontra Edizioni, Turin

Barbier E.B. (ed.), 1993, *Economics and ecology*, Chapman & Hall, London

Basden A., 1994, *A multi-modal approach to knowledge based system*, Information technology Institute, University of Salford, UK (unpublished)

Basden A., 1996, Towards an understanding of contextualized technology, in Proceedings of the International Conference of the Swedish Operations Research Society on *Managing the Technological Society: The Next Century's Challenge to O.R.*, University of Lulea, Sweden, 1st – 3rd October, pp.17-32

Basden A., *Cosmonomic Philosophy* (with special relevance to Information Technology), http:// www.basden. demon.co.uk/Dooy/summary.html)

Baumol W.J. and Oates W.E., 1988, *The theory of Environmental Policy*, Cambridge Univ. Press, Cambridge

Bonnes M. and Bonaiuto M., 1993, Users' perceptions and experts' evaluations of the quality of urban environment: some comparative results from the MAB-ROME project, in Bonnes M. (ed.), *Perception and evaluation of urban environment quality*, Proceeding of the Int. Symposium, Edigraf, Rome, 28th – 30th November, pp.179-193

Bonnes M., (ed.), 1993, *Perception and evaluation of urban environment quality*, Proceedings of the MAB-UNESCO International Symposium held in Rome, 28th – 30th November, Edigraf, Rome

Brandon P. (ed.), 1998, Managing Sustainability: Endurance through change, CIB World Conference on *Construction and the Environment*, Symposium D, Gavle, 7th – 12th June

Brandon P.S. and Powel J.A. (eds.), 1984, *Quality and profit in building design*, F&FN SPON, London

Brandon P.S., 1992, *Quantity surveying techniques*, Blackwell Science, Oxford

Brandon, P.S., Basden A., Hamilton I. and Stockley J., 1988, *Expert Systems: Strategic Planning of Construction Projects*, The Royal Institution of Chartered Surveyors, London, UK

Breheny M.J. (ed.), 1992, *Sustainable development and urban form*, Pion Limited, London

Brennan A., 1995, Ethics, ecology and economics, *Biodiversity and Conservation*, vol. 4, pp.798-811

Bresso M., 1982, *Pensiero economico e ambiente*, Loescher, Turin

Cadman H. and Payne G. (eds.), 1990, *The living city*, Routledge, London

Camagni R. (ed.), 1996, *Economia e pianificazione della città sostenibile*, Il Mulino, Milan

Capra F., 1989, *Il Tao della Fisica*, Adelphi, Milan

Checkland P.B., Forbes P. and Martin S., 1990, Techniques in soft systems practice, Part 3: Monitoring and control in conceptual models and in evaluation studies, *Journal of applied system analysis*, vol.17, pp 29-37

Clementi A., Dematteis G. and Palermo P.C. (eds.), 1996, *Le forme del territorio italiano*, Laterza, Rome

Clouser R., 1991, *The Myth of Religions Neutrality*, University of Notre Dame, London

Coccossis H. and Nijkamp P., 1995, *Planning for our cultural heritage*, Avebury, Hants

Coeterier J.F., 1994, *Liveliness in Town centres*, in Neary et al. (eds.), *The Urban Experience. A people-environment perspective*, Proceedings of the 13th Conference of the Int. Assoc. for People-Environment Studies, Manchester, 13th – 15th July, E&F SPON, London, pp.297-310

Costanza R. (ed.), 1991, *Ecological Economics*, Columbia University Press, New York

Costanza R., 1993, Ecological economic systems analysis: order and chaos, in Barbier E.B. (ed.), *Economics and Ecology*, Chapman & Hall, London, pp.29-45

Costanza R., d'Arge R., de Groot R., Farber S., Grasso M., Hannon B., Limburg K., Naeem S., O'Neill R.V., Paruelo J., Raskin R.G., Sutton P. and van den Bely M., 1997, The value of the world's ecosystem services and natural capital, in *Nature*, n.387, vol. 15, pp.253-260

de Raadt J.D.R., 1991, Cybernetic Approach to Information Systems and Organization Learning, *Kybernetes,* v.20, pp.29-48

de Raadt J.D.R., 1994, Expanding the Horizon of Information Systems Design, *System Research,* n.3, vol.2, pp.185-199

DeWitt C.B., 1995, Ecology and ethics: relation of religious belief to ecological practice in the Biblical tradition, *Biodiversity and Conservation*, vol.4, pp.838-848

Dixon J., Carpenter R. and Fallon L., 1986, *Economic analysis of the environmental impacts of development projects*, Earthscan, London

DoE - Department of the Environment, 1992, *Assessing the impact of urban policy*, Inner Cities Research Programme, HMSO, London

Dooyeweerd H., 1958, *A new critique of theoretical thought*, 4 vols, Presbyterian and Reformed Publisher Company, Philadelphia, Pennsylvania

Dooyeweerd H., 1968, *In the twilight of Western thought*, Nutley, New Jersey

Dooyeweerd H., 1979, *Roots of Western culture*; Pagan, Secular and Christian options, Wedge Publishing Company, Toronto, Canada

European Union, EU, 1997, Ministers of Regions and Political Leaders, Third Conference on the Environment, *The Göteborg Resolution*, Göteborg, Sweden, 18th – 20th June

Expert Group on the Urban Environment, EGUE, 1994, *European Sustainable Cities. Consultation Draft for the European Conference on Sustainable Cities and Towns,* first annual report, Aalbourg, Denmark, 24th – 27th June, Commission of the European Communities, Directorate XI, XI/307/94-EN

Ferry D.J. and Brandon P.S., 1991, *Cost Planning of Buildings*, VI edition, Blackwell Science Ltd, Oxford

Francescato G., 1991, *Housing quality: technical and non-technical aspects,* in Bezelga A. and Brandon P. (eds.), *Management, quality and economics in buildings*, E&FN SPON, Chapman & Hall, London, pp.602-609

Fusco Girard L and Nijkamp P., 1997, *Le valutazioni per lo sviluppo sostenibile della città e del territorio,* Angeli, Milan

Geenhuizen M. van, Banister D. and Nijkamp P., 1995, Adoption of New Transport Technology: A Quick Scan Approach, *Project Appraisal*, vol. 10, no. 4, pp. 267-275

Giaoutzi M. and Nijkamp P., 1993, *Decision support model for regional sustainable development*, Avebury, Aldershot

Graham A. and Bergvall B., 1994, Performance indicators in soft systems methodology, in Proceedings of the 17th IRIS Conference on *Information Systems Research,* Oslo, 6th – 9th August, pp.890-910.

Granaglia E., 1988, *Efficienza ed equità nelle politiche pubbliche,* Angeli, Milan

Griffioen S. and Balk B.M. (eds.), 1995, *Christian Philosophy at the Close of the Twentieth Century,* Uitgeverij, Kampen

Griffioen S. and Mouw J., 1983, *Pluralism & Horizons,* Eerdmans Publisher, USA

Griffioen S., 1995, The relevance of Dooyeweerd's Theory of Social Institutions, in Griffioen Sander and Balk M. Bert (eds.), 1995, *Christian philosophy at the close of the twentieth century,* Uitgeverij, Kampen, pp. 139-158

Hargreaves H.S., Hillis M., Lyons B., Sugden R. and Weale A., 1992, *The Theory of Choice. A Critical Guide,* Blacwell Publishers, Cambridge

Hart H., 1984, *Understanding our world,* Univ. Press of America, USA

Hugo V., 1832, *Notre-Dame de Paris,* II ed., Gosselin, Paris

Kalsbeek L., 1975, *Contours of a Christian Philsophy,* Wedge Publishing Company, Toronto

Lichfield N., 1988, *Economics in Urban Conservation,* Cambridge Univ. Press., Cambridge

Lichfield N., 1996, *Community impact Evaluation,* UCL Press, London

Lombardi P.L and Nijkamp P., 1999, A new geography of hope and despair for the periphery. An illustration of the Border Temple Model, in Proceedings of the *Geo-Symposium of the Aegean: Geographies on/of/along the EU border,* Mytilini, 23rd – 27th June (in press)

Lombardi P.L. and Basden A., 1997, Environmental Sustainability and Information Systems, *Systems Practice,* vol. 10, n. 4, pp.473-489

Lombardi P.L. and Brandon P.S., 1997, Towards a multimodal framework for evaluating the built environment quality in sustainability planning, in Brandon et al. (eds.), *Evaluation in the Built Environment for Sustainability,* E&FN SPON, Chapman & Hall, London, pp.6-21

Lombardi P.L., 1997, Decision making problems concerning urban regeneration plans, in *Engineering Construction and Architectural Management,* v.4, n.2, pp.127-142

Lynch K., 1960, *The image of the City,* The Technology Press & Harvard University Press, Cambridge

Lynch K., 1990, *Progettare la città,* Etaslibri, Milan

Marglin S., 1967, *Public investment criteria: benefit-cost analysis for planned economic growth,* MIT Press, Cambridge

Merret S., 1995, Planning in the age of sustainability. *Scandinavia Housing & Planning Research,* vol.12, pp.5-16

Mitchell G., May A. and McDonald A., 1995, PICABUE: a methodological framework for the development of indicators of sustainable development, *Int. Journal Sustainable Development World Ecol.*, vol.2, pp. 104-123

Nath B. and Taly I., 1996, Man, science, technology and sustainable development, in Nath, et al., (eds.) *Sustainable Development*, VUB press, Brussels, pp.17-56

Neary S.J., Symes M.S. and Brown F.E. (eds.), 1994, *The Urban Experience. A people-environment perspective,* Proceedings of the 13th Conference of the Int. Assoc. for People-Ennvironment Studies, Manchester, 13th – 15th July, E&F SPON, Chapman & Hall, London

Nijkamp P. (ed.), 1991, *Urban sustainability*, Gower, Aldershot

Pearce D. and Turner R.K., 1990, *Economic of natural resources and the environment,* Harvester Wheatsheaf, Hamel Hempstead

Pearce D. and Warford J.J, 1993, *World without end: Economic, Environment and Sustainable Development,* Oxford University Press, Oxford

Pearce D., Markandya A. and Barbier E.B., 1989, *Blueprint for a green economy,* Earthscan Publications Ltd, London

Polanyi M., 1967, *The Tacit Dimension*, Routledge and Kegan Paul, London

Rees W.E., 1992, Ecological footprints and appropriated carrying capacity: what urban economics leaves out, *Environment and Urbanisation*, vol. 4, n.2, pp.121-130

Roscelli R.(ed.), 1990, *Misurare nell'incertezza,* Celid, Turin

Ruskin J., 1849, *The Seven Lamps of Architecture*, London.

Russell P. and Grammenos F., 1995, A Building for all reasons. A vision of a balanced Mixed use Building, in Cole et al. (eds.), *Linking & prioritising environmental criteria*, Toronto, Canada, 15th – 16th November, pp.145-154

Schutz J., 1996, What has Sustainability to do with Ethics?, in Nath, et al., (eds.) *Sustainable Development*, VUB press, Brussels, pp.137-157

Simon H. A, 1947, *Administrative Behaviour*, The Macmillan Co, New York.

Simon H.A., 1982, *Models of bounded rationality*, vol.2, MIT press, Cambridge, Mass

Sinopoli N., 1997, *La tecnologia invisibile. Il processo di produzione dell architettura e le sue regie,* Angeli, Milan

Skitmore M., 1989, *Contract bidding in construction*, Longman Group Ltd, Hong Kong

Stanghellini S. and Stellin G., 1996, Politiche di Riqualificazione delle Aree Metropolitane: domanda di valutazione e contributo delle discipline economico-estimative, *Proceedings of the XXVI CeSET Seminar*, Milan, 17th – 18th October, pp.34-52

Stone P.A., 1989, *Development and planning economy*, E&F SPON, Chapman & hall, London

Strauss D.F.M., 1995, The Significance of Dooyeweerd's Philosophy for the Modern Natural Sciences, in Griffioen Sander and Balk M. Bert (eds.), 1995, *Christian philosophy at the close of the twentieth century*, Uitgeverij, Kampen, pp.127-138

SWEHOL, 1996, *Managing our Technological Society*, Proceedings of the Second Working Conference, Priorij Emmaus, Maarssen, April 15th – 19th

Turner R.K. (ed.), 1988, *Sustainable Environmental management: Principles and Practice,* London, Belhaven Press, Boulder, Westview;

United Nations Conference on Environment and Development, UNCED, 1992, *Earth Summit '92 (Agenda 21),* Regency Press, London

Valéry P., 1991, *Eupalino o l'architetto*, Biblioteca dell'Immagine, Pordenone

Voogd H., 1995, Environmental management of social dilemmas, in *European Spatial Research and Policy,* vol. 2, pp.5-16

Wackernagel M., Mcintosh J., Rees W. and Woollard R., 1993, *How big is our ecological footprint? A handbook for estimating a community's appropriated carrying capacity*, Taskforce on Planning Healthy and Sustainable Communities, University of British Columbia, Vancouver, Canada

WCED - World Commission on Environment and Development, 1987, *Our Common Future (The Brundtland Report*), Oxford University Press, Oxford

Wilson A. and Malin N., 1995, Establishing Priorities with Green Building, in Cole et al. (eds.), *Linking & Prioritizing Environmental Criteria*, Toronto, Canada, 15th – 16th November, pp.107-114

Winfield M. and Basden, A., 1996, An ontologically based method for knowledge elicitation, in SWOT, Proceedings of the International Conference of the Swedish Operations Research Society, *Managing the Technological Society: The Next Century's Challenge to O.R.,* 1st – 3rd October, University of Lulea, Sweden, pp.72-93

Wong C., 1994, Quality of urban living: an infrastructural dimension, in Neary et al. (eds.), *The Urban Experience*, E&F SPON, London, pp.257-269

Wong C., 1998, Determining Factors for Local Economic Development, *Regional Studies,* vol. 32, n. 8, pp. 707-721

Zeleny M., 1994, In Search of Cognitive Equilibrium: Beauty, Quality and Harmony, *Journal of Multi-Criteria Decision Analysis*, vol. 3, pp.3-13

Zevi B., 1973, *Spazi dell'architettura*, Einaudi, Turin

Chapter 5.0 – Decision making Problems in Urban Planning for Sustainability

The real question is not whether machines think, but whether men do
(B.F.Skinner)

The main purpose of this chapter is to show, with examples and case studies, that the Dooyeweerd framework is relevant to planning in the built environment and that each aspect plays an important role.

The previous chapter introduced the role and responsibility that man (as an authority) has in the achievement of urban sustainability. This is not only experienced in our everyday life and verified by the Cosmonomic Idea but it is also emphasised in the literature on sustainability. The relatedness of man to the built environment needs to be carefully discussed and analysed within the context of sustainable development of the built environment. This issue is important for sustainability as future developments of a system (a building, a city or a community) are strongly dependant on decision making made by mankind, particularly at the level of planning and design.

According to many experts in the field of planning (see Section 2.2.1), the new agenda of sustainability provides urban planning with a fresh opportunity and a critical test of its ability to influence market processes rather than merely respond to them, calling for a new conception of urban planning to close "the tremendous gap between planning potential and its performance" (Klosterman 1983). This requires a change in emphasis and a change in the criteria towards which sustainability is evaluated. It requires the adoption of a suitable framework which enables planners (and, in general, decision makers) to understand the problems implied in a planning decision.

As already suggested in the discussion developed in Chapter 2.0, at the moment such a framework is not available or agreed on among the experts and the different scientific disciplines dealing with sustainability in planning. Current evaluation approaches are inadequate for this aim but if planners want to devise strategies and policies (such as urban plans and projects) that can guide cities along a more sustainable development path, such a framework should be shared and agreed on. It should be able to assist the process of decision making, ensuring that all sustainability aspects are included, both issues related to the *quality of life* of citizens and issues related to the *quality of the environment* in which people live (Voogd, 1995). It should be able to check the *quality of planning*.

This chapter undertakes an analysis on the problems that decision makers may encounter to understand sustainability in the built environment. The analysis is based on case studies and planning examples with major consequences for sustainability. It is also supported by the theory of the Cosmonomic Idea which has been shown to provide benefits in the understanding of complex systems.

The aim of this analysis is to show the variety of decision making problems related to sustainability, as well as the richness and comprehensiveness of the Dooyeweerdian hierarchy of the modal aspects. Before starting this analysis, the chapter also discusses the role of urban planning, as it is recognised to be a *sine qua non* condition for the achievement of sustainability in urban environments.

The chapter is structured as follows. Section 5.1 develops an analysis of planning and design as activities of the built environment which have an important role in the process of achievement of sustainability. It also introduces the role and responsibility of planners and decision makers. This analysis is supported by the Cosmonomic Idea which suggests an integration between external reality (the built environment) and individual or social actors (planners and stakeholders). Section 5.2 discusses some crucial issues related to decision making processes in urban planning and design, providing case studies and examples related to sustainability. The illustration of each case study is supported by the theory of the modal aspects. Finally, Section 5.3 summarises the whole discussion providing final conclusions.

5.1 The Role of Planning for Sustainability

Urban planning and design have been assigned a relevant role in the achievement of sustainable urban development by governments in many EC countries. It is also recognised that cities plays a *Re Mida* (major) role in sustainability, as the world is becoming increasingly urbanised with all the advantages and disadvantages that go with it (Capello et al., 1999).

Among others, Breheny (1992) and Merret (1995) recognise that urban planning can reduce energy consumption and pollution by minimising the need for travel in relation to the ecological 'carrying capacity' of cities and more generally incorporating sustainability criteria in regional and local planning. Yet, the above illustration of case studies and examples have reinforced the view that better quality of planning can increase urban sustainability.

Within a different perspective, Symes (1997) argues that design can have a number of roles in creating more compatibility between criteria established in the different dimensions of the "quality" of the built environment and also in assessment methodologies. It can be seen as a means of co-ordination of diverse methods, of meeting a variety of requirements.

An understanding of planning and design is therefore important for this study because it helps to illustrate how these activities may contribute to develop sustainable solutions in urban (re)development problems.

Planning and design are officially recognised activities of the built environment (McLaughin, 1969). These activities deal with both physical and spatial issues (e.g. spatial distribution and organisation, layout and form), and social economic and institutional issues (e.g. fair allocation of resources, development costs and benefits), trying to answer the needs and requirement of the client (a single individual or a group). The same is applied to building design as Ferry and Brandon (1991, p. 88) state, "The building design process is a complex interaction of skills, judgement, knowledge, information, and time which has, as its object, the satisfaction of the client's demand for shelter, within the overall needs of society".

When the client is a local community, social needs are regarded as an issue of 'public interest' and are often part of the political agenda of the city (Lichfield et al., 1975; Lichfield et al., 1998; Healey, 1992).

Traditionally, local planning and urban design provide guidelines for further activities of the built environment, such as procurement and construction. Planning and design are also characterised by the traditional approach of scientific method, as both activities have a *founding function* in the analytical modality. The design team firstly studies the design problem, analysing the characteristics of the area and of the site (RIBA, 1965). In design method, inference is usually obtained from the brief; hypothesis is set up in the form of a model, such as a drawing, a check is made to see whether it complies with the interpretation of the brief and if it does, then the design is accepted (Brandon, 1992). The design team orders and structures the design problem, calculates and accounts for both physical and financial resources (budget) (Brandon and Powell, 1984). Data and information are collected of both a quantitative and qualitative nature. Furthermore, a design approach usually makes use of specific techniques, e.g. cost modelling, optimisation techniques, C.A.D., etc. and of other products of cultural and technical development and of different skills.

Planning and design problems are often both multidimensional and highly interactive. Very rarely does any part of a designed object (entity) serve only one purpose. For instance, in the field of design, the American architect Philip Johnson was reported to have observed that some people find chairs (which is qualified by a social objected-function) beautiful to look at (aesthetic aspect) because they are comfortable to sit in (sensitive aspect), while others find chairs comfortable to sit in because they are beautiful (Lawson, 1990). According to Lawson (1993) design is an activity that "involves a highly organised mental process capable of manipulating many kinds of information, blending them all into a coherent set of ideas and finally generating some realisation of those ideas".

From the foregoing discussion, it should be clear that urban planning and design are qualified by the *techno-cultural-historical* aspect; this is the leading (guiding) function of these activities. This aspect guides and regulates all creative processes and specifically those related to the cultural development of a community (Kalsbeek, 1975; Griffioen and Balk, 1995).

The Cosmonomic Idea recognises that planning and design are closely interwoven systems (i.e. *individuality structures)*. As for the built environment, we identify a first enkapsis between the sheets of papers (related to the drawings) or the manufactured material (related to the design models) and the raw material (plastic, wood, metal, or other) which have been used to manufacture the product (drawings or models). A second enkapsis is between those manufactured structures and the idea of the design team. This idea enkaptically links together a number of items of information derived from the application of scientific and technical analyses and the experience of the designer team.

All the decisions which have been required for developing the design have a different nature (economic, aesthetical, juridical) and have been driven not only by technical or cultural expertise but also by the designer's vision (credal aspect). Each decision involves and presupposes a different decision making process which is usually linked to (and interacting with) others in a complex manner (Saaty, 1980). Very rarely is a decision made in isolation from the context (Simon, 1947; Lynch, 1960; Saaty, 1980).

The above is a broad discussion of the decision making processes which results in a techno-historical-cultural product, i.e. an urban project or a design scheme, and this provides motivation and guidance for a modification or a (re)development of the built environment.

A question may arise: *What is the element that enables the future built environment to be sustainable?*

This question cannot be fully answered at the planning level. As known, design is just one stage of the development of the built environment and other activities will follow it, such as procurement and construction, use and demolition (see Section 5.2). Each of these activities certainly share a degree of responsibility, since each incorporates a number of different decision making processes, followed by specific actions. Furthermore, unexpected natural processes or external catastrophic factors may occur, intertwining in this process.

Reality is certainly not easy to predict as a system neither is it deterministic (Bocchi and Ceruti, 1994; Capra, 1996). In other words, we cannot blame the designer nor the planner if our neighbour does not provide regular maintenance to his house or if a citizen regularly throws rubbish onto the street or into the park.

However, at a certain level, the sustainability of a built environment can be forecasted by analysing the planning proposal and design scheme. This is, for example, what technical *ex-ante* planning evaluation generally aims at doing (see Section 2.2). Yet, the relevance of this activity of forecasting in ensuring higher quality performances for the built environment is recognised in the planning legislation of many EU countries, including the recent Italian *Merloni* Law (1994).

In the context of sustainability (and of this study), however, evaluation does not purely mean appraising the feasibility and profitability of the future asset on the market or checking some technical requirements and/or some environmental issues (e.g. risk analysis, static control, etc.). It also means an integrated holistic assessment of all the aspects related to the built environment and its performance, at different stages, from the earliest conception of the project's development.

This is important in order to make choice intelligible and explicit, which is a prime required of participation in planning for sustainability (see Chapter 2.0 and Chapter 6.0). It also implies that the planning process - given the uncertainty of knowledge – will follow a *precautionary approach* (UNCED, 1992), one which gives priority to long term views on ecological processes and takes a strategic stance in decision-making and will share the risk involved in decision making (moral argumentation) with a wide range of stakeholders being (or becoming) included and participative (Simin, 1999).

Clearly, the evaluation process cannot strictly be technical but it must certainly be guided by a scientific procedure (Mitchell, 1996). It requires the assistance of a suitable framework which is able to guide developers and decision makers through the process of identifying (un)sustainability issues (see Chapter 6.0). It also requires that personnel in organisations with the responsibility for urban development evaluation are adequately briefed on sustainability issues and characteristics (see Section 2.3), and this inevitably brings up the problem of education (Simin, 1999).

The following section reinforces the relevance that decision makers, such as planners, have in the process of achievement of sustainability in the built environment, on the basis of the theory of the Cosmonomic idea.

5.1.1 An "Opening process" for Sustainability in the Built Environment

In a recent review of current debates in the British planning system, Simin (1999) recognises there is a variety of interpretations within the overdue and much needed 'vision' provided by the sustainability agenda, each leading to a distinctively different development path for the future of the planning system. One discourse draws on the ideology of 'ecological modernisation', the other is based on the 'risk society' theory (see Table 5.1). The two are closely related to those technical and communicative planning evaluation approaches already discussed (see Section 2.2).

Table 5.1 – Potential future directions for planning systems

Planning in Ecological Modernisation	Planning in Risk Society
Regulatory face of planning	Radical and ideological face of planning
Legitimate arm of the state's regulatory regime	Pro-active arm of an interventionist state
Facilitate economic processes while making them environmentally benign	Defend the environment against risks associated to economic processes
Focus on centrally-formulated, non-spatial, apolitical regulatory criteria	Focus on strategic and holistic approaches to place-making
Elitist, hierarchical, issue-based	Participative, collaborative, integrated

(Source: Simin, 1999)

Simin (1999) argues that although planning as it is practised today fits neatly within what is perceived by ecological modernisation approaches as part of the state's legitimate regulatory activities (see also Chapter 2.0), there are increasing pressures, particularly at the local level, for the development of the kind of policy discourses which have strong resonance with the risk society perspective (e.g. the process of Local Agenda 21). Given the traditional affiliation of the planning system with 'public interest' objectives, Simin concludes by saying that planners can undoubtedly play a major role in responding to such demands, bringing a new dimension to the debate on planning education.

The leading role that decision makers, planners and all concerned stakeholders play for the sustainability of present and future community built environments is also recognised in the Cosmonomic Idea (see Section 4.3). In particular, Dooyeweerd talks of an *opening process* in order to illustrate the development of both organic and inorganic nature, including human societal relationships. Insofar as man can (and in fact does) influence this process, it can never come to an end (Doyeewerd, 1958).

The opening process in human society is indissolubly linked to the opening process in the modal aspects. In every aspect, in fact, there exists an indissoluble correlation between the law-side and the subject-side. This concept can be better illustrated by taking the well known Kalsbeek example of the emotional life of men and animals (Kalsbeek, 1975, p.128).

Although both men and animals have eyes to see the beauty of scenes provided by the natural environment such as a mountain setting, the animal "uses the information its eyes receive to find food or avoid falling off the cliff" while the man "is not limited to the sensitive function". The animal "and even a young child cannot perceive the beauty of the scene because their emotional lives are not open to it". The animal is limited to the force of organic life itself. The infant does in fact possess a latent possibility for such disclosure and, as he grows up, the opening process takes place. "The opening up in the sensitive involves opening up the latent *meaning-moments* which anticipate the *superstratum sphere*". For instance, cultural feeling arises as an opening anticipation of the cultural-historical modality. For the animal, however, the sensitive aspect is closed because it only has retrocipations in the preceding spheres.

What does it mean in this context of urban planning and design?

In Dooyeweerd's Idea, decision makers, such as planners, stakeholders and all concerned citizens (people who have "authority") have a leading role in the achievement of sustainability in the built environment. He noted that the opening of culture is guided by "the shaper of history" whose faith (credal) is propelled and directed by certain "ground motives" (Kalsbeek, 1975). In his idea, "the principle of cultural economy, a norm for historical development, would guide the shapers of history in preventing each cultural sphere from overdeveloping at the expense of another sphere" (p.138).

In the context of this study, it means that the built environment as a system may function and develop in a well balanced (sustainable) manner rather than functioning in a fragmented (unsustainable manner) but it requires vision and commitment (faith). The same can be applied to a building, a city, a community and so forth. Therefore, a sustainable building, a sustainable city, a sustainable community are systems whose parts (components, institutions, organs) work together harmoniously, recognising the *sphere sovereignty* of each.

As already suggested by Lombardi and Basden (1997), Dooyeweerd's conception of subject/object functions of the built environment may provide a necessary foundational attitude and motivation towards sustainability. It is worth noting that the aspects are a reality that are independent of us, and they pertain to all our functioning, even though we are usually not aware of them, or only tacitly, yet they still pertain.

Dooyeweerd's proposal is that when a system acts in line with the law spheres governing it then its being and acting will be more 'healthy' and when it acts against them then its being and acting will be less 'healthy'. This holistic type of 'health', which is captured in the Hebrew word, *shalom*, covers all modalities and entities, but the results of acting with or against the law spheres is not always immediate.

According to the founding-function of the built environment, the physical spheres can be recognised as acting as a precondition to the achievement of sustainability in higher levels. This can also be observed in reality, for example, when a reduction of energy consumption and air pollution increases the environmental quality of an urban district and the feeling of comfort of people who live in the area (Capello et al., 1999). This, in turn, will facilitate the social relations within the district, increasing the pleasure of out door activities, and leading to a general improvement in the morale of citizens.

While the results of physical laws are often felt immediately, with later aspects (normative laws) the effect is likely to be longer term and more subtle. The results of our acting might take more than a generation to manifest themselves. For instance, if people of the area have no vision, no commitment to the area, which are elements of the credal aspect, then morale is likely to be low, which will again affect all other functioning. It will also lead to divisions in society. Again, but in a different manner, true sustainability suffers.

While some aspects are perhaps less important than others for sustainability in particular planning situations, if planners ignore any of the more important ones then the built environment will not function well over a long period (Lombardi and Basden, 1997). For example, if the aesthetic modality is poorly represented in the urban area, this effects all its surroundings and the whole urban system, including its social surroundings. City users would than prefer to spend their time elsewhere, which results in heavy economic consequences for the town (Ashworth and Voogd, 1988).

When people (those who live and work in a city, or in an urban environment, as well as planners) act in line with the laws of a modality then we - and other entities around us - receive the benefits of that aspect; when we act against them we - or others - receive harm. On the contrary, when planners and citizens, or generally a decision maker, ignore a modality or go against its laws then those laws still pertain and sustainability is threatened, whether in the short or long term. This explains why the ignoring of, and imbalance among modalities can threaten sustainability.

When the subjects in an urban environment - those who live and work there, as well as planners - ignore a modality or go against its laws then those laws still pertain and sustainability is threatened, whether in the short or long term. Though we act against the laws of a modality we cannot set the laws aside; there will be consequences. It thus follows that the more we act in line with normative laws of all modalities, the more beneficial and 'healthy' will be our total living (Lombardi and Basden, 1997).

However, this does not mean that more planning can guarantee sustainability. All we can do is maximise the balance between modalities and attend to the types of relationships between them, and then we will lay the path towards a necessary integration. The problem of integration is further discussed in Chapter 6.0.

In the following, because of the relevance of the concept of time for sustainability, a brief discussion of this crucial issue is provided, in the light of the Cosmonomic Idea.

5.1.2 The Problem of Time in Sustainability

In the context of sustainability of cities, a considerable role is played by the problem of time. If an urban environment or a community is to be sustainable then it must be so over as long a term as is necessary for all the effects of functioning in all the modalities to be manifest - for good or ill. Therefore, it is important to see time in a richer sense than just a string of events or of causes and effects.

The Cosmonomic Idea does not propose a definition for Time because it cannot be captured in a concept. Many philosophers and experts have managed to define it. Dooyewwerd argues, however, that "they only appear to resolve the question of time. In reality, they always fall prey to the same illusion: it is not time they are defining but an aspect of time" (Kalsbeek, 1975, p.152).

In Kant's view, neither time nor space exists outside the boundaries of the sensory perception (Kant, 1988). The reality we think and we see around us exists only in our consciousness; the structural formation of the whole is derived from humans knowing themselves. In contrast with this conception, Dooyeewerd places time in isolation with respects to space and with a totally different function. Even in the theory of the modal aspects (which includes a spatial aspect) no temporal aspect can be found. On the contrary, Time embraces and penetrates the two basic types of creation structures: the individuality structure in which we distinguish concrete objects, events, acts, societal forms, etc. and the modal structure of the aspects, which play their own peculiar roles in these individuality structures.

This innovation of the Cosmonomic Idea is extraordinarily contemporary if we think of the current visible stronger relevance that time, rather than space, has on our lives. This is mainly due to the significant technological progress. In the past few decades, the technology sector (particularly, information technology and transport engineering) has created quicker communication, transport, etc., contributing to a culture link between people which has often led to an improvement in collaboration among countries and nations. In other words, it has contributed to reduce the differences between people 'in space'. The web space and its formative power, for example, can be shared by different people of different counties in the world, contributing to the linking of people together. On the other hand, however, the rapid growth of information technology has also contributed to increase the culture gap among individuals of different ages, i.e. 'in time'. Therefore time (as understood by Dooyeweerd), is not just a set of random or contingent events but it has a cultural formative power meaning.

In particular, Dooyeweerd distinguishes a *cosmic time* between the law side and the subject side. It is *time order* on the law-side (e.g. in the aspect of organic life, birth, maturing, adulthood, aging and dying), and *time duration* on the subject side (it is subject to that order but can vary greatly). In particular, time discloses itself in a diversity of modal meanings, i.e. it is *modalized* (Kalsbeek, 1975, p.154). In other words, the way in which time manifests itself in the various aspects is qualified in each modality by the peculiar meaning structure of that aspect (as the above example of the organic life in the biological aspect). Time is also *typicalized* in the individuality structures.

What this means is that Dooyeweerd does not eschew the idea of 'progress'; rather, he gives it new meaning that takes account of human formative action (history-culture-technology). He not only recognises the reality of this, but also postulates that there are normative laws that pertain concerning its healthy functioning (Lombardi and Basden, 1997). In other words, Time to Dooyeweerd is a direction to the history of the cosmos (named, *opening process*); a direction towards the opening up of the modalities so that the potential of all is fulfilled. This concept links to the notion of sustainability as development which opens opportunities rather than lead to conflicts or threats.

Because we can only deal very briefly with the question of time in this study, we have to be content with a mention of the above position and recommend further research on this subject (see Chapter 8.0).

5.2 Sustainability Case studies in Planning and the Built Environment

In the process of development of the built environment, different stages or activities can be identified, such as Strategic Planning; Local Planning; Procurement; Urban Design; Architectural Design; Construction; Use; Facility Management; Repair & Maintenance; Adaption/reuse & Refurbishment; Deconstruction, Demolition & Disposal (BEQUEST, 1999).

This study is concerned specifically with the stages of Local Planning and Urban Design (see Chapter 1.0). Both activities are informative formal schemes for future spatial layout of the physical environment which provide a projection or an idea of how the spatial and physical reality should be developed in a particular timescale. Therefore, as already stated in Section 5.1, they imply modification, change, and technical-cultural-historical development.

In the words of Nijkamp et al. (1999), "urban development means the creation of new assets in terms of physical, social and economic structures, but it is worth noting that each development process often also destroys traditional physical, social and cultural assets derived from our common heritage". In most cases, the evaluation of such assets in the planning process cannot be left to the market mechanism (Lichfield, 1988), as most urban historico-cultural assets represent 'unpriced goods' (Pearce and Turner, 1990) characterized by external effects which are not included in the conventional "measuring rod of money' (see Chapters 2.0 and 3.0). A careful process of decision-making is required to reach a satisfactory policy in a complex environment (Coccossis and Nijkamp 1995; Nijkamp et al., 1999; Lichfield et al., 1998).

Generally, a decision making process takes time and can also be very costly (Ackoff, 1981; Simon, 1985; Bruinsma et al., 1999). A number of problems faced in decision-making, related to planning and design, are illustrated by Nijkamp et al. (1999) as follows: the information or data available always contains an element of uncertainty; the data or information may be stored in different data-bases that may be difficult to access, manipulate, compare and study; a large set of - often conflicting - objectives or targets has to be taken into account; the decision-making process itself might be influenced by power relations or selfish motivations; a decision-making process has to take place within the shortest time possible to avoid countervailing effects.

Although these are recognised critical issues that can plague a decision making process, a major problem faced in planning evaluation for sustainability is the lack of a common language among the different stakeholders and urban actors (Brandon, 1998; Lichfield et al., 1998). This is required because planning evaluation is generally based on both technical and subjective values, experts judgement and opinions, rather than on the valuation and forecasting of a monetary value for the project, for example (see Chapter 2.0). In order to be effective, therefore, decision making for sustainability should be enlarged to include participation of stakeholders and concerned citizens (UNCED, 1992).

Today a number of powerful techniques are available which can support this task, such as visual and geo-referenced information system, decision support systems, virtual reality tools, etc. (see Chapter 2.0). These tools are very effective in storing and organising information but not very effective in structuring problems (Betty, 1994). Decision making processes for sustainability require structure and a flexible guide which can support the argument and the communication among stakeholders (Selman, 1996).

A framework for evaluating sustainability should be able to address some crucial issues related to the sustainability of a situation, answering questions such as the following:

Can we recognise it when we see it? If we can , then over what timescale are we making the judgement?

Is it a continuum in which we constantly review our assumptions and thereby change our reference point in order to match the new aspirations? If yes, then can our framework remain even if our assumptions and reference points change?

The above are basic, fundamental issues for decision making but seldom addressed by current tools (Brandon, 1998). A major problem is that sustainability is a complex issue which demands a holistic and coherent approach to policy making, one which combines the objectives of environmental sustainability with that of social equality and economic well-being. A second problem is that we do not have much information and experience or good examples of case studies on sustainability (Nath et al., 1996). This is because sustainability differs from place to place, i.e. it is 'local' (Selman, 1996; Cooper, 1999), and it keeps changing, i.e. it is time - restless.

Can the methodology of Dooyeweerd help to tackle the above crucial issues?

Can it be the basis for developing a robust and user-friendly framework for decision making (see hypothesis 2 in Section 1.3)*?*

The previous chapter has shown that the taxonomy of fifteen modalities represents a robust tool for analysing complex systems, such as the built environment. In the following, an overview of some critical planning situations is illustrated by using the structure of the fifteen modalities and the key issues identified in Table 4.1. Each example is analysed with the twin aim of increasing the understanding of each issue in the context of decision making for sustainability and of showing the relevance of each modal aspect to enable a genuine understanding of sustainability.

The next chapter will take this analysis further, by developing a framework which is able to handle the variety of issues illustrated in this analysis.

5.2.1 Examples with Major Consequences on Sustainability

Examples of the Numerical aspect

There are a number of examples of 'un-sustainability' in planning which deal with the numerical problem of accounting and calculation of thresholds. For instance, if planners do not establish an acceptable limit to the number of users on a site or area with an appropriate technique of carrying capacity (Rees, 1992), the sustainability of the area suffers from overcrowding and over utilisation of the resources. This is particularly evident in tourism and recreational planning where an optimum utilisation of tourism resources requires the systematic determination of the upper limits of development and visitor use (Allwinke and Speed, 1997).

Several examples of unsustainable planning could be observed during the '60s where development plans were mainly based upon spatial - quantitative development models (Roscelli 1990). In these models, the 'drive for change' in the built environment was that of market forces (Fusco Girard, 1990). The results of these construction activities are still visible in the obsessive concrete housings and user unfriendly buildings populating our large cities.

At a different macro-level perspective, the numerical aspect becomes crucial in relation to the problem of the world population. The world population today is nearly 6 billion, with about 1 billion malnourished humans and 2 billion living in poverty. At the current rate of growth, the world population will be 40 billion by 2100. Therefore, the rate of growth is projected to be reduced either by planning or by nature (Pimentel, 1996). This suggests that, on one hand, decision makers use balanced population-resource equations, while on the other hand, policy makers support population control policies which respect basic individual rights but prevent tragedies for future generations.

Key issues: Population (human), Amount of various resources available, Number of species and their population levels

Examples of the Spatial aspect

Space, and particular open space, is certainly a limited resource on the face of the earth. Urban density, mobility and lifestyles are reflected in the demand for space and the flow of resources (Breheny, 1992). Although spatial issues are of particular concern in planning and design (and therefore usually taken into account by planners), nevertheless it becomes very problematic particularly in high density cities, often representing a major factor of success for a development scheme (Nikamp and Pepping, 1998). At the building scale, for example, large buildings can often block sunshine and this is especially important for adjacent homes and gardens. This is taken into consideration by the British Standard on daylight BS8206.Part 2 recommends that the interiors of homes should receive over a quarter of a year's sunshine hours (Birtles, 1997).

Sometimes the development takes place in a compromised and constrained spatial organisation, where several material and non material barriers to spatial development create difficulties in the interaction and communications between people. As already known, a "barrier" refers to all obstacles that cause discontinuities in spatial interaction (Lombardi and Nijkamp, 1999). Barriers keep people and goods apart, or prevent communication and knowledge transfer. The result is the cultural isolation and the social segmentation of regions with several negative consequences for the long term sustainability of the place (Giaoutzi and Nijkamp, 1993).

Key issues: Layout, Shape, Building footprint. Location, Proximity, Terrain shape - flat, mountainous, etc., Neighbourhood area, Urban area

Examples of the Kinematics aspect

Transport and mobility are generally recognised as crucial factors for the sustainability of an urban context (Banister,1992; Buchanan, 1962). In Surrey, for example, it has been estimated that 70% of the road system is required exclusively to provide access to sprawling suburban housing (Moffat, 1995). In other words, the housing location and design necessitates this amount of roadway and vehicular movement in order to ensure access to essential community services such as work, school, shopping, fire protection and health care. When nitrogen oxide and other air emissions for housing related to transportation are calculated, the quantities actually exceed the total generation for house construction and operation. Since Surrey is a community with a smog problem, it is clear that the layout of the houses is inappropriate, once consideration is given to these infrastructure costs.

There are a number of research projects funded by UK Research Councils within the Sustainable Cities programme (EPSRC, 1998) which deal with the problem of transport system within cities. The findings of these projects (Cooper, 1999) show that no mix of transport/land use modelling policies appears to have a very large effect on reducing CO_2 emissions. This is significant as reducing such emissions has been and remains a strong driver of policy formulation and implementation in the UK as it is internationally. Radical traffic management policies appear more effective than land use policies. Continued pursuit of planning objectives grounded in the application of simplistic interpretations of 'compaction' and 'densification' may well have unintended and contradictory consequences.

For example, Breheny and his team concluded that more compact planning will not necessarily have the effect of reducing traffic volumes. Where there is improvement, it will come from more concentrated employment which makes it easier to use public transport to get to work. Their work suggests a simpler, more reliable transport strategy would be to raise fuel prices. This would have the additional benefit of encouraging more compact settlement patterns (Cooper, 1999).

A second example is offered by May and his team at the University of Leeds (May et al., 1997). The May team developed a model with the aim of examining the relationship between transport and land-use, and how they were affected by choices between planning policies. Road pricing was found to have the greatest effect. It was the only policy option investigated that improved environmental quality in the city centre.

A third example is the modelling tool assembled by the team of Cooke at the University of Wales in Cardiff. The model aimed at predicting the economic and environmental effects of particular changes on the whole of S E Wales. It showed that switching freight from road to rail would have only slight effects on the environment and only a small economic benefit. Additional survey work by the researchers found that awareness of teleworking in the region was low. Modest reductions in air pollution have modest economic impact, but there is a price to pay in other pollutants: sulphur dioxide and nitrogen oxide would both rise. In addition, a carbon tax would destroy a substantial number of jobs – 2260, mostly from service sectors. It would also lead to a 0.2% fall in gross output in the region (Cooper, 1999).

Key issues: Infrastructures, Roads, Motorway, Railways, Cycling roads, Pedestrian streets, Car Parking, Transport and Viability, Wildlife movement, Mobility, Accessibility

Examples of the Physical aspect

The physical environment plays a relevant role in current planning initiatives, affecting the development of planning schemes. The constraints generated by the physical conditions of an area are particular evident in Southern European cities, as the *Habitat II Report* illustrates (UNCHS, 1996). These cities find it difficult to meet acceptable environmental standards for large sectors of their population. They are facing problems of air, water, and soil contamination as a result of poor environmental practices with regards to housing in the past. Problems of urban sustainability due to a lack of attention to the *carrying capacity* of the physical environment (Rees, 1992) can be found in several cities in Europe and elsewhere (CER, 1996).

At a macro-scale, there is a need to protect our physical non renewal resources, such as water. As the word's population grows, so does its water needs (Pimentel, 1996). It has been calculated that if the world's population increases by about 20 percent to nearly 7 billion, the demand for water will double. The ever increasing amount of water required to meet human needs is resulting in increased demand for both surface water and groundwater resources. For example, by the time the Colorado River enters Mexico, it has literally disappeared because of the excessive removal of its water by the states of California, Arizona, and Colorado. Because of its slow recharge rate, groundwater resources must be carefully managed to prevent overdraft. The latter is now a world-wide problem. For example, in Tamil Nadu, India, groundwater levels declined by 25 to 30 m during the 1970s because of pumping for irrigation. A similar decline in groundwater is recorded in China, in Beijing and Tianjin, and the United States. The above two examples are reported by Pimentel (1996).

Another major threat to maintaining ample fresh water resources is pollution caused by people and industries. Urbanisation often degrades water quality through point source discharges from industry, diffuse pollution from roads and built surfaces, and from combined sewer overflows (see also the biological aspect).

At the level of building or urban district, there is a vast range of environmental issues or indicators which potentially could be included in the analysis of a plan development. For example, the BREEAM scheme for environmental labelling of buildings (Prior et al., 1993) groups them under three main headings: global issues and use of resources; local issues; indoor issues. In the global issues, both the energy and ozone depletion play a relevant role. Birtles (1997) suggests that the best thing would be to design buildings so that they do not need air conditioning. Other important issues considered in the scheme are both durability and ease of maintenance of materials in order to minimise the consumption of limited resources and limit the damage caused by the exploitation and processing of these materials. Other studies (Wilson and Malin, 1995) recommend that the number one priority is designing buildings for low energy use since ongoing energy use is the single greatest environmental impact of a building.

Large buildings can also cause substantial effects on the local wind patterns around them and can overshadow neighbouring properties; both sunlight and light from the sky can be affected. Nijkamp and Pepping (1998), identify the climatic condition of the context as a major critical factor of success in many development schemes. This has costly technical and environmental effects, particularly in the case of renewable and energy saving initiatives for cities. For example, the lack of continuous sunshine and the presence of foggy weather make the introduction of PV systems unlikely. A second example is the smoke chimney of incinerators: humidity, exposition to wind and atmospheric pressure affect the structure and the construction of the plants (Capello et al., 1999).

Key issues: Energy for human activity, Energy for biotic activity, Physical environment, Structure of ground on which to build, Building materials, Components

Examples of the Biological aspect

Humans depend on the millions of other species that exist in agro-ecosystems and nature. Species diversity also serves as a vital reservoir of genetic material for the future development of agriculture and forestry. Humans have no technologies that can substitute these natural services provided by wild biota. Yet the world is losing about 150 species per day because of human activities of deforestation, pollution, applying pesticides, urbanisation, etc. (Pimentel, 1996). In order to provide food, shelter and protection for all these valuable species and to ensure the preservation of adequate biodiversity and a quality environment, Odum and Odum (1980) estimate that about one-third of the terrestrial ecosystem should be preserved as natural vegetation.

The current system of production, consumption and waste generation is a linear system and its is contrary to the way all natural planetary ecosystems operate (Bresso, 1982; Lee, 1995). There is no cycle, no reconnection of the used-up product with the natural environment. The by-products of the system also find no recycling back into the natural environment. Clearly, the environment cannot absorb or render harmless these waste materials. Even in a city like Seattle (USA), which has one of the most exhaustive city-wide recycling programmes in existence, the rather impressive amount of material recycled cannot keep up with the rate of solid waste accumulation (Sustainable Seattle, 1993).

The future of our terrestrial globe is a problem; global sustainability is exploited and this catastrophic vision is testified by the above figures. Yet, local sustainability is suffering from a lack of attention to the biosphere and bio-diversity of the sites and examples are all around. A primary example is the pollution caused by people and industries (water pollution, air pollution, soil pollution, etc.). In Britain, for instance, dry weather flows of some urban rivers may consist almost entirely of effluent due to base-flow depression. These changes to flow regimes, water quality and channel morphology represent a loss of natural capital and a decline in carrying capacity, often characterised by a loss of ecological and recreational value in the river corridor or wetland (Mitchell, 1999b).

The European Environment Agency's state of the environment report (Stanners and Bordeau, 1995), found that: Household water demand has increased in most European states by 2-3% pa since 1980, with a continued rising trend, posing a significant threat of low river flows; 60% of industrial and urban centres in Europe suffer from over abstraction of aquifers, resulting in supply restrictions, saltwater intrusion into coastal aquifers, and a loss of habitat, particularly wetlands, due to falling water tables. The principal water quality issue in Europe is eutrophication arising from intensive agriculture and urban waste water disposal; 2% of European land will be polluted by industry, mining and landfill by 2045, posing major toxicity threats to water quality, unless remedial action is taken.

Mitchell (1999b) argues that in the UK the interests of the water environment have been highly marginalised in the land-use planning system, the principal mechanism for controlling development. British planning was characterised by a narrow focus, concentrated on short term commercial interests, particularly housing development, and planners were unable to properly address the complex, but important relationships that exist between socio-economic and environmental systems. As a consequence, a variety of natural resources (e.g. water) planning / land-use conflicts have recently become apparent.

Key issues: Food Shelter, Housing, Air and air quality, Water and water quality, Soil quality, Green areas, Pollution, Biodiversity, Habitat diversity and quality, Hygiene, Resilience of ecosystem

Examples of the Sensitive aspect

People's perception and feelings towards the environment play an important role in decision making for sustainability, as many ecological problems are often exacerbated by our perception and understanding (Nath and Taly, 1996; Bocchi and Ceruti, 1994). Decision makers often underestimate the harmful effects of small concentrations of contaminants or subtle change in ecological parameters; once discovered, the problem is usually at a point where even immediate action cannot solve it. An example is the acidification of Big Moose Lake (USA). This built up over several decades, due to acid rain and runoff, but the pH dropped precipitously, killing most of the lake's flora and fauna. A similar situation occurred with the German forests. Acid built up in the soil over a period of many years, but, by the time the trees started dying, it was too late to clean the soil and save the trees (Hatcher, 1996).

On an other hand, the variety of views that people have towards their own built environment may often challenge the designer, contributing to an improvement in the built environment. For example, at the building – district level, Bonnes and Bonaiuto (1993) show that that most technical personnel involved in managing and implementing quality standards hold a view of quality that is at variance with that of the general public. In particular, inhabitants' perceptions tend to overlap with experts' evaluations when the environmental quality is low, i.e. the lower the environmental evaluation, the lower the residential satisfaction.

In the field of sustainable development, it has also been noted that there is tension between initiatives in this field and a citizen's perception of quality of life (BEQUEST, 1999). This tension is often increased by current professional and political approaches to urban sustainable development problems, for instance, i.e. the problem of reducing automobile use.

Key issues: Feelings engendered by living in an urban environment, Feeling of well-being, Comfort, Fitness Noise, Security, Safety

Examples of the analytical aspect

It is recognised that in design it is generally difficult to know what problems are relevant and what information will be useful until a solution is attempted. In the words of Lawson (1990), "one of the essential characteristics of design problems is that they are often not apparent but must be found". Designers usually build trade-offs intuitively.

Studies in which designers are put "under the microscope" (Lawson, 1990) have revealed that while scientists focus their attention on discovering the rule, architects are obsessed with achieving the desired results. Scientists adopt a general problem-focused strategy and architects a solution-focused strategy. In addition, architects are able to learn about the nature of the problem largely as a result of trying out solutions, whereas scientists set out specifically to study the problem.

Among technical actors, there is a difference between planners and architects. Although they share many creative concerns, the former place greater emphasis on functionality rather than originality of designs because, as Hubbard (1994) remarked, "they are restricted by 'socially-oriented' rules which make them act, at least to a limited extend, in the public's interest". Yet, the concept of the public's interest is largely criticized in contemporary planning literature, as already discussed in Chapter 2.0 (Healey, 1995; Lichfield et al., 1998).

The questions that arise are the following: *Can the above observations be taken as a cause of unsustainable construction? Is the lack of scientific analysis in design a reason for unsustainability in the built environment?*

The answer is certainly yes when the lack of quality in the analysis causes disorder, and constrains and provides impediments to the existing built environment or to its users. However, this is not always possible to verify. Rules of thumb in design and planning standards are still very much based upon the Rational School of thinking, which dates back to the beginning of this century, with Gropius and Le Corbousier as leaders. They have focused their attention on specific requirements, presuming to be able to establish criteria to obtain universally valid goals (Choay, 1965). In other words, these standards have been formulated in a culture conditioned by a deterministic approach to the problem of knowledge as exclusively quantitative tools for reading reality. Although a number of other contemporary authors, such as Geddes (1915) and Lynch (1960), have improved the current way of operating in planning, there is still a lack of an explicit and global system, which is able to interconnect all the relevant meanings and aspects of reality. Choay (1965) defines it as "a semiological system" taking Victor Hugo's well known metaphor of a town as a book (Hugo, 1832).

A final remark is related to the robustness and validity of the evidence base from which some research findings on sustainable cities are generated, as they may challenge the current orthodoxy within the UK and EU towards support for 'the compact city'. Cooper (1999) recognises that the nature of the evidence base on which present local-national-international policy-making rests may not be generalisable, even where this evidence-base is firmly grounded in one locality. Effective policy solutions may therefore have to be context-specific, rather than generic. In other words, "what 'works' in one country, town or city will not necessarily be effective in another".

Key issues: 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

Examples of the Historical aspect

To a large extent present values, attitudes, customs, lifestyles, etc. are deeply rooted in the past. Heritage is that part of culture which is transmitted from one generation to the next. To some extent a society's identity is based on its heritage. This is the reason for which many societies, in both the developed and developing world, attach great value to heritage. Clearly, the meaning of the term 'heritage' is quite broad and encompasses a great many attributes. Part of our heritage is visible, in the sense that it has a physical existence. It consists of various artefacts created by man in the past. Often this type of heritage is part of our everyday living environment (e.g. monuments, buildings, gardens, landscapes, etc.) and may also serve as shells for our activities. Yet, these artefacts go through a long-term life cycle in terms of physical condition and quality. Then society has to face the choice between development and conservation (Nikmap et al., 1999).

The management of cultural heritage has become especially important within the framework of urban planning (e.g., urban renewal, redevelopment, renovation, restructuring or urban areas). For instance, in various cities the threat of urban degradation requires a physical and economic restructuring which very often is to the detriment of the historico-cultural heritage of the city (Lichfield, 1996).

Over the years, substantial experience has been accumulated in conservation planning. In this context many - mainly descriptive - contributions have been made to the analysis of prevailing policies, strategies and measures in policy situations marked by conflict between development and conservation (Lichfield et al., 1998). Despite many debates in this field, so far no uniformly acceptable urban development planning paradigm has emerged. Although various successful interventions exist around the world, there is little opportunity to transfer this experience to other areas, as the socio-economic and cultural context is different from one place to another. As noted above in relation to the analytical, "each case is bounded by its particularities" (Nijkmap et al., 1999)

Key issues: Encouraging creativity in the community, Creativity when facing problems, Heritage, History of the community and area, Technology employed

Examples of the Communicative aspect

Planning and design are decision making processes which are developed not just in isolation but rather in a multiple social actors' context. In design, for example, Lawson (1990) shows that the problem usually originates not in a designer's mind (as, happens with the artist) but with a client. This requires a degree of transfer of power away from the centre. In turn, it demands for better communication between designer and client.

Recent findings in the field of sustainability and quality of life (BEQUEST, 1999) reveal there are very different levels of awareness of the nature and importance of consultation with stakeholders by professional actors from different cultural backgrounds. This is the case even when professionals recognise, either overtly or covertly, that citizen's behaviour and demand for goods and services is a major determining factor in the use of the built environment.

In the field of planning for sustainability, the emphasis is placed on an enlargement of public participation within the planning process, consultation and development. This necessitates a greatly enhanced level of ecological literacy in relation to the environment (Brennan, 1995). Often, and particularly in planning for social infrastructures, communication between planners and citizens or local communities is indirect and filtered by organisational policies (e.g. the Italian "Circoscrizioni di quartiere"). This often leads to misunderstanding and complications. The lack of participation may also lead to a lack of commitment towards the planned development (see credal aspect). For example, the above mentioned BEQUEST (1999) has pointed out that "although the vocabulary and the concept of indicators are recognised as a vehicle for stakeholder participation, there is little common understanding of intention and outcomes, so that citizens do not feel empowered to make a difference and thus are reluctant to consider behavioural changes".

In literature, planning is often regarded as a practical means of seeking to establish a common language for problem solving and a means of communicating shared or preferred values. It is in itself a language, a form of communication, and informative tool for the application of development policy strategies. Moreover, many experts in the field of planning and evaluation (such as, Healey, Kakee, Voogd, Nijkamp; etc.) have often highlighted the communicative meaning of planning evaluation (see Chapter 2.0). The message which is communicated through design produces values for the community. The drawing itself is a sign, a symbol, a language, a model which helps illustrate a project or development. And finally, the product of design can 'speak' to the user (Symes, 1997).

However, several studies of "urban language" have pointed out some problems and particularly the gaps between experts and citizens in urban development. Yet, Choay (1965) emphasises the need for a common "semiotic system" among actors emphasising that current technical (design) language (i.e. modern architecture) is a dead language because it does not share the same value system of people. Other more recent studies contribute to reveal additional limitations of current vocabulary in planning and design, particularly with regards to quality standards, emphasising the need for more communication and links between current technical language and the community value system (Hubbard, 1994; Bonnes and Bonaiuto, 1993).

Key issues: Ease of communication in the community, Quality of communication; Lingual networking, Symbol transferring, Information provision

Examples of the Social aspect

Decision making related to urban developments with environmental implications are often very problematic. Usually, the social conflicts that stem from choices which are not accepted by citizens may stop the development (Bobbio, 1996; Camagni, 1996). Many examples of this kind can be found in the field of a waste disposal, airports and all those social infrastructures and technological systems with relevant environmental impacts. Their location in the neighbourhoods a town is always problematic (Lichfield, 1988; Bresso et al., 1990; Lombardi and Zorzi, 1993).

Local policy makers often try to balance quality of life factors with economic opportunities for their residents, particularly in those areas which have experienced dramatic losses in jobs and income during the 1970s and 1980s. Empirical findings related to US metropolitan areas in the Northeast and upper Midwest has shown that this task is difficult and that both types of factors have important consequences for city residents (Clark, 1997). For example, rapid growth which ultimately leads to increases in local disamenities (e.g. congestion and air pollution), which further burdens the fiscal health of the community and may eventually stop the very growth which is the origin of the policy. In the valuations of noxious activities by city residents, it was typically white workers who required greater compensation for high as compared to low growth areas (Clark, 1997).

In the research project named "Modelling and Evaluating Sustainable Energy Strategies for Cities" (ESPRC, 1998), Godfrey Boyle and Helena Titheridge used a set of computer tools to model the consequences of different energy policy strategies in Leicester and Milton Keynes. A new method was used to assess the economic, environmental and social costs of five strategy scenarios which applied increasing effort to cutting energy use. In the 'Green scenario', residents were assumed to make minor changes to make their lifestyles less damaging to the environment. Both economic and environmental forecasts were favourable for the 'Green scenario' in Leicester (Cooper, 1999).

In the field of building design and construction, Russell and Grammenos (1995) reported that privacy and ownership are of prime importance and a prime source of satisfaction with housing; for example, in general, owner-occupied housing units are better maintained and have lower utility bills. Ownership has been shown to promote initiatives and creativity with respects to space and use; it permits and invites personalisation and self expression, both of which satisfy the need for self esteem and good public persona.

Key issues: Social relationships and interaction, Recreational places, Social climate, Cohesion, Plurality, Competitiveness, collaboration

Examples of the Economic aspect

It is known that our living environment depends, at a fundamental level, on social stratification and economic growth. The implications of this dependency has been recognised over recent decades. The challenge for business and society is to employ ecological concepts in a practical manner. This means the promotion of a long-term vision as part of corporate planning rather than a short term expedient. An example in this field is reported by Moffat (1995). It refers to the largest commercial development in Canada in the community of Surrey B.C. where, for a small savings in the costs of construction, the designers have greatly restricted the opportunity for Surrey's new town centre to convert to a 'district heat and power' system, as the majority of the new buildings are being designed with baseboard electric resistance heating systems and rooftop chillers. Any consideration of the future costs would certainly have meant different heating systems in the area; yet no such accounting has occurred. This short-term view is clearly an issue of low quality of planning and design which refers to the previously illustrated analytical aspect.

The need to take a long-term view of economic appraisals and business calculations (and in general, of decision making for planning) is often emphasised in studies related to "environmental economics" (see Section 3.1). This requirement, however, encounters the problem of the uncertainty towards the future (unpredictability) and the question of 'internalising' the environmental costs actually paid by the community (see Section 2.2 and, among others , Bihop and Heberlain, 1979; Turner, 1988; Pearce et al., 1989; Pearce and Turner, 1990; Costanza, 1991; Markandya and Richardson, 1992; Costanza et al., 1997).

The 'polluter pays' principle recognised by the 1992 Rio Declaration (UNCED, 1992) suggests that the polluter should bear the costs of preventing and controlling pollution, so that these are fully reflected in the costs of goods and services provided to the community. Problems would inevitably occur if an industry or a plant goes out of business through the rigorous enforcement of this principle. A community might decide that, for example, the employment benefits of keeping a factory open outweigh the health and other environmental costs of pollution. Carew-Reig and other authors of an "Handbook for National Planning" (Hens, 1996), report that, usually, environmental agencies in developed countries have taken a flexible approach with the continuation of government subsidies in special cases, and negotiations of individual programmes have been undertaken to allow certain polluters to meet new environmental standards over an extended period of time.

Clark (1997) defines economic development as "a double edged sword". "It carries with it economic relief for those at the bottom of the income distribution, and it can also expose those same individuals to higher levels of congestion, lower air quality, and a host of other risks associated with increased industrialisation" (p. 396).

A good example is related to the labour market. In order to achieve the lowest production costs, business traditionally seeks the lowest labour costs it can find at every level. Social stratification thus occurs, because there must be enough cheap labour to keep costs down and profits up (Hatcher, 1996).

Hatcher (1996) reports an example of the Green Disks company (America), illustrating a business niche approach implementing ecological opportunities. Green Disks is a company which recycles software packages and used floppy disks and is currently working on a number of possibilities, as recycling methods have to address different levels of returned floppy disk quality. The company is always looking for new ways to improve its own efficiency as well as that of its partners. In one case they found a manufacturer of floppy disks with excess capacity at its manufacturing plant. Green Disks rented the plant to recycle floppy disk casings into new casings. The existing plant thus became more efficient; the owners increased their financial strength, while Green Disks did not have to invest in a new plant (Hatcher, 1996).

Key issues: 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

Examples of the Aesthetic aspect

The aesthetic aspect plays an important role in determining the harmony of a settlement or the visual appeal of a building. The latter plays a relevant role in decision making particularly in the field of architectural design (Lynch, 1960).

It is recognised that aesthetic issues are very fuzzy and subjective. For example, Voogd (1995) defines them as " characteristics of objects or situations that delight the senses and/or exalt the mind ". Zeleny (1994) thinks that 'beauty' is more stable than 'quality' because it is not connected to use. In other words, the concept of quality may change in accordance to people' habits or needs or with the use that is made of a thing while beauty does not. However, it could be argued that perceptions of 'beauty' can change with fashion.

Hubbard (1994) notes that an appreciation gap exists between planners and the public in much the same way as has been demonstrated with respects to architect and non-architect groups. Whilst the public tends to appreciate continuity in the townscape, planners, like architects, tend to appreciate more fashionable and 'up-to-date' architectural styles. Given the traditional affiliation of the planning system with 'public interest' objectives, these results lend support to the view that there should be greater integration of 'public interest' within the planning process, particularly with respects to the aesthetic control, where current procedures for participation and consultation are clearly inadequate.

Key issues: Beauty, Visual amenity and landscape, Architecture and design, Architectonic Style, Decoration, Social harmony, Ecological harmony and balance

Examples of the Juridical aspect

Individuals represent collective preference which may be translated into norms and institutions, such as what happened in the USA in the market of pollution rights. The task of these institutions is to protect the rights of future generations. Legal institutions traditionally protect heritage values as merit goods, i.e. goods whose value do not derive from consumer preferences. This is the common juridical reason underlying Contingent Valuation analysis (Cummings et al., 1986).

A good example is illustrated by Hatcher (1996). It refers to a manufacturing plant located in a north-west US shipping port that own the rights to a large amount of water from wells on its property. Five separate entities must negotiate an agreement in order to transfer the water, each with its own proper agenda in terms of price, quality control, public safety, environmental consideration, legal directives, liability concerns, and future operations. Conflicting values and perceptions however make negotiations difficult. By installing a circulating pipeline, the project introduces cyclical reuse of water and recovery of waste heat in a way that ties a variety of industrial users together. The result would be that new business could develop with no increase in water use or waste water discharge. Yet the project has at best a 50 percent chance of going ahead because antiquated laws and restrictive corporate directives make such an innovative solution extremely difficult. Here, the presence of antiquated regulations and restrictive corporate directives is regarded as a barrier to innovation and often to the forging of a path to sustainability.

Key issues: Laws and law-making, esp. with regards to property, Ownership, Regulation and other policy instruments, Contracts, esp. for buildings, Rights, Responsibilities, Inequities, Property-market interests

Examples of the Ethical aspect

The Burtdland Report (WCED, 1989) firstly, and the Rio Declaration (UNCED, 1992) secondly, have suggested that the following two major principles dealing with ethics rest at the heart of sustainable development: the principle of inter-generational equity, which says that the needs of the present are met "without compromising the ability of future generations to meet their own needs" (this is linked to the physical and biological aspects); the principle of intra-generational equity, which requires that people within the present generation have the right to benefit equally from the exploitation of resources and that they have an equal right to a clean and healthy environment (this is linked to the economic and juridical aspects). However, Schultz (1996) argues that, at present, the difference between rich and poor is tending to grow in industrialised counties. He also recognises that neither scientific research nor ethics can induce a turn-around without an appropriate "glue", a subconscious or emotional "knowledge" of being part of a system, an "integrative power" which is variously described, e.g. as truth, respect, affection, love, legitimacy, loyalty.

In planning, there are visible examples of neighbourliness, for example in the care paid by residents to their gardens, to keep public streets, squares and parks clean, and so forth. Yet, there are many examples of NIMBY (not in my back yard) particularly in planning for infrastructures, such as an airport or a waste disposal plant (see also the Social modality).

In the field of building design and construction, Russell and Grammeneos (1995) suggest the practice of sharing as 'the essential lubricant of a community' (p.152). For example, one major opportunity for sharing, that has enormous potential for personal saving, greater flexibility and environmental benefits, is the idea of shared car ownership. The two authors recognise that buildings facilitate sharing, whilst respecting the need for ones own privacy can strike a balance of fostering vested interest in both individually and community owned property. The atrium building has the essential ingredient, especially in a harsh climate, of shared space that encourages the essential social interaction required to foster a sharing ethic.

Key issues: General demeanour of people towards each other; Goodwill, Neighbourliness, Solidarity, Sharing, Equity

Examples of the Credal aspect

According to Schultz (1996), any definition of sustainability has to be culturally acceptable in order for it to be effective. This brings in the issue of learning (analytical), on one hand, and of interest or commitment, on the other.

Today, it is generally recognised that decision making for sustainability requires participation, skilled argument and communication (Healey, 1992, Fisher and Forester 1993). A major example is the process of Local Agenda 21, derived from the 1992 Earth Summit nomination of the local authorities as major agencies for promoting sustainable development.

Although some local Agenda 21 initiatives have made striking progress and the agenda's influence on contemporary public policy debates has been considerable (Selman, 1996), a number of recent studies offer a different view. For example, the Gibbs' survey of the integration of economic development and the environment in local UK authorities (Manchester Metropolitan University) revealed that most local authorities fail to involve the business community in their sustainable development initiatives. This was flagged by the researchers as a major shortcoming, preventing the establishment of private-public partnerships (Cooper, 1999).

Within local authorities, however, it appears that economic development officers and planners often attach more weight to economic objectives, and especially job creation, than sustainability or the environment. They also typically see 'the environment' in very narrow terms – as a local resource that can be improved by small scale changes (Cooper, 1999; Lombardi, 1999b).

A cross-cultural comparison of the Agenda 21 strategy, as well as its understanding by various members of the community, in typical post-industrial environments was undertaken in the UK and Italy in the cities of Salford and Turin (University of Salford, 1997). This was recently investigated by Curwell and

Lombardi (1999), and the study suggested that, despite efforts in both cities to engage in Agenda 21, there was still some way to go to achieve the broad understanding, interest and commitment necessary across all members of society to ensure real progress towards sustainable development in each city. In particular, the Turin case study shows there is a clear gap of commitment between the economic and the social actors in terms of the public participation issues of sustainability (*Drive's for change*). This has contributed to the refusal of the development of a large commercial building in the area and may now prevent the achievement of a common understanding of sustainability in urban regeneration within the city. The Salford experience appears to show that consultation is in itself not sufficient to develop common understanding and to produce real changes in attitudes. Sustainable urban regeneration needs social consensus and negotiation between parties (see also Section 6.1.2).

A final combined finding derived from the recent survey produced by Cooper (1999) is that, in the UK at least, it cannot simply be assumed that local authorities, as currently structured, empowered and resourced, are committed to, or capable of, delivering policy objectives on sustainable urban development – whether these are formulated locally, devised by national governments, or drawn up internationally.

Key words: Loyalty to the community, General level of morale, Shared vision of what we are, Aspirations, Shared vision of the way to go

5.3 Summary and Conclusions

This chapter has identified some problems that decision makers encounter in the understanding and planning for sustainability in the built environment. Case studies and examples related to sustainability in urban planning and design have been analysed and structured in accordance with the Dooyeweerdian modalities.

The role that planning and design activities play in the achievement of sustainability in urban environments has been discussed and the responsibility of planners and all decision makers, including all stakeholders and concerned citizens, has been highlighted.

The Cosmonomic Idea has been adopted here to understand the above issues and tackle the complexity of the problems discussed in this chapter. It has been useful not only as it has provided structure and continuity to our analysis, helping an identification of different levels of information in the analysis, but also as it has recognised a multi-person approach to the problem, since it suggests an integration between decision makers and the context. This reinforces the need of establishing a common language between actors and a shared framework of understanding and evaluating sustainability in which the Dooyeweerd's approach assists.

The next chapter deals with this problem, developing a complete framework for evaluation in the field of planning and design.

5.4 Main References

Ackoff R.L., 1981, *Creating the corporate future*, Wiley, New York

Allwinkle S.J. and Speed C.E., 1997, Sustainability of the Built Environment - Tourism Impacts, in Brandon et al. (eds.), *Evaluation of the Built Environment for Sustainability*, E&FN SPON, Chapman & Hall. London, pp.263-275

Ashworth G.J. and Voogd H., 1988, Marketing the city: concepts, processes and Dutch applications, in *Town Planning Review*, 59, pp.65-79

Banister D., 1992, Energy Use, Transport and Settlement Patterns, in Breheny (ed.), *European Research in Social Science 2. Sustainable Development and Urban Form*, Pion Limited, London, pp.39-57

BEQUEST - Building Environment Quality Evaluation for Sustainability through Time Network, 1999, *Report 1998-99*, EC Environment and Climate Research Programme, Theme 4: Human Dimensions & Environmental Change, Directorate D - RTD Actions: Environment - E.U. DG12

Betty M., 1995, Planning support systems and the new logic of computation, *Regional development dialogue*, vol. 16, n.1, pp.1-17

Birtles T., 1997, Environmental impact evaluation of buildings and cities for sustainability, in Brandon et al. (eds.), 1997, *Evaluation in the Built Environment for Sustainability*, E&FN SPON, Chapman & Hall, London, pp. 211-223

Bishop R.C. and Heberlein T.A., 1979, Measuring values of extramarket goods: are indirect measures biased?, in *American Journal of Agricoltural Economics*, December, pp.926-932

Bobbio L., 1996, *La democrazia non abita a Gordio*, Angeli, Milan

Bocchi M. e Ceruti M. (eds.), 1994, *La sfida della complessita*, Feltrinelli, Milano

Bonnes M. and Bonaiuto M., 1993, Users' perceptions and experts' evaluations of the quality of urban environment: some comparative results from the MAB-ROME project, in Bonnes M. (ed.), *Perception and evaluation of urban environment quality*, Proceeding of the Int. Symposium, Edigraf, Rome, 28th – 30th November, pp.179-193

Brandon P.S. and Powell J.A. (eds.), 1984, *Quality and profit in building design*, F&FN SPON, London

Brandon P.S., 1992, *Quantity surveying techniques*, Blackwell Science, Oxford

Brandon P.S., 1998, Sustainability in management and organisation: the key issues?, in Brandon (ed.), Managing Sustainability: Endurance through change, CIB World Conference on *Construction and the Environment*, Symposium D, Gavle, Sweden, 7th – 12th June, pp.1739-1750

Breheny M.J. (ed.), 1992, *Sustainable development and urban form*, Pion Limited, London

Brennan, A., 1995, Ethics, ecology and economics, *Biodiversity and Conservation*, vol. 4, pp.798-811

Bresso M., 1982, *Pensiero economico e ambiente*, Loescher, Turin

Bresso M., Russo R. and Zeppetella A., 1990, *Analisi dei progetti e valutazione di impatto ambientale*, Angeli, Milan

Bruinsma F., Nijkamp P., Vreeker R., 1999, Experts at Arm's Length of Public Policy-Makers. A Case Study on Utrecht (forthcoming)

Buchanan C., 1962, *Traffic in towns*, HMSO, London

Camagni R. (ed.), 1996, *Economia e pianificazione della città sostenibile*, Il Mulino, Milan

Capello R., Nijkamp P. and Pepping G., 1999, *Sustainable cities and energy policies*, Springer-Verlag, Berlin

Capra F., 1996, *The web of life*, Doubleday-Anchor, New York

CER-Ministero dei lavori pubblici, 1996, *Rapporto sulle condizioni abitative in Italia*, United Nations Conference on Human Settlement (Habitat II), Istanbul, 3rd – 14th June

Choay F., 1965, *L'Urbanisme. Utopies et rèalitiès*, Editions du Seuil, Paris

Clark D., 1997, Hedonic values of noxious activity: a comparison of US worker responses by race and ethnicity, in Brandon et al. (eds.), 1997, *Evaluation in the Built Environment for Sustainability*, E&FN SPON, Chapman & Hall, London, pp.382-398

Coccossis H. and Nijkamp P., 1995, *Planning for our cultural heritage,* Avebury, Hants

Cooper I., 1999, Learning lessons from the UK Sustainable Cities research programme, in Lombardi (ed.), Analisi e valutazione di programmi e progetti di sostenibilità urbana. Alcune esperienze, *Urbanistica* n.112 (in press)

Costanza R. (ed.), 1991, *Ecological Economics,* Columbia University Press, New York

Costanza R., d'Arge R., de Groot R., Farber S., Grasso M., Hannon B., Limburg K., Naeem S., O'Neill R.V., Paruelo J., Raskin R.G., Sutton P. and van den Bely M., 1997, The value of the world's ecosystem services and natural capital, in *Nature*, n.387, vol. 15, pp.253-260

Cummings R.G., Brookshire D.S., Schulze W.D., 1986, *Valuing environmental goods: an assessment of the contingent valuation method,* Rowman and Allanheld, Totowa, New Jersey

Curwell S. and Lombardi P.L., 1999, Riqualificazione urbana sostenibile, in Lombardi (ed.), Analisi e valutazione di programmi e progetti di sostenibilità urbana. Alcune esperienze, *Urbanistica* n.112 (in press)

Dooyeweerd H., 1958, *A new critique of theoretical thought*, 4 vols, Presbyterian and Reformed Publisher Company, Philadelphia, Pennsylvania

Engineering and Physical Science Research Council, Natural Environment Research Council, and Economic and Social Research Council, 1998, *Urban sustainability initiatives of the Research Councils*, Joint EPSRC/NERC/ESRC/LINK pamphlet, Swindon, England

Ferry D.J. and Brandon P.S., 1991, *Cost Planning of Buildings*, VI edition, Blackwell Science Ltd, Oxford

Fisher F. and Forester J. (eds.), 1993, *The argumentative turn in policy analysis and planning,* Duke University press, Durham

Fusco Girard L. (ed.), 1990, *Conservazione e sviluppo: la valutazione nella pianificazione fisica,* Angeli, Milan

Geddes P., 1915, *Cities in Evolution*, Williams and Norgate, London

Giaoutzi M. and Nijkamp P., 1993, *Decision support model for regional sustainable development*, Avebury, Aldershot

Griffioen S. and Balk M. B. (eds.), 1995, *Christian philosophy at the close of the twentieth century*, Uitgeverij, Kampen

Hatcher L.R., 1996, Business and Sustainability, in Nath et al. (eds.), *Sustainable Development*, VUBpress, Brussels, p.207-232

Healey P., 1992, A planner's day: knowledge and action and iterative practice, *Journal of Planning Association*, 58, n. 1, pp.9-20

Healey P., 1995, The communicative turn in planning theory and its implications for spatial strategy formation, *Environmental and Planning B: Planning & Design*, v.23, n.2, pp.217-234

Hens L., 1996, The Rio Conference and Thereafter, in Nath, et al., (eds.) *Sustainable Development*, VUB press, Brussels, pp.81-110

Hubbard P.J., 1994, Diverging evaluations of the built environment: planners versus public, in Neavy et al. (eds.), *The Urban Experience*, Proceedings of the 13th Conference of the International Association for People-Environment Studies, Manchester, 13th – 15th July, E&F SPON, London, pp.125-133

Hugo V., 1832, *Notre-Dame de Paris*, II ed., Gosselin, Paris

Kalsbeek L., 1975, *Contours of a Christian Philsophy*, Wedge Publishing Company, Toronto

Kant I., 1988, *Critique of pure reason*, J.M.Dent & Sons Ldt., London

Klosterman R.E., 1983, Fact and value in planning, *Journal of the American Institute of Planners*, vol. 49, pp. 216-225.

Lawson B., 1990, *How designers think. The design process demystified*, Butterworth-Heinemann ltd., Cambridge

Lawson B., 1993, Parallel lines of thought, *Languages of design* vol.1, pp. 321-331

Lee J.A., 1985, *The environment, public health and human ecology: Consideration for economic development*, Johns Hopkins University Press, Baltimore

Lichfield N., 1988, *Economics in Urban Conservation*, Cambridge Univ. Press., Cambridge

Lichfield N., 1996, *Community impact Evaluation*, UCL Press, London

Lichfield N., Barbanente A., Borri D., Kakee A. and Prat A. (eds.), 1998, *Evaluation in Planning. Facing the challange of complexity*, Kluwer Acc. Press, Dordrecht

Lichfield N., Barbanente A., Borri D., Kakee A. and Prat A. (eds.), 1998, *Evaluation in Planning. Facing the challange of complexity*, Kluwer Acc. Press, Dordrecht

Lichfield N., Kettle P. and Whitbread M., 1975, *Evaluation in the planning process*, Pergamon Press Ltd, Oxford

Lombardi P.L., 1999b, Agenda 21 e monitoraggio dello sviluppo urbano sostenibile, *Urbanistica* n.112, (in press)

Lombardi P.L. and Basden A., 1997, Environmental Sustainability and Information Systems, *Systems Practice*, vol. 10, n. 4, pp.473-489

Lombardi P.L. and Nijkamp P., 1999, A new geography of hope and despair for the periphery. An illustration of the Border Temple Model, in Proceedings of the *Geo-Symposium of the Aegean: Geographies on/of/along the EU border*, Mytilini, 23rd – 27th June (in press)

Lombardi P.L. and Zorzi F., 1993, Comparison between aggregated techniques for assessing the effects of decision-making processes in the environmental field, in Manso et al. (eds.), *Economic Evaluation and the Built Environment,* vol.4, Laboratorio Nacional de Engenheria Civil, Lisbon, pp.126-138

Lynch K., 1960, *The image of the City*, The Technology Press & Harvard University Press, Cambridge

MacLoughlin J.B., 1969, *Urban And Regional Planning: A Systems Approach*, Faber and Faber, London

Markandya A. and Richardson J. (eds.), 1992, *Environmental Economics,* Earthscan, London

May A.D., Mitchell G. and Kupiszewska D., 1997, The Development of the Leeds Quantifiable City Model, in Brandon et al. (eds), *Evaluation of Sustainability in the Built Environment*, E&FN SPON, Chapman & Hall, London, pp.39-52

Merloni Law n.109, 1994, *Gazzetta Ufficiale Repubblica Italiana*, Rome

Merret S., 1995, Planning in the age of sustainability. *Scandinavia Housing & Planning Research*, vol.12, pp.5-16

Mitchell G., 1996, Problems and fundamentals of Sustainable Development Indicators, *Sustainable Development*, vol.4, n.1, pp. 1-11

Mitchell G., 1999b, Planning, Environmental Assessment and Catchment Management: UK Experiences on the Sustainable Development of Land and Water, in Lombardi (ed.), Analisi e valutazione di progetti e programmi di sostenibilità urbana, *Urbanistica*, n.112 (in press)

Moffat S., 1995, The missing ingredients: a look at how to improve methods for linking and prioritizing environmental criteria for assessing buildings, in Cole et al. (eds.), *Linking & Prioritizing Environmental Criteria*, Toronto, Canada, 15th – 16th November, pp.115-120

Nath B., Heans, L. and Devuyst D. (eds.) 1996, *Sustainable Development*, VUB press, Brussels

Nath B. and Taly I., 1996, Man, science, technology and sustainable development, in Nath, et al., (eds.) *Sustainable Development*, VUB press, Brussels, pp.17-56

Nijkamp P. and Pepping G., 1998, A meta-analytic evaluation of sustainable city initiatives, *Urban Studies*, vol. 35, pp.1481-1500

Nijkamp P., Bal F. and Medda F., 1999, A survey of methods for sustainable city planning And cultural heritage management (forthcoming).

Odum M.T. and Odum E.C., 1980, *Energy Basis for Man on Nature*, McGraw Hill Inc., New York

Pearce D. and Turner R.K., 1990, *Economic of natural resources and the environment,* Harvester Wheatsheaf, Hamel Hempstead

Pearce D., Markandya A. and Barbier E.B., 1989, *Blueprint for a green economy*, Earthscan Publications Ltd, London

Pimentel D., 1996, Human Demography and the Environmental Resources, in Nath et al. (eds.), *Sustainable development,* VUBpress, Brussels, p.111.136

Rees W.E., 1992, Ecological footprints and appropriated carrying capacity: what urban economics leaves out, *Environment and Urbanisation*, vol. 4, n.2, pp.121-130

RIBA, 1965, *Architectural Practice and Management Handbook,* RIBA Publications, London

Roscelli R.(ed.), 1990, *Misurare nell'incertezza,* Celid, Turin

Russell P. and Grammenos F., 1995, A Building for all reasons. A vision of a balanced Mixed use Building, in Cole et al. (eds.), *Linking & prioritising environmental criteria,* Toronto, Canada, 15th – 16th November, pp.145-154

Saaty T.L., 1980, *The Analytic Hierarchy Process*, McGraw Hill, New York

Schultz J., 1996, What has Sustainability to do with Ethics?, in Nath, et al., (eds.) *Sustainable Development*, VUB press, Brussels, pp.137-157

Selman P., 1996, *Local Sustainability*, Paul Chapman, London

Simin D., 1999, Sustainability: A new vision for the British planning system, in Lombardi (ed.), Analisi e valutazione di programmi e progetti di sostenibilità urbana. Alcune esperienze, *Urbanistica,* n.112 (in press)

Simon H. A, 1947, *Administrative Behaviour*, The Macmillan Co, New York.

Simon H., 1985, *Casualità, razionalità, organizzazione*, Il Mulino, Bologna

Stanner D. and Bourdeau P. (eds), 1995, *Europe's Environmnt: The Dobris Assessment*, European Environment Agency, Copenhagen, Chapter 10, The urban environment, pp.261-296

Sustainable Seattle, 1993, *1993 Indicators of a Sustainable Community*, Sustainable Seattle Network and Civic Forum, Washington

Symes M., 1997, Space management in European compact city, in Brandon et al. (eds.), Evaluation of the Built Environment for Sustainability, E&FN SPON, Chapman & Hall, pp.363-370

Turner R.K. (ed.), 1988, *Sustainable Environmental management: Principles and Practice,* London, Belhaven Press, Boulder, Westview;

United Nations Conference on Environment and Development, UNCED, 1992, *Earth Summit '92 (Agenda 21),* Regency Press, London

United Nations Conference on Human Settlement, UNCHS, 1996, *The indicators programme: monitoring human settlements for the global plan of action,* paper - United Nations Conference on Human Settlement (Habitat II), Istanbul, June

Voogd H., 1995, Environmental management of social dilemmas, in *European Spatial Research and Policy,* vol. 2, pp.5-16

WCED - World Commission on Environment and Development, 1987, *Our Common Future (The Brundtland Report)*, Oxford University Press, Oxford

Wilson A. and Malin N., 1995, Establishing Priorities with Green Building, in Cole et al. (eds.), *Linking & Prioritizing Environmental Criteria*, Toronto, Canada, 15th – 16th November, pp.107-114

Zeleny M., 1994, In Search of Cognitive Equilibrium: Beauty, Quality and Harmony, *Journal of Multi-Criteria Decision Analysis*, vol. 3, pp.3-13

Chapter 6.0 – Development of an Analytical Framework for the Evaluation of Sustainability

Faire et non pas subir,
tel est le fond de l'agréable
(Alan, 1924)

Note: The concepts of this chapter are summarised in **Appendix C**. It is recommended that the reader examine this appendix before reading the discussion which follows.

The last chapter emphasised the role of planning and design in the achievement of sustainable urban development. It also pointed out a number of problems in decision making for sustainability which correlate with the fifteen modal aspects. Among others, it emphasised the question of language and of a shared vocabulary. This is crucial to develop a common understanding of the sustainable built environment which is required because better communication among stakeholders will help participation.

This chapter tackles these issues by developing a scientific framework which aims at guiding official public developers and decision makers through the process of understanding and evaluating sustainability in planning. The framework also acts as an educational tool, since it clearly includes information on sustainability issues.

The theory of the Cosmonomic Idea supports the development of the scientific procedure that underlies the framework. The framework also relies on the analysis and typological system of sustainability aspects illustrated in Chapter 4.0. Fifteen meaning-nuclei are in fact suggested to provide decision makers with a qualification system to classify relevant sustainability issues in the urban planning situation, on the basis of a *top-down* approach (hence the term *analytical* framework).

A number of scientific criteria and specifications, followed by questions on examining sustainability, guides the user in the handling of the evaluation of a planning proposal. This evaluation involves all the following: a technical and ecologically oriented assessment of the construction under development (a "green design") that illustrates the environmental compatibility of this development within the existing context; an assessment of the historical and cultural significance of the planning asset and of its social desirability; an analysis of the economic and juridical feasibility; a check of the visual appeal of this new (re)development and of its flexibility or adaptability which may allow the meeting of some future user' needs and an understanding of what interest or concern there is in the Local Agenda of the city.

A number of current assessment methods and tools are specified for each sustainability aspect. This results in a structured multi-layers *tool-kit* which makes use of current knowledge for pinpointing tools and problem solving methods for each situation related to sustainability in the built environment.

Although the framework under development is flexible and usable in different evaluation contexts, monitoring and *ex-post* planning situations, it is worth stating again that it is specifically developed for *ex-ante* evaluation (see Section 1.3). This will also be reflected in the selection of the assessment methods and procedures that are included in it (see Section 6.2).

Specific attention is paid to a definition of each modal aspect with headings which may be more familiar to a larger number of stakeholders, and more specifically, to technical decision makers. A literature review on sustainable development and its understanding by various members of the community is at the basis of the development of this new vocabulary. This also takes into account the results of an assessment on the comprehension of the modalities by the non-expert (but concerned) users, i.e. under-graduate and post-graduated students in architectural, planning and environmental engineering fields, that was undertaken at different stages of development of this study. An illustration of this assessment is provided in the next chapter.

This chapter is structured as follows. Section 6.1 reviews the sustainability issues included in the check-list in the context of planning and decision making. This leads to an identification of a number of sustainability criteria for evaluation in planning. A more user-friendly main heading for each modality is also provided, taking into account the results of both a literature review and an assessment of the comprehension of the aspects (see Chapter 7.0). In Section 6.2, each sustainability criterion is examined on the basis of the PICABUE approach (Mitchell et al., 1995). This helps to develop questions to examine sustainability and assist the selection of suitable assessment tools for the problem within each aspect. Section 6.3 deals with this last problem, by considering the main benefits and limitations of each method, as identified in Chapter 2.0. Finally, Section 6.4 provides a summary and some conclusions.

6.1 Establishing Common Understanding and Language

Under what criteria should a planning scenario, say a (re)development, be evaluated to guarantee the sustainability of the future asset?

This is a major question in the establishment of an analytical framework. The aim of this section is to address this question, reconsidering various issues explored in the course of this dissertation. At the root of this revision rests, on one hand, the application of the methodology of Dooyeweerd to the built environment (see Chapter 4.0), and on the other hand, the illustration of the planning case study review (see Chapter 5.0). Both analyses have led to an identification of various problematic issues and critical factors in decision making for sustainability within each modal aspect.

Although clearly not exhaustive, Table 4.1 has illustrated several relevant issues related to the built environment, providing an indication of the complexity and richness of the urban system. A mixed variety of elements is present in this table: animated and non animated, material and non material, artefacts and non-renewable resources; many urban functions are also represented as institutions (e.g. banks, schools, etc). The table classifies them according to the *meaning kernel* of each aspect and, for those issues which display a multi–aspect nature, the classification relies on current knowledge and literature in this subject area (e.g. efficiency is qualified in the economic modality). This check-list has been established as a platform for the development of an analytical multidisciplinary framework for the evaluation of sustainability (see also Appendix C).

The subsequent illustration of different case studies and planning examples related to sustainability (see Section 5.2) has made it clear that the framework should be flexible and able to take various situations and planning problems into account. It should include criteria which are relevant to decision making and, at the same time, easily checked by users, providing information on the sustainability of an urban development.

This framework should be able to lead to collaboration among stakeholders, facilitating 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 at this decision-making process (stakeholders and concerned citizens). In other words, it must possess a user-friendly terminology.

Section 6.1.1 provides an overview of the kind of stakeholders that a planning process usually deals with and that the framework should be able to communicate with. As already stated, the framework should specifically accomplish the task of facilitating participation and collaboration among stakeholders and formal decision makers (planners and technical actors) whose role of "opening the process" was analysed in the previous chapter (see Section 5.1). It should also include aspects which are relevant to stakeholders. As Moffat (1995) notes, "relevance is largely determined by the amount of influence and control decision makers can bring to any problem". Results from a number of recent studies on urban actors and their view of a sustainable built environment are therefore reviewed.

While taking the stakeholders' perspective into account, Section 6.1.2 re-examines the fifteen modal aspects in the light of the decision making problems encountered in the planning examples illustrated in Chapter 5.0. This review leads to the establishment of a final set of sustainability criteria for planning evaluation. These criteria are included in the analytical framework which is going to be developed. They also correspond to a new definition of the modal aspects that is more familiar to stakeholders.

6.1.1 Main Stakeholders and their View of Sustainability

Several recent studies on sustainability in planning and construction activities have revealed that stakeholders usually do not speak the same language and experts do not use the same vocabulary in their analyses (Cole. et al., 1995; Palmer et al., 1997; Brandon et al., 1997; Kilbert, 1997; Curwell and Cooper, 1998; Curwell and Lombardi, 1999, BEQUEST, 1999). On the contrary, they often have a different view of sustainability and quality issues.

The implications of this issue is particular relevant in a study of this kind as it may represent a barrier to the development of a shared common evaluation among the various groups of societal actors. As Lombardi and Basden (1997) have pointed out, "if unity in diversity is important for urban sustainability, the different experts, stakeholders and all city or building customers need to be able to communicate at a sufficiently deep level so that the understanding of sustainability can be clear and agreed on". Therefore, a common language to understand sustainability should be established between stakeholders and urban decision makers in order to enable participation in decision making for sustainability.

In the following, a short overview is provided of *who* the stakeholders are and *what* views are.

Who are the Stakeholders

In Western European countries, urban and land use developments cannot take place outside the boundaries of governmental planning regulations, such as national planning regulations, policies towards building permits for residential and industrial land use and policies regarding the preservation and development of natural areas. There are, usually, also a number of physical constraints to development, such as characteristics of the area (e.g. soil type, groundwater table) and existing infrastructure and land use types (e.g. accessibility to facilities and infrastructures and amount of similar land use in the neighborhood). Therefore, public intervention and planning presupposes knowledge on key actors and key factors.

Bruinsma, Nijkamp and Vreeker (1999) specify a multiplicity of drivers and stakeholders involved in modern land use changes. First of all, there is the *industrial* sector which seeks to expand its activities through a further extension of industrial land use (e.g., industrial suburbs on the edge of cities). There is also the *household* sector which - as a result of demographic growth, accompanied by a decline in family density - needs more residential areas and generates an urbanisation of suburbs and even villages. Next, an important actor of change is the *agricultural* sector, which is subject to increasingly intense competition and multinational policy regimes (e.g. the Common Agricultural Policy in Europe), the result of which is thus too difficult to predict. And finally, the *transportation* sector (including freight transport and leisure mobility) is increasingly an important driver of land use changes with far-reaching implications for long-term sustainable land use.

In the study developed by Curwell and Lombardi (1999) on Sustainable urban regeneration, the urban actors were classified according to the P.E.S.T. system as follows:

- *Political* - Leaders of local political parties; Environmental spokespersons of local political parties; Members of the planning committee(s).
- *Economic* - Business Leaders; Investors; Land Owners; Building/ Property Owners; Local CBI; the Chamber of Commerce; the Institute of Directors; Managing Directors of Utility Companies; Managing Directors of Transport Companies; Local Authority Business & Tourism Development Officers.
- *Social* - Community leaders (social clubs, sports clubs, music societies, art groups, youth clubs, recreational clubs e.g. gardening, Masons, Roundtable); Education (Headmasters/ Headmistresses, Directors of Colleges of Further Education); Religious Leaders (Christian Protestant & Catholic, Hindu, Moslem, Others); Local Environmental Action Groups (Friends of the Earth, Greenpeace, Civic Trust).
- *Technical* - Officers of Local Authority (Agenda 21 Strategy, Planning, Economic development, Transport Engineering); Professional Consultants (Environmental,

Architects, Engineers, Surveyors, Conservationists); Technical representatives (Housing Associations, Development Companies, Construction Companies, Utility Companies, Transport companies).

Other classifications exist, for instance, the French system ATEQUE (1994), slightly modified by BEQUEST (1999), which identifies the following five poles of societal actors:

- the pole of *collective interests* (elected representatives, administrations, governmental agencies, regional and developmental authorities, local authorities research institutions and technical centres, vocational training institutions, consumer associations, associations for environmental protection);
- the pole of *operational decision-making* (development companies, non-managing building owners, managing building owners, backers);
- *the pole of design* (prime contractors, including architects, technical consultants, town planners, landscape engineers, construction economists);
- the pole of *project carry-through* (industrial and distribution companies, contractors, control offices);
- the pole of *use* (service providers, managers, users of residential buildings, users of service-providing buildings, insurers).

In the context of this study, the following broad definition of stakeholders can be assumed which is also presupposed in all the above studies and classifications of actors: '*a group of individuals who have specific interests regarding future development and who have the opportunity to influence decision-making processes to serve these interests* (adapted from Bruinsma et al., 1999).

What is their View and Understanding of Sustainability

Recent studies have specifically highlighted the different views of sustainability among urban actors.

A number of authors have used the four commonly accepted sustainability principles of Futurity, Environment, Public Participation and Equity identified by the

PICABUE approach (Mitchel et al., 1995) as a means of gauging the degree of common commitment of representatives of a very wide range of disciplines (engineers, architects, urban designers, planners, ecologists, economists, plus a geographer, political scientist, transport planner, surveyor and building technologist) towards sustainable development.

The studies developed by Palmer et al. (1997), Curwell and Cooper (1997) and Curwell et al. (1998) have revealed the wide differences of commitment among respondents to the four principles underpinning sustainable development. In particular, the survey of Curwell, Hamilton and Cooper (1998) have revealed that the architect is strongly committed to both Environment and Futurity but only weakly to Participation and Equity while the surveyor has a fairly strong commitment to both Futurity and Participation but only a modest one to Environmental and Equity; finally, the construction economist shows little commitment to any of the principles.

For a determined period, the BEQUEST network (1996-99) has also used the four-sided PICABUE definition of sustainable development as the foundation of a common understanding, specifically for measuring attitudes and terminology. This has shown that "sustainability" and "environment" are often used interchangeably to mean the same thing, i.e. only those issues represented by the first two dimensions in the PICABUE definition (Futurity and Environment).

BEQUEST (1999) recognises that "This results in an inadequate understanding by the majority of actors of the full potential of sustainable urban development with a consequent and possibly damaging continuation of assessment effort within a narrower environmental protection paradigm".

The other dimensions are overlooked or given scant attention. In particular "Equity issues (e.g. specifying local labour or materials) are not considered at building or urban planning scales. And, although some form of Participation is included in re/development planning, this is hampered by lack of understanding and is not carried through in the majority of building projects" (BEQUEST, 1999).

On the basis of a different analytical approach, Curwell and Lombardi (1999) have provided a cross-cultural comparison of the Agenda 21 strategy, as well as its understanding by various members of the community in Salford and Turin, by using a case study approach (respectively, Chapel Street and Spina 3). A common structured interview research technique was employed using a comprehensive questionnaire based on a check-list of sustainability and quality of life aspects with a number of influential actors (P.E.S.T. classification) from each city. As already introduced in the example illustrated in Section 5.2 (under the credal modality), the results from an analyses of the respondents showed different views of sustainability and perceptions of quality among societal actors in each case study as follows (see Curwell and Lombardi, 1999).

The Salford case study confirmed a number issues that are of major concern to the citizens, such as crime and transport. To some extent this is understandable in an inner city area suffering from economic and social stress. It is also very significant to note that in the minds of those that live and work in the Chapel Street area of Salford such basic fundamentals of quality of life have a significantly higher priority over the economic regeneration and environmental protection issues. Whereas in Europe and North America protection of the environment is often the priority issue in the mind of design and development professionals (Curwell and Cooper 1998).

In contrast, the issues of crime, health and safety as well as transport are of much less concern in Turin. The Turin case study appears to show that there is a gap of commitment between the economic and the social actors in terms of the participative issues of sustainability. Consultation is in itself not sufficient to develop a common understanding and to catalyse real changes in attitudes. Sustainable urban regeneration needs social consensus and negotiation between parties. These are difficult tasks without the full participation of people, both experts and citizens, at an early stage of the (re)development process.

6.1.2 Sustainability Criteria and New Definitions of the Modal Aspects

The previous analysis and particularly the last study on sustainable urban regeneration has emphasised the need for public participation and negotiation between parties towards the development of a common understanding of sustainability. To be effective the process needs information, understanding and opportunity (Bobbio, 1996).

In this section, a revision of all the aspects is provided in order to develop relevant sustainability criteria for the evaluation of (re)development planning processes. Each modal aspect is specified according to the results of the analyses developed in the course of this study, as illustrated in Section 4.2 and Section 5.2. The new definition of each aspect also takes into account the discussion developed in Section 6.1.1 and the results of an assessment on the comprehension of the modalities which are illustrated in Section 7.1.

We will start our examination from the top of the modal order as the credal aspect appears the most critical aspect.

From Credal to Commitment, Interest and Vision

The credal modality is a crucial aspect as it provides meaning to people's actions and choices, either individually or as a community. It corresponds to the drive for human actions, the political point of view, the people's vision of a community development, the commitment towards a sustainable development, etc. (UNCED, 1992). It identifies the reasons underpinning urban policies and political strategies, as well as the goals of a community. For instance, the previous analyses of stakeholders has revealed a great deal of interest in, and commitment to sustainable development, but a general lack of awareness among certain societal actors of the wider ramifications of Agenda 21. A number of them feel constrained in their role, they feel unable to make change happen effectively, even where society as a whole has recognised better patterns of life, or more efficient, less resource intensive methods (Curwell and Lombardi, 1999). In planning evaluation, therefore, the credal aspect is better identified as Commitment, Interest and Vision, determining a strategic level for decision makers where goals and objectives may be, implicitly or explicitly, identified (Bentivegna, 1999).

Ethical

As acknowledged by the examples related to the ethical aspect illustrated in Section 5.2, this modality – which refers to a particular attitude towards the others which is governed by love and morality- is often encountered in decision making problems related to sustainability as a *leading function* of neighbourliness and of the general demeanour of people towards each other and their built environment. Yet, in many planning situations, the ethical was found in connection to the economic and the juridical aspect, and may be described as Equity.

Equity is defined as a fear distribution of cost and benefits among societal actors (Voogd, 1995), referring to a reduction of social inequalities (Mitchell et al., 1995). Although this concept is very relevant for sustainability, it may be misleading in the context of an evaluation of sustainability since it is not altruistic (Varela, 1992; Schutz, 1996). On the contrary, in the context of this study, the term **Ethical** seems broader and suitable to use since it suggests that citizens (particularly building and land owners) go beyond mere duty in consideration of ownership and responsibility and that those who live nearby should go beyond the traditional NIMBY (not in my back yard) defensiveness.

From Juridical to Rights and responsibilities

The kernel meaning of the juridical modality is well explained through the concepts of **Rights and responsibilities**. These express the human need for justice (Hargreaves et al., 1992) which is usually institutionalised and formalised in a body of laws, regulating social justice. Thus, the concepts of rights and responsibility will refer, in turn, to all the following: property and planning laws, legal institutions and political structure, land titles, planning regulations and other policies (see example of the manufacturing plants located in the north-west USA provided in Section 5.2 under the heading of juridical modality).

From Aesthetic to Visual appeal and architectonic style

The aesthetic modality refers to beauty. This can be understood as "a characteristic of objects or situations that delight the senses and/or exalt the mind" Voogd (1995). A better definition for it is "harmony " (Dooyeweerd, 1968). Often it is understood in term of quality but the latter is always connected to use while the former is not specifically related to material needs, therefore, according to Zeleny (1994), it is more stable than quality. In design, beauty is generally related to architectonic style and decoration. In planning evaluation a more specific definition for this aspect is **Visual appeal and architectonic style of buildings and settings** (Ruskin, 1849; Lynch, 1960; Hubbard, 1994).

From Economic to Efficiency & Economic appraisal

In the Cosmonomic Idea, the economic modality is not concerned so much with finance, but rather with wise use of limited resources (see Appendix B). In the ecological field of study, this may refer to the ability to incur the least possible waste when satisfying our needs. In the manufacturing and construction fields, the same definition can be adopted with regards to the production of goods. Finally, in economics, it means the ability to achieve desirable goals by managing limited resources (Hargreaves et al., 1992). This is expressed by the concept of **Efficiency**, which is based on the neo-classical concept of optimisation (Fishburn 1970; Keeney and Raiffa, 1976; FORMEZ, 1978). When it is applied to planning and design, it asks developers and designers to consider how to make best use of all the available resources. As in the example illustrated by Moffat (1995), it asks them to consider future costs for designing and development buildings (see Section 5.2). Therefore, it very often refers to an **Economic appraisal** (MacLoughlin, 1969; Lichfield et al., 1975; Ruddock, 1992).

From Social to Social climate, social relationship and cohesion

The social modality refers to relationships which usually link people together. Personal interaction increases synergy, co-operation and association which are important elements for sustainability in planning. The (re)development of urban areas requires **Social climate, social relationship, social cohesion** (Bobbio, 1996). This has been recognised in several examples of planning and urban policies with environmental implications (see Section 5.2).

From communicative to communication and the Media

The communicative modality is particular important in planning for sustainability, mainly because decision making in planning is developed not just in isolation but rather in a multiple social actors' context. **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 (Apel, 1992). In this field, many advanced modelling techniques have recently provide support to decision makers (see Section 6.2.2).

From Historical to Creativity and cultural development

In the Cosmonomic Idea, the historical modality means "formative power" (see Appendix B). In planning and design for a human community this is reflected in **Creativity and cultural development** (see examples in Section 4.2). It also refers to conservation strategies for the built heritage (see examples in Section 5.2).

From Analytical to Analysis and formal knowledge

In planning and design, the analytical modality refers to **Analysis and formal knowledge**. It deals with discernment, identification, comparison, classification. As already mentioned in Section 4.2, it qualifies the activity of scientists, researchers and all those people who use scientific tools in their professional work (DoE, 1992). Since it deals with understanding, conceptualising, reasoning and deductive thinking, it also characterises: quality of analysis for planning and high level research (see Table 4.1).

From Sensitive to Perceptions of people towards the environment

The sensitive modality specifically qualifies living creatures as being able to have feelings and emotions towards the environment. In planning and design, this can be expressed in term of **Perceptions of people towards the environment** (see examples reported in Section 5.2).

From Biotic to Health, and ecological protection or bio-diversity

The biotic modality is particularly important for 'environmental sustainability' as it defines the "vitality" of a system to survive, or to live, grow and develop (see, for example, the concept of carrying capacity of a building or an urban system). In terms of system ecology, the city can be compared to an ecosystem with its own structure, functions and metabolism (Geddes, 1915; Howard 1946; Alexander, 1966; Cadman and Payne 1990). The "autopoiesis" concept developed by Maturana and Varela (1980; 1987) as the self-capacity of a system to live and develop or to survive, has also been used to explain and understand sustainability in cities (see Fusco Girard and Nijkamp, 1997). Ecologists specify that vital functions regulate the generation and regeneration of living organisms such as birth, development, reproduction, metabolism, etc. Case studies and examples of sustainability case studies in planning have shown that both, **Health, and ecological protection or bio-diversity** (Lombardi and Zorzi, 1993; Bettini, 1996; Nath et al., 1996) are relevant issues for sustainability in the development of an area.

From Physical to Physical environment, mass and energy

Also crucial is the physical aspect since it qualifies energy and mass and all the physical environment, such as water, air, soil, natural materials, resources, and land on which to build (Capra, 1989; 1996). In the field of sustainable development and quality of life, it is often used in connection with the concept of prosperity, defined by Voogd (1995) as "the amount of available capital of natural non-renewal resources". In planning and the built environment, the **Physical environment, mass and energy** are major issues of concern for sustainability (Odum and Odum 1980; Owen 1992; Jones et al., 1997; Capello et al., 1999).

From Kinematics to Transport and mobility

The kinetic modality deals with "movement" (a concept derived from science and mechanics). As recognised from the literature review (see Section 5.2), **Transport and mobility** are crucial factors for the sustainability of an urban context (Buchanan, 1962; Breheny, 1992; Geenhuizen et al., 1995), for both their environmental ecological impacts on one hand, and their utility and quality of life features.

From Spatial to Space, location, shape and extension

The spatial modality means "continuous extension", providing a foundation for spatial planning activities. In planning and design, it generally refers to **Space, location, shape and extension** (Cecchini and Taylor, 1987; Breheny 1992; Clementi et al., 1996; Symes, 1997) which are major issues of concern for sustainability.

From Quantitative to Numerical accounting

Finally, the quantitative modality means 'awareness of how much of things', dealing with numerical data, statistics and mathematics (see Table 4.2). These numerical attributes are traditionally adopted to develop a quantitative measurement of the urban (re)development in planning (OECD, 1994; Thrilwall, 1994). Therefore, in the evaluation of planning and design, it refers to **Numerical accounting,** such as the number of people, inhabitants, square mitres, hectares of ground on which to build, and so forth (Papa and Galderisi, 1993).

The final list of criteria to evaluate sustainability in planning within each modality is illustrated in Table 6.1.

Table 6.1 – List of sustainability aspects within the modal order

MODALITIES	REDEFINED MODALITIES TO REFLECT SUSTAINABILITY
Quantitative	Numerical accounting
Spatial	Spaces, shape and extension
Kinematics	Transport and mobility
Physical	Physical environment, mass and energy
Biological	Health, bio-diversity and ecological protection
Sensitive	Perceptions of people towards the environment
Analytic	Analysis and formal knowledge
Historical	Creativity and cultural development
Communicative	Communications and the Media
Social	Social climate, social relationships, social cohesion
Economic	Efficiency & Economic appraisal
Aesthetic	Visual appeal and architectonic style
Juridical	Rights and responsibilities
Ethical	Ethical issues
Credal	Commitment, interest and vision

6.2 Informing the Framework for Evaluation of Sustainability

The previous section has illustrated a list of issues which are relevant to the evaluation of sustainability and their definition within the context of urban planning. These issues are the main headings of a holistic and integrated evaluation framework in planning which is suggested to provide information about the effects of an urban development on the formal decision-takers (planners, designers and urban authorities), and any members of the general public who may participate in the decision-making process (concerned citizens).

One of the aims of this section is to develop some working examples of questions related to the (re)development of an urban area. These questions will help decision maker (planners or stakeholders) to examine each sustainability 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 the evaluation in planning. It is also worth noting again that the evaluation will not be limited to technical factors, but also to non technical aspects as it follows the check-list of aspects illustrated in Section 6.1 (Table 6.1). Each of them represents a level of information which may be relevant for the stakeholders.

A second aim of this section is to provide an indication to decision makers of some suitable techniques which are available to assess each aspect. Most of these methods are included in Appendix A of this thesis, as discussed in Chapter 2.0.

A final remark - already mentioned in the introduction of this chapter - is that the evaluation perspective adopted in the development of both the questions and the assessment methods is related to the so called *ex-ante* evaluation of alternatives. Clearly, this example may be one in a series. By changing questions and assessment techniques, the check-list of aspects remain the same and can be assumed as the base for an *ex-post* or a *monitoring* evaluation. The flexibility of the framework is further discussed in the conclusion to this thesis (see Chapter 8.0).

The following sub-sections provide a short illustration of the questions used to examine sustainability and an identification of some evaluation tools currently used for assessing each aspect. As already mentioned in the introduction of this chapter, an effective summary of the findings of this study is illustrated in Appendix C.

6.2.1 Key-questions (PICABUE approach) Examine Sustainability within each Aspect

As the definition of a sustainability aspect is a process which also includes non technical aspects, the process must be guided by a scientific tool. In this context the PICABUE approach (Mitchell et al., 1995), whose benefits in gauging the degree of common commitment of societal actors and representatives of different disciplines towards sustainable development have already been highlighted (see Sub-section 6.1.1.2), may be useful to develop appropriate questions under each sustainability aspect, linking them to the four recognised principles underlying sustainable development:

- *Futurity* -a concern for future generations, not cheating on our children;

- *Social Equity* - a concern for today's poor and disadvantaged, equal access to resources;
- *Environment* - preserving the eco-system, ensuring that human activities do not threaten the integrity of ecological systems;
- *Public participation* - a concern that individuals should have an opportunity to participate in decisions that affect them, ability to influence decisions.

Although other frameworks exist which aim at understanding and classifying sustainability issues, such as the Pentagon Prism Model developed by Nijkamp and Pepping (Nijkamp and Pepping, 1998; Capello et al., 1999) within a comparative study of sustainability initiatives in order to identify critical success factors in energy policy (see Appendix A), PICABUE seems more appropriate in the context of this study.

Firstly, it is not scoped and limited to renewable energy policies or other sectorial and compartmentalised policy making as in the Pentagon model; rather, it is general and holistic. Secondly, it is founded on the sustainable principles that underlie official reports on Agenda 21, and therefore it is not too general or broad as is S.L.E.P.T. (Social, Legal, Economic, Political and Technical) system or the Flag and the Spider models (Bruinsma et al., 1999; Nijkamp et al., 1999). PICABUE has often been used to classify quality issues and sustainability indicators within the context of a sustainability I.T. model for cities (May et al., 1997). Thirdly, it is very simple and easy to understand by people, as revealed by the studies on stakeholders' concern about sustainability in planning and construction (Palmer et al., 1997). In this study, it is usefully to help link each aspect with the official understanding of sustainability principles (UNCED 1992).

Starting from the top of the modal order, the following are key-questions related to each sustainability aspect under the four main headings of Futurity, Equity, Environment and Participation. These questions are indicative of the issues that need to be addressed and aid a person making the assessment to consider all the key issues (and moral imperatives).

Commitment, Interest and Vision

- Futurity: Is the political situation stable?
- Equity: Does the (re)development scheme meet with regional – national plans?
- Environment: Has a Strategic Environmental Assessment been undertaken? Will finance be available for environmental protection?
- Participation: Has the (re)development scheme been agreed on by stakeholders?

Ethical concerns

- Futurity: Does the development scheme provide the same or improved opportunities for people in the future as in the present?
- Equity: Does the development scheme reduce social inequalities? Does it support the action of voluntary groups?
- Environment: Does the scheme provide a protection of biosphere, ecosystem and animal species?
- Participation: Have the stakeholders been involved in the development of the scheme?

Rights and responsibilities

- Futurity: What are the modifications in current property structure? Have the rights and the responsibilities of all developers, land and building owners and users, been accounted for in the long term?
- Equity: Does the scheme provide an identification of those who benefit and those who pay for the development? Does it include some possibilities for the reimbursement of damage and a payment for the rights received?
- Environment: Is there compliance with the technical - planning standards related to the protection of the environment?
- Participation: What is the degree to which people can change their environment either directly or through elected representatives? What citizen groups are entitled to participate in the decision making process?

Visual appeal and architectonic style of buildings and settings

- Futurity: Does the development scheme improve the artistic character and significance of buildings and settlements in the short and long term? Does the condition of the built environment enhance the visual appeal?
- Equity: Are the planned interventions aesthetically satisfying to all the stakeholders?
- Environment: Is the development in harmony with the context, the surroundings and the eco-system? Does the scheme improve the visual appeal of natural settings?
- Participation: Have the viewpoints of both stakeholders and experts been taken into account in the development of the proposed design?

Efficiency and Economic appraisal.

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

Social climate, social relationship, social cohesion

- Futurity: 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?
- Equity: 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?

- Environment: Does the plan consider the impacts of tourism on the cultural and natural settings?
- Participation: Have social clubs, voluntary groups and cultural associations been involved in the development of the scheme?

Communication and the Media

- Futurity: 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?
- Equity: Does the plan improve the accessibility to communication facilities for all citizens, including poor and disadvantaged?
- Environment: Does the plan include environmental audits? Is an environmentally oriented advertising available for the area?
- Participation: Is information on the development scheme available to all stakeholders? Are all relevant citizen groups able to take part to the discussion, argument and evaluation in planning? Does everyone understand the language used?

Creativity and cultural development

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

Analysis and formal knowledge

- Futurity: Has scientific analysis been applied to the problem, including consideration of the long term perspective? Does the funding provided evidence and support the solution in the long term?
- Equity: Is an educational scheme available for citizens ?
- Environment: Is there an educational programme relating to the environment available for the community?
- Participation: Has the developed analysis been accessed and agreed on by most of the stakeholders?

Perceptions of people towards the environment

- Futurity: Is a long term security scheme available for the area?
- Equity: 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 children's viewpoint taken into consideration?
- Environment: Does the plan solve the problems of noise in the area? Does it take into account the visual impact?
- Participation: Are the viewpoints of all stakeholders, including those who have no voice, taken into consideration? Have the groups for the rights of children been active in decision making ?

Health, and ecological protection or bio-diversity

- Futurity: 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 renewal resources in the long term?
- Equity: Is every stakeholder able to enjoy an appropriate level of quality of air, water and soil in the developing area? Does he/her feel happy with the presence of green areas, hygiene, health and health services, hospitals, gyms, etc.?

- Environment: 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?
- Participation: Are the community groups active on environmental issues? Have all the stakeholders taken part in the development of the environmental planning scheme?

Physical environment, mass and energy

- Futurity: Is an energy scheme available which takes into account a long term perspective? Is a maintenance scheme for the buildings available?
- Equity: Does every stakeholder feel happy with the level of quality of housing and urban facilities?
- Environment: Has the development been based on an energy saving scheme?
- Participation: Have Local Environmental Action Groups such as Friends of the Earth, Greenpeace, Civic Trust association, Wwf, Ambiente Italia, etc. been involved in the development of the scheme?

Transport and mobility

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

Space, location, shape and extension

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

Numerical accounting

- Futurity: How long is the development process?
- Equity: How much redistribution of wealth is contained within the scheme?
- Environment: How much is the development in terms of natural and non renewal resources?
- Participation: How many stakeholders have taken part to the decision making?

6.2.2 Current Assessment Methods for each Sustainability Aspect

Chapter 2.0 has illustrated a variety of existing assessment methods which try to cope with the problems of decision processes by defining a logical structure based on rationality and objectivity. It has also shown the limitations of these methods with regards to a sustainability assessment of the urban environment, supporting the view that "Different assessment techniques are required for different dimensions, and for the meso and macro scales. Therefore, sustainability assessment of the urban environment may need to be more of a procedure or process using various techniques, rather than one integrated method" (BEQUEST, 1999).

The Evaluation methods belong to various different technical fields and scientific disciplines such as economics, different branches of engineering, structural technology, architecture, town planning, etc.

As previously remarked concerning the identification of the key-questions to examine sustainability (see Section 6.2.1), the following list of assessment methods should not be understood as a rigid and comprehensive selection list. It is just an illustration, an example which needs implementation and further research for the final tool-kit of decision making tools.

Following the top-down direction of the previous section, we can recognise that the issues of **Commitment, Interest and Vision** are generally assessed by using Strategic regional plans. These aim at driving information on the development strategies of the city, identifying goals and objectives (Therivel et al., 1992; Wood, 1994). Alternatively, focus groups may provide the necessary support to assess the political view point and the vision of people in a community development, highlighting the reasons underpinning urban policies and political strategies, as well as the goals of a sustainable development (Selman, 1996).

The **Ethical issues** have implications with a number of aspects, such as the juridical, social, economic, etc. In planning, it may be assessed on the basis of the well known C.I.E. – Community Impact Evaluation (Lichfield et al., 1975; Lichfield, 1988; Lichfield, 1996). In relation to the biological and physical implications of an urban development, it may be useful to adopt an E.I.A. procedure (85/337/CEE, 27.6.85; Alberti et al., 1992; Bresso et al., 1990; Bettini, 1996, etc.).

Rights and responsibilities are specific issues of concern in planning and construction as any modification of the built environment may have an ownership and other issues in the juridical field (see: property and planning laws, legal institutions and political structure, land titles, regulations and other policies). These issues can be evaluated against a number of specific laws and regulations, at different levels: local, national and European levels (see: European, National and Local Planning Laws and Regulations). Additionally, a number of institutional bodies deal with these issues, such as Public Committees and Public advisory boards, Public Planning Councils.

The next issue in the hierarchy of aspects is particularly important in planning and design, i.e. the **Visual appeal and architectonic style of buildings and settings**. An assessment of these issues is traditionally intuitively developed by designers, using a traditional design approach and design methodologies. Among these, Lynch's approach (1960) to design is the most well known approach to design assessment, which is based on the visual impact of buildings and settlements (Lynch, 1960). In recent years, we have witnessed an increasing use of scientific tools based on spatial IT in land use planning (e.g. G.I.S.) and in urban design (e.g. C.A.D.). These aid designers to evaluate a design from an aesthetical viewpoint. In addition these tools help the participation of people in decision making (Betty, 1995; Betty and Densham, 1996; Nijkamp and Scholten, 1993). The systematic translation of these data into spatial information, induced by advanced modelling techniques, visualisation methods and even multi-media communication techniques, has created a platform for a new form of interactive and participatory planning in which policy-makers, experts, planners, interest groups and even the public at large have access to an unprecedented stock of systematically organized information (Nijkamp and Scholten, 1999).

Economic appraisal is a well known approach in planning since it assists the process of decision-making, considering the alteration of the distribution of financial and environmental resources between interests (Lichfield et al., 1975). It has received great attention among scholars (see Chapters 2.0). Methods, such as cost benefit analysis and other 'formal' techniques, have been developed and widely applied in spatial planning over the last twenty-five years to support this task. All these methods are based on the neo-classical concept of optimisation and the assumption that the impact of a policy proposal can be assessed for all relevant variables of the proposal. A number of suitable techniques are illustrated in Appendix A, including Life cycle costing of buildings, Cost benefit analysis and Multicriteria analysis.

The issue of **Social climate and cohesion** for a (re)development project can be developed on the basis of Polls and surveys or Questionnaire techniques, which aim at providing information on this area (Bezzi and Palumbo, 1998).

Communication is the way we transfer information among stakeholders within participative decision making but also within a real urban environment. Many advanced modelling techniques, visualisation methods and even multi-media communication techniques have recently created a platform for a new form of interactive and participatory planning in which policy-makers, experts, planners, interest groups and even the public at large have access to an unprecedented stock of systematically organized information (Healey 1997; Voogd, 1998). Seen from this perspective, the 'networked' society has had enormous implications on the style of planning and urban design (Nijkamp and Scholten, 1999).

The evaluation of **Creativity and cultural development** is not an easy task since it usually deals with non quantifiable issues. It may include either Design approaches or Technological analysis. The latter is particularly important in dealing with conservation strategies for the built heritage. A traditional planning evaluation technique for urban plans and project is the Goals achievement matrix by Hill (1968). This bases the assessment of the project upon a set of criteria specified by decision makers. It has been used quite widely in the field (Voogd, 1983; Lichfield, 1988; Fusco Girard, 1987).

Analysis and formal knowledge in planning and design processes can be assessed using multicriteria techniques such as the Analytical hierarchy process (Saaty 1980; Saaty and Vargas, 1981; Roscelli, 1990; Lombardi, 1997; Fusco Girard and Nijkamp, 1997) or other modelling approaches, with the aim of enhancing a scientific reasoning and a deductive thinking approach in planning (Betty, 1976; Nijkamp et al., 1999; Mitchell 1999a).

Perceptions of people towards the environment can be checked on the basis of a wide range of different tools which are able to take into consideration the results of psychological studies. Some methods are based on visual dimensions, such as visual impact analysis and assessment and cognitive mapping, I.T. tools and Virtual reality. Lynch's theoretical outlook approaches (Lynch, 1960; Bezelga and Brandon, 1991) may also play a role in this evaluation.

Others are based on quantitative indicators and statistical approaches, such as Surveys and polls or Questionnaire techniques. These usually try to quantify the feelings of noise, comfort, security, safety and privacy of people in an urban environment. Examples of quantitative indicators for assessing the issue of safety are crime statistics, racial provocations, rape rate, etc. (OECD, 1997)

Many specific approaches have recently been developed for evaluating the biological issues of **Health, bio-diversity and ecological protection** in planning evaluation (Mitchell, 1999a). The most well known are the two approaches of Ecological footprint (Wackernagel et al., 1993) and Carrying capacity (Rees, 1992). Unfortunately, an application of these approaches is not easy because it encompasses the collection of a large amount of data and quantitative information on environmental impacts (Fusco Girard and Nijkamp, 1997).

Other more operational approaches are those that specifically deal with an assessment of the impacts of the project on the environment, such as a general Environmental impact analysis (E.I.A.). Alternatively a number of indicators and various national measures, dealing with these issues, have been identified by development organisations such as the United Nation, OECD. The most popular are: Air quality (long term SO2 + TSP; short-term concentration: O3, SO2; TSP); quality of drinkable water; tons of white water; quality of water for beaches; quality of water on and under ground; wastewater, soil quality; contaminated lands; bio-diversity (e.g. number of bird species); presence of green areas (e.g. percentage of people owning a garden); production of special waste; etc. (Cogo, 1997; Lombardi, 1998b).

E.I.A. is the traditional procedure for assessing the impacts that a re-development proposal has on the **Physical environment**. Additional tools, which are related to the physical elements of the environment specifically at building scale, are the well known BREEME (Prior, 1993) and BEPAC (Cole et al., 1993). But many other techniques, dealing with more specific energy issues (wind energy; CHP/DH, PV system, solar water heating, etc.), exist in technical engineering fields (Brandon et al, 1997; Capello et al., 1999)

The issues of **Transport and mobility** are also specific issues in planning. An evaluation of these issues generally requires the adoption of appropriate engineering tools and technical approaches, such as traffic planning schemes, traffic flows; mobility system checks, etc. Many of these approaches make use of quantitative indicators such as the following: modal split; commuting patterns; traffic volume; transportation of goods; proximity to urban green area; percentage of streets enabling pedestrian accessibility; number of trips per capita in average length per mode; percentage of population living close to public transport; length of pedestrian streets; length of cycle-roads; percentage of public transport of goods (ton/km); number of private cars; length of fast motor-ways; length of rail-ways; length of public transport; number of people using public transport (millions); average distance from work; percentage of transport network on the total urban area; percentage of people moving in the town over the total urban population; etc. (Sustainable Seattle, 1993; Stanner and Bourdeau, 1995; OECD, 1997)

In planning evaluation, the issue of **Space** can be tackled on the basis of some recent innovative approaches, such as spatial geo-information systems (G.I.S.) which have set the tone for a new mode of physical planning based on an overwhelming quantity of detailed spatial data (Betty and Densham, 1996; Nijkamp and Scholten, 1999). Design approaches, both traditional or based on I.T. (e.g. C.A.D.), are also adopted for assessing the shape of buildings and settlements. Finally, indicators such as urban land-cover (total area; total built-up area; open area; transportation network), derelict areas, urban renewal areas, population density, are often used to measure the spatial capacity of the urban project and the 'extension' of the urban district (or urban complex) as well as its stability in time.

Numerical measurements may refer to different spatial planning issues, such as the following: number of people, inhabitants, square mitres, hectares of ground on which to build, etc. Alternatively, they may refer to physical and technical elements (mass and building components) or to financial issues (Life cycle cost of a building). A large number of quantitative indicators and indexes can be found in literature on urban sustainability which have recently been developed in both the social-economic and the ecological fields (Pearce and Warford, 1993; Cole et al., 1995; Mitchell, 1999a; Lombardi and Micelli, 1999).

6.3 Summary and Conclusions

This chapter has focused on the development of an analytical framework to understand urban sustainability in planning and the built environment by decision makers.

In doing this, an analysis of the various stakeholders and their views or commitment towards sustainable development was undertaken, taking into account results from recent studies in this field. Subsequently, the sustainability aspects for the evaluation in planning were reviewed, providing a more traditional definition of each aspect, from a stakeholders viewpoint. The next chapter shows their relevance and comprehensiveness (see Chapter 7.0).

Each sustainability aspect was examined by using the PICABUE approach and a list of key-questions was provided, although it is recognised that this list is not exhaustive. This check-list was finally linked to a number of assessment methods in use.

The final analytical framework is illustrated in Appendix C.

Future knowledge on sustainability, more experience and applications of this framework to real case studies may show that this framework is not generally applicable and it may require adaptation for each planning situation and context. At present, however, this is the most relevant and comprehensive list of sustainability aspects for the evaluation of sustainability in planning and design available, as the next chapter tries to show.

6.4 Main References

Alberti M., Bettini V. and Falqui E., 1984, *Bilancio d'impatto ambientale*, Clup, Milan

Alexander C., 1966, A city is not a tree, *Design*, 206, pp.44-55

Apel K.O., 1992, *Etica della comunicazione,* Jaca Book, Milan

ATEQUE, 1994, *Identification of Actors Concerned with Environmental Quality of Buildings,* Technical Document No.1, Paris, December

Bentivegna V., 1999, Valutazione e pianificazione strutturale, in Lombardi and Micelli (eds), *Le Misure del Piano*, Angeli, Milan, pp.41-53

BEQUEST - Building Environment Quality Evaluation for Sustainability through Time Network, 1996-99, EC Environment and Climate Research Programme, Theme 4: Human Dimensions & Environmental Change, Directorate D - RTD Actions: Environment - E.U. DG12

BEQUEST - Building Environment Quality Evaluation for Sustainability through Time Network, 1999, *Report 1998-99*, EC Environment and Climate Research Programme, Theme 4: Human Dimensions & Environmental Change, Directorate D - RTD Actions: Environment - E.U. DG12

Bettini V., 1996, *Elementi di ecologia umana*, Einaudi, Turin

Betty M. and Densham P., 1996, Decision support, G.I.S. and Urban Planning, *Sistema Terra*, year 1, issue 1, pp.72-76

Betty M., 1976, *Urban modelling,* Cambridge Univ. Press., Cambridge

Betty M., 1995, Planning support systems and the new logic of computation, *Regional development dialogue*, vol. 16, n.1, pp.1-17

Bezelga A. and Brandon P.S. (eds.), 1991, *Management, quality and economics in buildings*, E&FN SPON, Chapman & Hall, London

Bezzi C. and Palumbo M. (eds.), 1998, *Strategie di valutazione,* Gramma – Linee di ricerca sociale, Perugia

Bobbio L., 1996, *La democrazia non abita a Gordio*, Angeli, Milan

Bonnes M. and Bonaiuto M., 1993, Users' perceptions and experts' evaluations of the quality of urban environment: some comparative results from the MAB-ROME project, in Bonnes M. (ed.), *Perception and evaluation of urban environment quality*, Proceeding of the Int. Symposium, Edigraf, Rome, 28th – 30th November, pp.179-193

Bonnes M., (ed.), 1993, *Perception and evaluation of urban environment quality*, Proceedings of the MAB-UNESCO International Symposium held in Rome, 28th – 30th November, Edigraf, Rome

Brandon P.S., Lombardi P.L. and Bentivegna V. (eds.), 1997, *Evaluation in the Built Environment for Sustainability,* E&FN SPON, Chapman & Hall, London

Breheny M.J. (ed.), 1992, *Sustainable development and urban form*, Pion Limited, London

Bresso M., Russo R. and Zeppetella A., 1990, *Analisi dei progetti e valutazione di impatto ambientale,* Angeli, Milan

Bruinsma F., Nijkamp P. and Vreeker R., 1999, Experts at Arm's Length of Public Policy-Makers. A Case Study on Utrecht (forthcoming)

Buchanan C., 1962, *Traffic in towns,* HMSO, London

Cadman H.. and Payne G. (eds.), 1990, *The living city,* Routledge, London

Camagni R. (ed.), 1996, *Economia e pianificazione della città sostenibile*, Il Mulino, Milan

Capello R., Nijkamp P. and Pepping G., 1999, *Sustainable cities and energy policies*, Springer-Verlag, Berlin

Capra F., 1989, *Il Tao della Fisica*, Adelphi, Milan

Capra F., 1996, *The web of life*, Doubleday-Anchor, New York

Cecchini A. and Taylor J.L. (eds.), 1987, *La simulazione giocata,* Angeli, Milan

Clementi A., Dematteis G. and Palermo P.C. (eds.), 1996, *Le forme del territorio italiano*, Laterza, Rome

Cogo M., 1997, *Progetto Venezia 21*, Fondazione Eni Enrico Mattei, Venice

Cole R.J., Campbell E., Dixon C. and Vrignon J. (eds.), 1995, *Linking and prioritising Environmental criteria*, Proceedings of the International Workshop CIB TG-8, 15th – 16th November, Toronto

Cole R.J., Rousseau D. and Theaker I.T., 1993, *Building Environmental Performance Assessment criteria,* Version 1, Office Buildings, The BEPAC Foundation, Vancouver

Curwell S. and Cooper I., 1998, The implication of urban sustainability, in *Building Research & Information,* n.1, vol.26, pp.17-28

Curwell S. and Lombardi P.L., 1999, Riqualificazione urbana sostenibile, in Lombardi (ed.), Analisi e valutazione di programmi e progetti di sostenibilità urbana. Alcune esperienze, *Urbanistica* n.112 (in press)

Curwell S., Hamilton A. and Cooper I., 1998, The BEQUEST Network: Towards Sustainable Urban Development, *Building Research and Information*, n.1, vol. 26, pp. 56-65

DoE - Department of the Environment, 1992, *Assessing the impact of urban policy,* Inner Cities Research Programme, HMSO, London

Dooyeweerd H., 1968, *In the twilight of Western thought,* Nutley, New Jersey

Fishburn P.C., 1970, *Utility theory for decision making*, Wiley, New York

FORMEZ, 1978, *Analisi costi benefici: esperimenti ed applicazioni*, Quaderni regionali n.10, Naples

Fusco Girard L and Nijkamp P., 1997, *Le valutazioni per lo sviluppo sostenibile della città e del territorio,* Angeli, Milan

Fusco Girard L., 1987, *Risorse architettoniche e culturali*, Angeli, Milan

Geddes P., 1915, *Cities in Evolution*, Williams and Norgate, London

Geenhuizen M. van, Banister D. and Nijkamp P., 1995, Adoption of New Transport Technology: A Quick Scan Approach, *Project Appraisal*, vol. 10, no. 4, pp. 267-275

Hargreaves H.S., Hillis M., Lyons B., Sugden R. and Weale A., 1992, *The Theory of Choice. A Critical Guide*, Blacwell Publishers, Cambridge

Healey P., 1997, *Collaborative Planning*, MacMillan, London

Hill M., 1968, A goals-achievement matrix for evaluating alternative plans, *Journal of the American Institute of Planners*, vol.34, n.1, pp.19-28

Howard E., 1946, *Garden City of Tomorrow,* London

Hubbard P.J., 1994, Diverging evaluations of the built environment: planners versus public, in Neavy S.J., Symes M.S. and Brown F.E. (eds.), *The Urban Experience*, Proceedings of the 13th Conference of the International Association for People-Environment Studies, Manchester, 13th – 15th July, E&F SPON, London, pp.125-133

Jones P., Vaughan N., Cooke P. and Sutcliffe A., 1997, An energy and environmental prediction model for cities, in Brandon et al. (eds), *Evaluation* *of Sustainability in the Built Environment*, E&FN SPON, Chapman & Hall, London, pp.53-66

Keeney R.L. and Raiffa H., 1976, *Decisions with multiple Objectives, Preferences and Value Tradeoffs*, John Wiley & Sons, New York

Kilbert C.J., 1997, Environmental cost internalisation for sustainable construction, in Brandon et al. (eds.), Evaluation of the Built Environment for Sustainability, E&FN SPON, Chapman & Hall, pp.200-210

Lichfield N., 1988, *Economics in Urban Conservation*, Cambridge Univ. Press., Cambridge

Lichfield N., 1996, *Community impact Evaluation*, UCL Press, London

Lichfield N., Kettle P. and Whitbread M., 1975, *Evaluation in the planning process*, Pergamon Press Ltd, Oxford

Lombardi P.L. and Basden A., 1997, Environmental Sustainability and Information Systems, *Systems Practice*, vol. 10, n. 4, pp.473-489

Lombardi P.L. and Micelli E. (eds.), 1999, *Le misure del piano*, Angeli, Milan

Lombardi P.L. and Zorzi F., 1993, Comparison between aggregated techniques for assessing the effects of decision-making processes in the environmental field, in Manso et al. (eds.), *Economic Evaluation and the Built Environment*, vol.4, Laboratorio Nacional de Engenheria Civil, Lisbon, pp.126-138

Lombardi P.L., 1997, Decision making problems concerning urban regeneration plans, in *Engineering Construction and Architectural Management*, v.4, n.2, pp.127-142

Lombardi P.L., 1998b, Managing sustainability in urban planning evaluation, in Brandon P. (ed.), Managing Sustainability: Endurance through change, CIB World Conference on *Construction and the Environment*, Symposium D, Gavle, Sweden, 7th – 12th June, pp.2041-2050

Lynch K., 1960, *The image of the City*, The Technology Press & Harvard University Press, Cambridge

MacLoughlin J.B., 1969, *Urban And Regional Planning: A Systems Approach*, Faber and Faber, London

Maturana H and Varela F., 1987, *The tree of knowledge*, Shambhala, Boston

Maturana H. and Varela F., 1980, *Autopoiesis and Cognition*, D.Reidel, Dordrecht, Holland

May A.D., Mitchell G. and Kupiszewska D., 1997, The Development of the Leeds Quantifiable City Model, in Brandon et al. (eds), *Evaluation of Sustainability in the Built Environment*, E&FN SPON, Chapman & Hall, London, pp.39-52

Mitchell G., 1999a, A geographical perspective on the development of sustainable urban regions, in *Geographical Perspectives on Sustainable Development*, Earthscan (in press)

Mitchell G., May A. and McDonald A., 1995, PICABUE: a methodological framework for the development of indicators of sustainable development, *Int. Journal Sustainable Development World Ecol.,* vol.2, pp. 104-123

Moffat S., 1995, The missing ingredients: a look at how to improve methods for linking and prioritizing environmental criteria for assessing buildings, in Cole et al. (eds.), *Linking & Prioritizing Environmental Criteria*, Toronto, Canada, 15th – 16th November, p.115-120

Nath B., Heans L. and Devuyst D. (eds.) 1996, *Sustainable Development*, VUB press, Brussels

Nijkamp P. and Pepping G., 1998, A meta-analytic evaluation of sustainable city inititives, *Urban Studies*, vol. 35, pp.1481-1500

Nijkamp P. and Scholten H., 1999, New interoperable planning tools for Sustainable land use, in Lombardi (ed.), Analisi e valutazione di progetti e programmi di sostenibilità urbana, *Urbanistica* n.112 (in press)

Nijkamp P. and Scholten H.J., 1993, Spatial Information Systems: design, modelling and use in planning, *International Journal of Geografical Information Systems*, vol. 7, pp.85-96

Odum M.T. and Odum E.C., 1980, *Energy Basis for Man on Nature*, McGraw Hill Inc., New York

OECD, 1994, Report on *Environmental Indicators*, OECD, Paris

OECD, 1997, *Better understanding our cities. The role of urban indicators*, OECD, Paris

Owen S., 1992, *Energy, Environmental Sustainability and Land-use Planning,* in Breheny M.J., (ed.), 1992, *Sustainable Development and Urban Form*, Pion London, pp.79-105

Palmer J., Cooper I. and van der Vost R., 1997, Mapping out fuzzy buzzwords - who sits where on sustainability and sustainable development, *Sustainable Development*, vol. 5, n. 2, pp. 87-93

Papa R. and Galderisi, 1993, *Toward a definition of urban quality indicators as innovative tools for the urban environment management,* in Bonnes M. (ed.), *Perception and evaluation of urban environment quality,* Proceeding of the Int. Symposium, Edigraf, Rome, 28th – 30th November, pp.179-193

Pearce D. and Warford J.J, 1993, *World without end: Economic, Environment and Sustainable Development,* Oxford University Press, Oxford

Prior J. (ed.), 1993, *Building Research Establishment Environment Assessment Method, BREEAM, Version 1/93, New Offices*, Building Research Establishment Report, Second Edition

Rees W.E., 1992, Ecological footprints and appropriated carrying capacity: what urban economics leaves out, *Environment and Urbanisation*, vol. 4, n.2, pp.121-130

Roscelli R.(ed.), 1990, *Misurare nell'incertezza,* Celid, Turin

Ruddock L., 1992, *Economics for Construction and Property*, Edward Arnold, London

Ruskin J., 1849, *The Seven Lamps of Architecture*, London.

Russell P. and Grammenos F., 1995, A Building for all reasons. A vision of a balanced Mixed use Building, in Cole et al. (eds.), *Linking & prioritising environmental criteria*, Toronto, Canada, 15th – 16th November, pp.145-154

Saaty T.L. and Vargas L.G., 1981, *The logic of priorities, applications in businnes, energy, health, transportation*, Kluwer-Nijhoff, The Haugue

Saaty T.L., 1980, *The Analytic Hierarchy Process*, McGraw Hill, New York

Schutz J., 1996, What has Sustainability to do with Ethics?, in Nath, et al., (eds.) *Sustainable Development*, VUB press, Brussels, p.137-157

Selman P., 1996, *Local Sustainability*, Paul Chapman, London

Simon H. A, 1947, *Administrative Behaviour*, The Macmillan Co, New York.

Stanner D. and Bourdeau P. (eds), 1995, *Europe's Environmnt: The Dobris Assessment*, European Environment Agency, Copenhagen, Chapter 10, The urban environment, pp.261-296

Sustainable Seattle, 1993, *1993 Indicators of a Sustainable Community*, Sustainable Seattle Network and Civic Forum, Washington

Symes M., 1997, Space management in European compact city, in Brandon et al. (eds.), Evaluation of the Built Environment for Sustainability, E&FN SPON, Chapman & Hall, pp.363-370

Therivel R., Wilson E., Thompson S., Heaney D. and Pritchard D., 1992, *Strategic Environmental Assessment*, Earthscan, London

Thrilwall A.P., 1994, *Growth and Development*, MacMillan, London (5th edition)

United Nations Conference on Environment and Development, UNCED, 1992, *Earth Summit '92 (Agenda 21),* Regency Press, London

Varela F.J., 1992, *Un know how per l'etica,* Laterza, Turin

Voogd H., 1983, *Multicriteria evaluation for urban and regional planning*, Pion, London

Voogd H., 1995, Environmental management of social dilemmas, in *European Spatial Research and Policy,* vol. 2, pp.5-16

Voogd H., 1998, The communicative ideology and *ex-ante* planning evaluation, in Lichfield et al. (eds.), *Evaluation in Planning*, Kluwer Academic Publisher, Dordrecht, pp.113-126

Wackernagel M., Mcintosh J., Rees W. and Woollard R., 1993, *How big is our ecological footprint? A handbook for estimating a community's appropriated carrying capacity*, Taskforce on Planning Healthy and Sustainable Communities, University of British Columbia, Vancouver, Canada

Wood C., 1994, *The environmental assessment of plans programmes and policies: a comparative review*, E.I.A. Centre, Planning and landscape Dept., University of Manchester, Manchester M13 9PL

Zeleny M., 1994, In Search of Cognitive Equilibrium: Beauty, Quality and Harmony, *Journal of Multi-Criteria Decision Analysis*, vol. 3, pp.3-13

Chapter 7.0 – Assessment of the Framework

A fool may ask more questions in one hour
than a wise man can answer in seven years
(Jacob Weiss)

This chapter is concerned with the question of assessing the developed framework. However, it is worth remarking that this is a problematic issue since both technical information and scientific knowledge related to sustainability in the built environment is, 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 (see Sections 5.2), 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; it requires multi-disciplinary and multi-people working contexts over a long time period (BEQUEST, 1999). A further major constrain is the lack of an existing data-base on sustainability so that true testing becomes extremely difficult. Moreover, true testing will probably take many years as sustainability is not a *status quo* but, rather, a process that sometimes takes a generation to manifest itself. Current debates on sustainability tend to focus on statistical indicators and classification systems as an agreed structure for organising the information required in decision making as is not yet available (Mitchell, 1996).

It is in response to the above mentioned need that this study has been undertaken; the need has provided the necessary motivation and opportunity (see Chapter 1.0). It is due to the mentioned problem that this study has adopted a new theoretical base (the Cosmonomic Idea) to address the need, structuring an analytical framework for the evaluation of sustainability in planning.

This process has required understanding, investigation and information. It has also required testing and reviewing. However, from the foregoing discussion, it should be clear that the information included in the latter should be considered as a working example and that future practical applications of the framework will be required. Yet, a continuous implementation and adaptation of the framework to each planning situation and decision making process are necessary to allow users to adopt it as a fully operative tool for the evaluation of sustainability.

As the information on which the framework relies is still in a state of change it follows that the assessment of the model framework can only be partial. Rather, the assessment primarily focuses on the theoretical structure underlying the framework.

The aim is to see if the model meets the tests of transparency and replicability which are recognised as essential requirements for assessment, particularly, at the urban (or district) level (Mitchell, 1999a). Transparency is considered to be essential to understand results and communicate them to others (in other words, to prove that the model is not a black-box); replicability is needed to ensure that the benefits produced for one case study can be repeated for another. Yet, a model is required to have a user friendly interface, i.e. a vocabulary which is accessible to users (Cole et al., 1995). In addition, Wegener (1994) argues that an urban model should provide thoughts that 'open up' the field to new problems which were not evident previously.

In this study, two performance assessments are provided in relation to the above mentioned requirements. The first deals with the language and terminology used, i.e. the comprehension of the aspects included as a requirement for both the user friendly interface and the transparency of the evaluation of a planning proposal. It tries to answer the following key-questions:

Is the vocabulary and language used within the framework appropriate for users? Are the modalities easy to understand? Are they easy to communicate to people? Are they easy to check?

The second deals with the requirements of replicability and transparency of the framework, taking into account the comprehensiveness of the aspects in the decision making process for sustainability. The key-questions here are:

Is the framework flexible enough to be able to produce meaningful results in different planning situations? Is it transparent enough to produce clear indications for decision making within each aspect?

These assessments have required preparation to structure the test and collect the necessary information. In particular, the first one has required *de rigueur* field work and two stages of development. The first stage concerned an assessment of the traditional terms provided by Dooyeweerd (or better, from current English literature in this area) for the modalities while the second assessment was specifically related to the new vocabulary and definitions for the modalities. The second assessment applies the framework to a variety of case studies, with all the consequences that go with this (e.g. collection of information, analysis and conceptualisation, classification and interpretations, and so forth).

Finally, it might be worth mentioning that before developing the above mentioned two assessments, this study undertook a widespread confirmation of the modalities, from an expert perspective, with the aim of gauging ideas on the practicability of the model in the field of urban planning and design. This was carried out without a formal scientific method but mainly through discussion following the presentation of papers in various International workshops and conferences, from 1995 onwards. The list of these scientific meetings is provided in Section 7.5.

Since the results of these discussions were not formally structured they cannot be assumed as a verification for the framework and are therefore not illustrated in this chapter. Nevertheless, this step has been very useful to encourage the development of this framework since all those who have been exposed to the modal structure of the framework have seen it as a significant advance.

In the light of the foregoing clarifications and discussion, the chapter is structured as follows. Section 7.1 illustrates the assessment on the vocabulary used within the framework and its comprehension to users. This includes two stages of development and two different panels of respondents. Section 7.2 deals with an assessment of the modal aspects and the general structure of this framework. The relevance and comprehensiveness of the aspects for evaluating sustainability will be assessed on the basis of robust evidence based on literature, case studies and applications. This assessment also shows that decision making based on traditional current assessment methods are limited and do not sufficiently encompass all those issues which lead to the confidence that sustainability will be achieved. Section 7.3 reinforces the view that the framework is able to provide benefits to the problem of decision making for sustainability, on the basis of two applications in different contexts. Section 7.4 provides some final remarks relating to the assessment.

7.1 An assessment of the Comprehension of the Aspects

Winfield and Basden (1996) have suggested that an understanding of the modalities is developed on an intuitive basis. Taking their suggestion, the assessment on the comprehension of the modalities and their meaning has been undertaken on the basis of an *ex-tempore* exercise with different panels of respondents where the panels were asked to classify a number of issues related to the built environment (attributes and institutes) according to the modalities.

The two stages took place at different times; the first at an early stage of development of the research, the second at a later stage. The general purpose of the two assessment exercises was to show that Dooyeweerd's modalities and their specification can be employed to understand and to evaluate sustainability in urban planning since they are expressed in a language which is generally understood by users (see sub-hypothesis *b* in Section 1.3).

The two assessment exercises were designed to accomplish a number of different tasks. The first exercise focussed on an assessment of the original terminology of the modalities, as explained by their meaning nuclei (see Table 3.3), based on their association with some every-day-experience issues, as randomly selected from Table 4.1. The second one focused on an assessment of the new definition provided for the aspects, in relation to the modalities and their meaning nuclei. It has also checked the different understandings of the modalities by users when they are introduced to the philosophy of the Cosmonomic theory.

It is worth recalling the reason why each modality was redifined in this study. This was to provide a definition which would be more specific in the context of an evaluation of sustainability in planning as well as more familiar to stakeholders and technical decision makers (see Section 6.1). The new definition is based on the results of the analyses undertaken in this study (see Sections 4.2 and 5.2), taking the results of other people's work on the viewpoint of stakeholders (see Section 6.1.1) as well as the results of the first assessment of the modalities (see Section 7.1.1) into account.

In both the assessments that are illustrated in Section 7.1.1 and 7.1.2, students of environmental engineering, planning and architectural fields have taken part in the exercise. However, both the composition and the number of the respondents in each panel was kept flexible for the assessment exercises. The reason for this was mainly because of practical circumstances. However, the cultural differences within each group have also created an unexpected additional test for the understanding.

The following two sections provide a summary of the results obtained from the first assessment and the second, respectively.

7.1.1 First Assessment Exercise on the Understanding of the Modalities

The ability to analytically or logically understand and classify elements is a well recognised common characteristic of the human mind, although it may differ and vary from individual to individual (Saaty, 1980; Saaty and Vargas, 1984a; Strauss, 1984).

The assessment exercise developed in the course of this study was undertaken on the 16th October 1998 inside a lecture hall at the Polytechnic of Turin, using a panel of fortyone under-graduated students in environmental engineering.

The exercise consisted of asking the students to classify two sets of fifteen words which define attributes and urban institutes, into modalities. The purpose was to verify the general comprehension of the aspects. This, in turn, would have suggested that the check-list of fifteen Dooyeweerdian modalities can offer a robust classification system for the issues related to planning and the built environment.

The two lists of words were taken from the analysis of the built environment illustrated in Chapter 4.0 and specifically in Table 4.1. These words were randomly selected from the list, particularly those related to the institutions. The selection of the attributes, however, followed a more focused process, directed towards the identification of key issues for the evaluation of sustainability in the built environment. In other words, these issues would have represented an alternative definition for the modality in the evaluation framework.

The students were required to match each attribute and each artefact to a modality, within 30 minutes. They were provided with two lists, one of attributes and one of artefacts.

The lists did not follow a prescribed order and were not supported by any explanation or definition. The only guide for the students was the meaning nucleus of each modal aspect. Figure 7.1. shows the table and the lists provided to the students.

Figure 7.1 – The assessment exercise: "Insert the right term within the right aspect"

ASPECTS	MEANING OF EACH ASPECT	ATTRIBUTES	INSTITUTIONS
Quantitative	Awareness of 'how much' of things		
Spatial	Continuous extension		
Kinematics	Movement		
Physical	Energy, mass		
Biological	Life function		
Sensorial	Senses, feeling		
Analytical	Discerning of entities, logic		
Historical	Formative power		
Communicative	Informatory, symbolic representation		
Social	Social intercourse, social exchange		
Economical	Frugality, handling limited resources		
Aesthetics	Beauty		
Juridical	Retribution, fairness, rights		
Ethical	Love, moral		
Credal	Faith, commitment, trustworthiness		

ATTRIBUTES		INSTITUTES	
a) Signing	b) Form, shape	1) Bank	2) Street
c) Perception	d) Traffic	3) Clubs	4) The Media
e) Efficiency	f) Teaching	5) School	6) Tribunal
g) Interest	h) Sizing	7) Church	8) District (area)
i) Pollution	j) Solidarity	9) Census office	10) Building
k) Ownership	l) Synergy	11) Archive	12) Asylum
m) Materials	n) Technology	13) Hospital	14) Art gallery
o) Harmony		15) Voluntary centre	

The students knew nothing about the theory of Dooyeweerd and therefore were not driven or conditioned into making their choice.

The development of this exercise with 41 people has produced 82 lists containing 15 elements each, resulting in a total of 1230 allocations for the classification framework. A data entry was developed to automatically count the number of correct answers within each modality. An analysis of the responses was supported by an *Excell* package containing the statistical calculation "Count-if".

The following two Tables, 7.1 and 7.2, illustrate the results of this analysis separately for the two lists, and show how many times an issue, respectively, an attribute or an institutes, has satisfied the criterion of "Count-if". Thus, for example, in Table 7.1, the attribute (*a*), *signing,* has satisfied the criterion 32 times (out of a total of 41). This means that 32 students were able to classify it within the right level of Communicative, while only 9 (students) were not. Among these, one (student) associated it to the spatial modality (SP), one to the analytical modality (AN), one to the social modality (SO), while one did not give any answer and five associated it to the historical modality (HI).

Table 7.1 – Number of responses within each attribute in the list

	n.	QU	SP	KI	PH	BI	SE	AN	HI	CO	SO	EC	AE	JU	ET	CR
Sizing	**21,0**	21,0	3,0	1,0	6,0	1,0	1,0		1,0	1,0	1,0	1,0		2,0		1,0
Form	**16,0**	17,0	16,0		2,0	2,0	1,0			1,0				2,0		
Traffic	**36,0**			36,0						4,0	1,0					
Materials	**25,0**	1,0	4,0		25,0	1,0	1,0		3,0		1,0	1,0		3,0	1,0	
Pollution	**23,0**		1,0			23,0	1,0		1,0		7,0	1,0	3,0		1,0	
Perception	**33,0**		2,0				33,0	1,0	1,0	1,0			1,0	1,0	1,0	
Teaching	**8,0**		6,0					8,0	**15,0**		1,0	5,0		2,0		
Technology	**8,0**	1,0		1,0	2,0			**25,0**	8,0			1,0				1,0
Signing	**32,0**		1,0					1,0	5,0	32,0	1,0					
Synergy	**24,0**			1,0				2,0			24,0			2,0	5,0	5,0
Efficiency	**30,0**			1,0	1,0	1,0		1,0	2,0		1,0	30,0		4,0		
Harmony	**29,0**		6,0			1,0	2,0	1,0	1,0				29,0	1,0		
Ownership	**22,0**		1,0		1,0	3,0		1,0						22,0	7,0	4,0
Solidarity	**19,0**					2,0	1,0		1,0						19,0	15,0
Interest	**15,0**						3,0	3,0	1,0		3,0		9,0		5,0	15,0

It may be worth noting, within the same Table, that some issues are better understood than others. For instance, the issues of traffic (kinematics), perception (sensitive) and efficiency (economic) achieved a higher number of responses by the students. These three terms are keep in the development of the framework for evaluation of sustainability in the built environment (see Appendix C).

On the other hand, two specific issues, i.e. Teaching and Technology, do not reach a good level of performance since the majority of allocations were made to the wrong aspect. The issue of Teaching is more frequently associated to the historical aspect while Technology is associated to analytical. This does not necessarily mean that the two modalities (analytical and historical) have been misunderstood by the students. The result is due to the choice of the entry. In particular, education, and therefore teaching, implies cultural formation which is the essence of the historical modality. Therefore the association made by the students is not completely wrong.

The term Technology can also be misleading since it embodies a certain level of analysis. A better explanation of the two modalities would probably have helped the students to classify the issues correctly.

The general conclusion of this discussion, therefore, is that the two issues, teaching and technology, are not useful as specifications of the modalities in the context of planning and the built environment. Consequently, in the development of the evaluation framework, they are not selected.

Additional terms which need a better specification are: form (spatial), solidarity (ethical) and interest (credal). On the contrary, a good performance was achieved by the terms: signing or advertising (communicative), harmony (aesthetic), materials (physical), synergy (social), pollution (biologic) and ownership (juridical). All these specifications of the modalities are above the arithmetic mean. However, they may require a better specification in the analythical framework (see Section 7.1.2).

The same rule of analysis and reading-key is applied to the second list of issues - urban institutes - illustrated in Table 7.2. Here, the number of correct responses is higher than in the previous table. It is also remarkable to note that the two issues related to analytical (school) and the historical (archives) again receive the minimum number of correct responses among the aspects, followed by the numerical (census office). The best performance is achieved by the juridical modality (tribunal) and by the kinematics (street), biological (hospital) and credal (church) modalities.

The final percentage of correct answers provided for each modality by the sample of participants is illustrated in Table 7.3. This table lists the two sets of words in their correct position within each modality and shows the percentages of right answers for the two sets of terms. For example, 51 % of the 41 students selected the right word (sizing) for that modality (quantitative). Figure 7.2 provides a graphical representation of the same results.

Table 7.2 – Number of responses within each institute in the list

	n.	QU	SP	KI	PH	BI	SE	AN	HI	CO	SO	EC	AE	JU	ET	CR
Census office	**18,0**	18,0	1,0		2,0			2,0	14,0			3,0				
Urban area	**33,0**		33,0		5,0		1,0			1,0						
Street	**40,0**			40,0			1,0									
Building	**29,0**	3,0	2,0		29,0		2,0			1,0	2,0					
Hospital	**40,0**					40,0	1,0									
Asylum	**24,0**		1,0	1,0			24,0			5,0	3,0		3,0		1,0	1,0
School	**16,0**	10,0	1,0				1,0	16,0	11,0		2,0					
Archives	**15,0**	6,0			1,0			18,0	15,0			1,0				
The Media	**30,0**	2,0	1,0		1,0		3,0	3,0		30,0	1,0					
Clubs	**29,0**		2,0			1,0	2,0	1,0		1,0	29,0				5,0	
Bank	**36,0**				2,0				1,0			36,0			1,0	
Art gallery	**38,0**										2,0		38,0			
Tribunal	**41,0**													41,0		
Voluntary centre	**33,0**						3,0			1,0	1,0				33,0	2,0
Church	**40,0**														1,0	40,0

Table 7.3 - Percentage of correct answers within each aspect on the total of the (41) respondents

MODALITIES	ATTRIBUTES	%	INSTITUTES	%
Quantitative	Sizing	51%	Census office	44%
Spatial	Shape	39%	District	80%
Kinematics	Traffic	88%	Street	98%
Physical	Materials	61%	Building	71%
Biological	Pollution	56%	Hospital	98%
Sensorial	Perception	80%	Asylum	59%
Analytical	Teaching	20%	School	39%
Historical	Technology	20%	Archive	37%
Communicative	Signing	78%	The Media	73%
Social	Synergy	59%	Clubs	71%
Economical	Efficiency	73%	Bank	88%
Aesthetics	Harmony	71%	Art gallery	93%
Juridical	Ownership	54%	Tribunal	100%
Ethical	Solidarity	46%	Voluntary centre	80%
Credal	Interest	37%	Church	98%

From Table 7.3, it is clearly recognised that, as a total, the percentage of right answers within the sample is quite high. This positive result is even more emphasised if we consider that the human mind finds it difficult to analyse (and compare) at the same time more than seven issues (the maximum number being nine), as tested by several psychological studies (Saaty and Vargas, 1982; 1984a). Here, the exercise was even more complex because there were two lists of 15 issues each.

Comparing the results obtained from the two lists of issues, it can be remarked that a higher percentage of correct answers is achieved within the second list of words, corresponding to the artefacts (urban institutions). Figure 7.2 makes this more clearly visible by showing the 'gap' between the curve related to the list of attributes and that related to the list of institutes. In particular, the latter is higher than the former. This distance is measured in percentages of responses and it increases linearly with the variation of percentage achieved by the same modality in the two separate lists of issues.

Particularly relevant, in this respect, is the gap in the spatial, biological, juridical ethical and credal. A possible explanation of this result is that students (and human beings in general) are more familiar with tangible examples, things, artefacts, etc. Studies on this matter have suggested that the human mind is better able to understand an 'entity' within its context rather than in isolation (Bocchi and Ceruti 1994; Nath and Taly, 1996).

Finally, this exercise has clearly recognised that some aspects, e.g. analytical and historical, need more attention than others and certainly a better specification. As already acknowledged, the choice of the entry for the analytical played a large role and a better explanation for this modality would probably have helped the students to correctly classify the issue.

The purpose of this exercise was to point out problem areas which need addressing. Therefore, in the development of the framework for the evaluation of sustainability in planning and the built environment (see Section 6.1), a better specification was provided for each of the 'weak-defined' aspects illustrated in this exercise. The second assessment of the modalities in Section 7.1.2 shows the benefits of this new vocabulary.

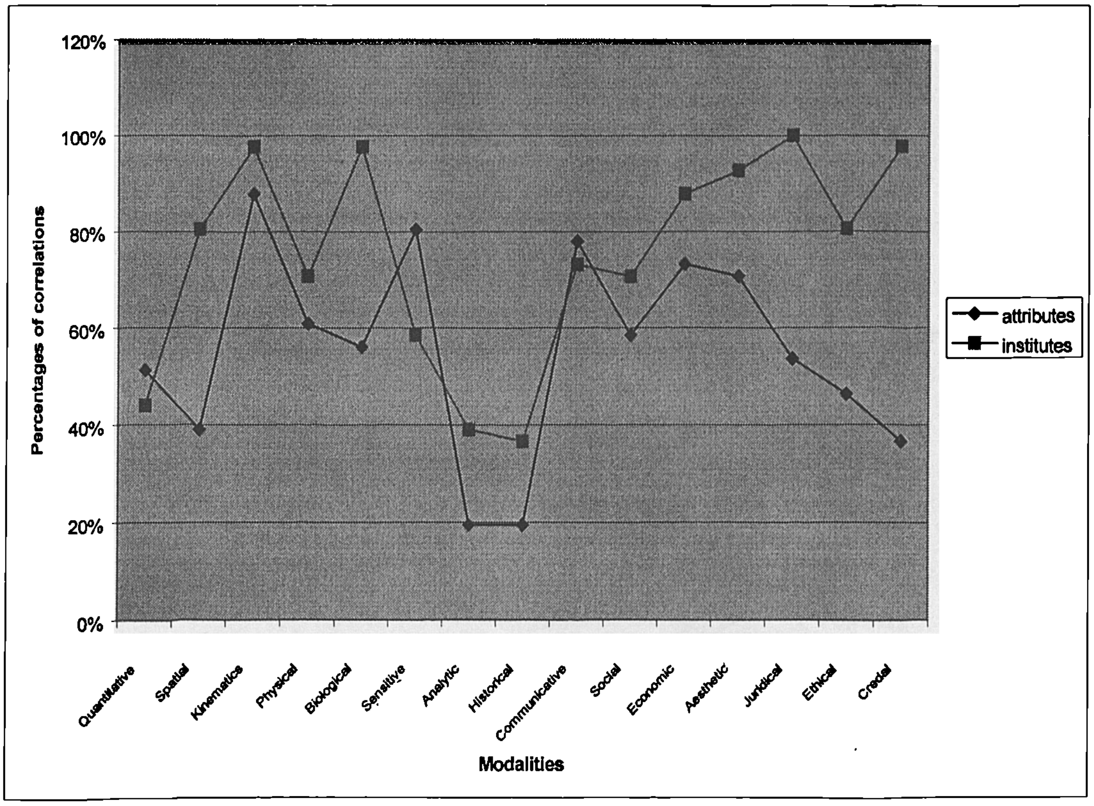


Figure 7.2 –The percentage of correct responses within each modality

7.1.2 Second Assessment Exercise on the Comprehension of the Aspects

The new definition provided to each modality was illustrated in Chapter 6.0 (see Section 6.1). It took into consideration feed back from the results of the first assessment of the modalities, providing a better specification (more focussed on the evaluation of the built environment for sustainability) for some aspects. Thus, for example, the analytical and the historical aspects were defined respectively, "Analysis and formal knowledge" and "Creativity and cultural development".

Following an assessment similar to the one previously illustrated, a second exercise was undertaken to check the understanding of the new definition of the modalities by 'potential' users or stakeholders. This took place at a later stage of development, in May 1999.

This new assessment exercise was developed using two panels of eighteen post-graduated students each, attending two different Specialisation Schools, respectively, at the Polytechnic of Turin on Cultural heritage (panel 1) and at the ENAIP Centre of study in Trieste on Waste management (panel 2).

The students from the Cultural heritage school have a similar formative background in Architecture. The students from the Waste management school, however, have different degrees: philosophy, chemistry, language, natural science, biology, political science, economy, and humanities. In addition, the first panel of respondents were briefly introduced to the theory of Dooyeweered (at a superficial level), while the second panel were not. Therefore, it was also possible to weight the influence that this issue has on the general understanding of the aspects from the user's viewpoint.

The exercise consisted of correlating the aspects, as they are now defined in section 6.2 (from now on, they are named "sustainability aspects") just with the Dooyeweerdian modalities. As in the previous exercise, the list of sustainability aspects did not follow a prescribed order. However, the modalities were listed within their order in connection to their meaning nuclei. The students were required to insert the right sustainability aspect in the right level of modal order. The two panels of respondents were given the same amount of time (15 minutes) to complete this exercise.

At the end of the exercise, a total of 36 lists with about 540 entries were collected. As for the previous assessment exercise, these responses were translated into an electronic data entry where the simple statistical calculation of 'Count-if' was applied to count the number of correct responds within each aspect.

Table 7.4 shows the results of this analysis, in percentage terms, on the total achieved by each aspect for the two separate panels. Figure 7.3 provides a graphical representation of these results.

On average, the percentage of right answers within the panels of respondents is very high (the arithmetic mean is 91,46 in panel 1 and 86,86 in panel 2). The maximum is 100% in both panels, related to the *physical environment* (physical) and *health & bio-diversity* (biological). The minimum value in panel 2 is 75% while in panel 1 it is 81%; both the minimum values are related to a 'soft' aspect, such as the *ethical*. This reinforces the previously expressed view that tangible things are easier to understand (see Section 7.1.1).

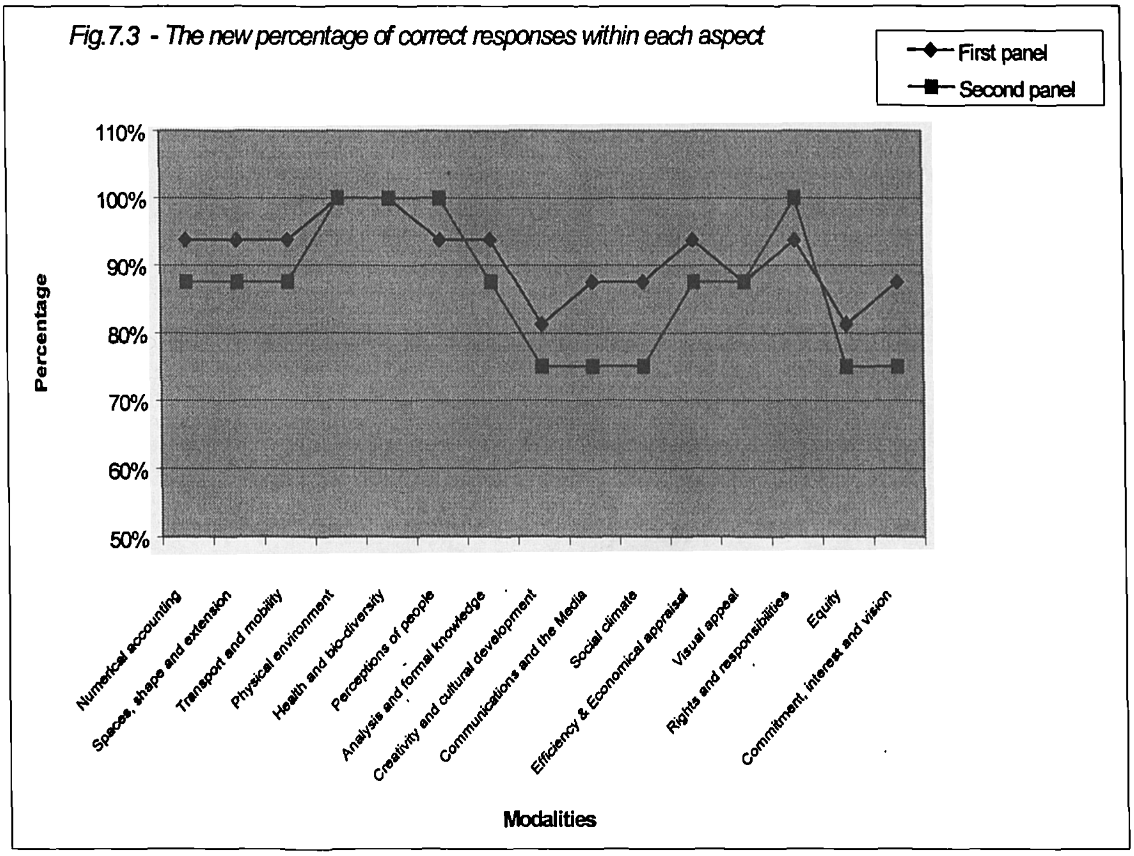
Some mistakes are, for example, the identification of ethical (defined as equity in the list) with the credal modality; of efficiency (economic) and analysis (analytical) with the numerical aspect; of cultural development with the social modality or the communicative modality. However, these 'mistakes' are very rare while the percentage of 'right' answers is high.

Table 7.4 – Percentage related to the number of right answer in each panel (1 and 2)

MODALITIES	ISSUES	PANEL 1 (%)	PANEL 2 (%)
Quantitative	Numerical accounting	94%	88%
Spatial	Spaces, shape and extension	94%	88%
Kinematics	Transport and mobility	94%	88%
Physical	Physical environment	100%	100%
Biological	Health and bio-diversity	100%	100%
Sensitive	Perceptions of people	94%	100%
Analytical	Analysis and formal knowledge	94%	88%
Historical	Creativity and cultural development	81%	75%
Communicative	Communications and the Media	88%	75%
Social	Social climate	88%	75%
Economical	Efficiency & Economical appraisal	94%	88%
Aesthetics	Visual appeal	88%	88%
Juridical	Rights and responsibilities	94%	100%
Ethical	Ethical issues (equity)	81%	75%
Credal	Commitment, interest and vision	88%	75%

In this exercise, the two panels have shown a very slight difference in understanding (see also Figure 7.3). In general, the percentage is higher for the first panel. This better performance of panel 1 is probably due to the brief illustration of the Cosmonomic theory that was provided before the exercise. The only exception to this observation is the minor percentage obtained by panel 1 in relation to the sensitive and juridical aspects. These aspects achieved the highest level of performance (100%) with panel 2. However, the difference is very small (only 6%) and the simple is also very small.

Fig.7.3 - The new percentage of correct responses within each aspect



A comparison with the results obtained in the previous assessment exercise (see, in particular, the column of *attributes* in Table 7.3) is also useful in that it shows an evident increase in the percentage obtained in each aspect.

On average, the understanding of each aspect increases by about 35 percent. In panel 2, the comprehension of the analytical and historical modalities increases by, respectively, 68 percent and 55 percent, although these terms still remained difficult to 'grasp' for a few of the respondents.

This means that the second selection of sustainability aspects is more appropriate than the previous one and better explains the meaning underlying the modal aspects. It is worth recalling, however, that in this second exercise, the students had only one list of issues to allocate within the modal order (but they also had a shorter time to complete the exercise) and that both the panels were composed of postgraduate students.

Finally, it is remarkable to note that the biological and the juridical aspects (particularly in the second panel) are still the aspects which are more clearly understood by the students. This means that the two modalities are sufficiently explicative and can be defined either, as *pollution* and *ownership* (as in the exercise of section 7.1.1) or as *health & biodiversity* and *right & responsibility* (as in the present exercise).

In conclusion, the results of this assessment exercise would suggest that the new terminology provided for the modalities is, in itself, appropriate and, therefore, the theory of the modalities can be transferred - as it has been done in this study - to the built environment.

The aspects are sufficiently comprehensive as such, without any illustration either of the theory of Dooyeweerd or the meaning that each aspect has for an evaluation of sustainability. However, as the reader will remember, the framework does include an explanation of each aspect; it also illustrates a number of questions with the aim of guiding users in the process of evaluation (see Appendix C).

A final remark. Although the headings under which the evaluation of sustainability can be made is important, it is the definition under those headings that is more relevant and meaningful for a decision making process. Therefore, while the specification of each aspect can change, and probably will, though time, as people begin to use the framework, the meaning under the heading will remain. In other words, this assessment does not invalidate the classification structure underpinning the framework.

7.2 An Assessment of the Transparency and Replicability of the Framework

This section aims to provide evidence for the comprehensiveness of the aspects for the long term planning of a situation (see sub-hypotheses *a* and *c* in Section 1.3). This study suggests an assessment approach based on case studies. In particular, it proposes to use examples of decision making problems which have been tackled previously by some traditional evaluation methods. Thus, it is possible to compare the new approach with those undertaken previously in order to see whether there is an improvement.

A reason for choosing this assessment approach rather than, for example, a sound argument based on a literature search, depends on the fact that the aspects, as they appear within the framework now, are themselves a result of an extensive literature review on sustainability (see Section 5.2); thus it would appear trivial to assess them within the context of a literature review. Another possibility would have been to develop pragmatic testing based on empirical observation or experience, employing statistical inferencing or inductive approaches. However, this would have only produced limited results, as already discussed in the general introduction to this chapter. Certainly, more testing is required in the future as this information is made available to the public scientific domain.

In each example, it is shown that the framework is able to render all the factors underlying the decision making explicit, pinpointing the limitations of the method which was used in the case study (see hypothesis 1 in Section 1.3). In turn, this will help to illustrate that the framework is comprehensive and able to sufficiently address the identified problems (see hypothesis 2 in Section 1.3).

The case studies are well known to the writer and enable her to apply (conceptually) the structure underlying the framework. They are also related to different planning situations in order to show the flexibility of the framework to different contexts and its potential generalization (i.e. its replicability). As already stated, planning and design are multi-aspect activities and generally propose a continuous variety of different problems that challenge designers (see Section 5.2).

Three case studies are selected which are specifically related to the following major current planning problems for sustainability (UNCHS, 1996): urban regeneration and management of either historical contexts or technological infrastructures.

Within the first problem, an example is illustrated of how a financial cash flow analysis is able to tackle the problem, showing that a number of aspects - which are important for the true long term sustainability – are left uncovered. Within the second context, the following two examples are provided: an evaluation of local built heritage, on the basis of the contingent valuation method, and a selection of a new waste treatment for the city of Turin, tackled by multicriteria methods.

All three case studies are documented, respectively, in the following publications and reports: Gabetti & Isola (1998); Sirchia (1997); Lombardi and Zorzi (1993). No detailed background illustration is therefore provided (also justified by an economy of space within this thesis).

Between the three case studies, there is a slight difference in terms of time, as the last example dates back to the beginning of this decade while the first one relates to the end of the decade. There are in fact five years of difference. However, this does not discredit the contents of the following sections.

7.2.1 Example 1: Urban Regeneration

The recovery of redundant areas puts into play important resources with significant public consequences. It inevitably involves an interaction between some public and private parties such as major developers and investors, (planning authorities, holding companies, financial institutions). The areas considered for a conversion process of urban functions often have a rich urban significance and their position is generally close to a large and active city. This is the case of the ex-industrial area of Sesto S.Giovanni, a small town close to Milan (Italy).

The urban regeneration (still at a procurement stage) includes a large amount of redundant areas (40 hectares) in a district named the Falck area, after the owner, the Falck S.p.a. industrial company. The redevelopment process has only recently taken place thanks to an agreement between local authorities, the owner and some major investors. A design competition was recently developed (October 1998) where competitors were asked to come up with solutions for a new urban park. The principles underlying the future park were explicitly related to a sustainable development.

The park was intended to create a new urban system made up not only of residential, services, tertiary and commercial functions but also of a productive, educational centre based on innovative technologies and post-industrial scenarios. Planning proposals were also required to take into account the protection and the putting back together, in a new way, of existing ex-industrial archaeological structures.

The following analysis refers to only one of the projects presented in the above competition and specifically concerning the economic-financial cash flow analysis which was developed to support the feasibility of the project presented by the design team (Gabetti & Isola, 1998). In particular, a summary "highest and best use" analysis (Prizzon 1994) was developed to support the view of designers with regards to the expected return of capital that the new development could generate. This used a property market survey of the area and its surroundings. Surveys for real-estate market analyses generally make use of recent population, sector, building owner, transaction and market price trends.

The cash flow analysis is based on the appraisal and financial accounting of a variety of scenarios. A major assumption is that a percentage of buildings will be sold to the private real-estate market and a percentage will be managed by a public-private development society for renting out. A second major assumption is the choice of the interest rate to be used in the calculation of the net present value (see Appendix A). The active and passive financial interest rates that are used for the accounting of the financial cash flow are also not universally fixed and valid but depend on the assumptions made by the analyst and on his/her own experience and knowledge of the property market. It is assumed that only analyses developed by very skilled real-estate market experts or financial experts, economists and surveyors (or architects) can be trustworthy.

An economic-financial cash flow analysis basically takes the structure of a cost-benefit approach into account but it considers only a financial point of view. The focus of the analysis is the estimation of a net present value for the development to take place. The benefits and the cost of an action are counted within a specified analysis time period, which is fixed by the analysts. The time scale considered in this project appraisal is 6 years for the construction activities and a total of 25 years for the cash flows.

This traditional approach for project appraisal makes use of market prices and financial interest rates. Therefore, only monetary and financial data are used in the analysis. The hypotheses on which the application is founded are supported by some additional socio-economic information.

In terms of urban sustainability, an analysis based on only market prices and financial issues is limited by not considering externalities and intangibles. These major limitations have already been highlighted by environmental economists, as illustrated in Chapters 2.0 and 3.0 of this thesis.

From the foregoing discussion, the major strengths, weaknesses, opportunities and threats of this approach are recognised as follows:

Strengths: Clear results for developers and investors, easy to read and to understand

Weaknesses: Subjective assumption in the forecasting. Poverty of the results with regards to externalities and intangibles

Opportunities: Vision of the market 'strength' of the development. The results of this analysis may be used by public sectors and local administrations to negotiate social services with private investors.

Threats: Social and community rights. Environmental rights. Stakeholders and citizens have no voice.

Most of these limitations have already been revealed by the literature available in the field of planning evaluation and sustainability (see Chapter 2.0 and Appendix A).

Additional limitations can be revealed by the PICABUE approach and, specifically, that all the four principles of equity, environment, futurity and public participation are missing. Clearly, this is not sufficient to identify what is specifically lacking in this analysis. Although useful, the PICABUE approach is limited (see Section 6.2), as "it inadequately expresses other important dimensions of sustainable urban development such as heritage, aesthetics and ethics" (BEQUEST, 1999).

On the contrary, an application of the structure underlying the analytical framework which has been developed in this thesis is able to provide the required information, as shown in Table 7.5.

Table 7.5 – Analysis of the cash flow application on the basis of the aspects included in the framework

ASPECTS	MAJOR CONCERNS REGARDING SUSTAINABILITY
Numerical accounting	Refers to the counting of the benefits and the cost within a specified analysis time period.
Spaces, shape and extension	No concerns for the future need of spaces and people 'outstanding' the market force (e.g. poor and disadvantaged)
Transport and mobility	Concerns limited to current needs
Physical environment	Concerns limited to the building characteristics within the market survey. No energy concern. No attention paid to the carrying capacity of the site.
Health, bio-diversity and ecological protection	Concerns limited to the green park within the market context. No ecological concerns e.g. pollution.
Perceptions of people	No concerns outside the market survey. Here, people are considered only as 'consumers'.
Analysis and formal knowledge	The analysis is limited to the market surveys. It does not allow an understanding of quality in planning
Creativity and cultural development	Concerns limited to the present development within the context of the market forces. No attention to the historical development of the site
Communications and the Media	Only relates to the language of the market
Social climate, social relationships and social cohesion	Individuals are not only consumers in a market system. It does not allow an appraisal of the social relationships unfettered by supply/demand considerations
Efficiency & Economical appraisal	Strong concerns
Visual appeal	No concern
Rights and responsibilities	Limited to only real estate market issue, may possibly generate threats to poor and disadvantaged
Ethical issues	No concern. Inequalities may be generated from the development and the general moral of citizens may decrease
Commitment, interest and vision	Limited to the 'institutional' interest revealed by the presence of regional schemes. No community commitment assessment.

7.2.2 Example 2: Total Economic Value of a Historical Building

This example deals with the building level and specifically with the forecasting of an 'option value' (see Section 3.1.) for a historical building. As specified by Sirchia (1997), this estimation aims at improving future cultural heritage management policies, as the handling of these resources is often inefficient, from an economical point of view, because of the implicit dimension of their economic value .

The historical physical asset of architectural significance is the castle of Rivoli, in the metropolitan area of Turin (Italy). This built heritage is a great Baroque complex - the architectonic project dates back to the 15^{th} century and was revised first by Castellamonte and later by Juvarra – and is part of the cultural circuit of historical Residences of the Savoy monarchy. In 1979, the castle was restored as a Museum of Contemporary Art, housing both permanent and high profile temporary exhibitions. At the same time, it is a museum in itself, thanks to its architectural and historical qualities.

A contingent valuation method (CVM) was applied to forecast an economic 'option value' for the building. Compared to the use value which directly refers to the profitability resulting from consumer functions, this method is related to the aesthetic, visual or recreational uses of the resource. Sirchia argues that usually only the direct use value which refers to the profitability resulting from consumer functions is taken into consideration in decision making.

The CVM was directed to the valuation of the willingness to pay (WTP) of the direct users of the castle so that in the future it would be possible to keep the same current level of cultural services. The results were obtained through a regression of a logical type. The WTP was obtained as a monetary flow of approximately 1.400.000.000 Italian lire (Sirchia, 1997).

As already discussed in Chapter 2.0 (see also Appendix A), although progress has been made in devising a monetary value for intangibles, such as visual, aesthetic or ecological qualities (Bishop and Heberlein, 1979; Bishop, 1982; Cummings et al., 1986), CVM is still affected by some of the limitations of all the monetary groups of techniques of straightforward cost-benefit analysis (Dixon et al., 1986).

The following SWOT analysis summarises the main features illustrated by current literature on planning evaluation:

Strengths: CVM results in a single very understandable measure which is expressed in monetary terms. It is able to capture many of the 'externalities' of environmental and cultural resources.

Weaknesses: CVM takes into consideration individuals as consumers. Individuals, however, are also citizens who represent collective preferences and interpersonal values.

Opportunities: CVM provides a monetary measure to many 'invisible' functions of natural and cultural resources and their interrelations within the ecosystem (the cognitive problem of implicit demand layers) as an aid to decision making.

Threats: CVM lacks an understanding of the preferences of future generations and the problem of time preference of today's generations. These pose the problem of legitimacy of the 'commodity fiction', by which the subject of trade (a natural or cultural asset) is reduced to the form of a commodity in a hypothetical market.

Again, as in the first exercise, a more detailed analysis based on the multimodal structure underlying the analytical framework (which itself includes the four PICABUE principles) contributes, by illuminating a number of critical factors for sustainability; issues which decision makers may not be aware of or which would have been difficult to identify without the help of this check-list as a guide.

This is illustrated in the following Table 7.6.

Table 7.6. – Analysis of the CVM application on the basis of the aspects included in the framework

ASPECTS	MAJOR CONCERNS REGARDING SUSTAINABILITY
Numerical accounting	Data collection on the social economical characteristics of the interviewers
Spaces, shape and extension	The building area and the surroundings for the surveys
Transport and mobility	The mode of transport and the travel required for users to visit the castle
Physical environment	Only the castle as the object of the analysis
Health, bio-diversity and ecological protection	Not considered
Perceptions of people	Only the perception of interviewers and interviewees
Analysis and formal knowledge	Great detail in the development of the analysis
Creativity and cultural development	Protection of the historical environment is the focus of the analysis within a hypothetical planning scenario
Communications and the Media	Social surveys based on questionnaires and interviews
Social climate, social relationships and social cohesion	Only the tourist community is considered
Efficiency & Economical appraisal	Individuals willing to pay for, or willing to accept, are the criteria used as compensation for a certain change in the level of provision of goods
Visual appeal of buildings and settings	The historical building is an art gallery and the visual impact is relevant here
Rights and responsibilities	There is a juridical reason underlying the analysis. Individuals represent collective preference which may be translated into norms and institutions such as in the USA market of pollution rights. Legal institutions traditionally protect heritage value as a 'merit good', i.e. goods whose value do not derive from consumer preferences
Ethical issues	Some attention is paid to future generation needs by means of the concept of interpersonal interest of citizens (Pearce et al, 1991). The scenario considered for the evaluation is hypothetical and there is no certainty that both present and future generations will enjoy the built heritage. Both the understanding of the preferences of future generations and the problem of temporal preference of today's generations pose the problem of legitimacy of the 'commodity fiction', by which the subject of trade (a natural or cultural asset) is reduced to the form of a commodity in a hypothetical market.
Commitment, interest and vision	Survey techniques may be efficient to stimulate decision makers with a common vision. However, only interviewees ("the tourist society") are those who participate in the decision making process

7.2.3 Example 3: Selection of Municipal Waste Treatment System

This example deals with a major ecological issue of concern for sustainability: the problem of municipal waste. This generally consists of organic substances, paper, metals, textiles, glass, synthetic materials and a large variety of small quantities of toxic substances. Municipal waste is generally collected in most European cities, although in deteriorating neighbourhoods removal systems do not always work adequately, due to a lack of public funding.

In Europe, between 150 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 production of municipal waste, indicating an increase in production of municipal waste at the rate of 3 per cent 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 plastic 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 per cent of produced waste. Incineration of municipal waste causes a reduction of up to 30% in weight of the initial quantities of treated waste and can be designed to recoup the energy content of the waste. On the hand, however, this can cause notorious problems of air pollution, harmful and toxic waste products. In addition, it is very costly and extremely difficult to manage (Stanner and Bourdeau, 1995).

Efforts are now undertaken in many cities in Europe 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 wastes that leave 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 via the system of controlled burial. Although the system is still operational, the problem of finding new technical solutions for the future remains, after the closing of the new plant which should be exhausted around the year 2003.

The decision to dispose of urban waste by means of a new landfill raises the problem of finding new suitable land sites with particular hydro-geological characteristics, such as those which are connected to possible underground water or soil pollution. In addition, negative visual impacts on the landscape can be generated during the life cycle of the tip and a considerable increase in dust, rats and insects, smell and fire hazards may occur. All these problems are at the basis of the social conflicts which are usually generated in decisions of this kind.

In the case study developed by Lombardi and Zorzi (1993), the three main systems of disposing municipal waste described above, i.e. controlled burial, incineration and recovery/selection, were analysed and an environmental impact analysis was developed for decision making. In this application, a number of environmental factors and the social-economical issues were taken into consideration: air, water, soil, landscape, public hygiene, technological risk, economic analysis, life cycle of the system, ease of operation. An assessment of the significance of each impact, in terms of reversibility and duration in time, was also developed by taking a 9-point measurement scale. This impact analysis formed the basis of the application of three different multicriteria methods (MCA), in order to devise a single preference index for each alternative system of disposing urban waste.

The reason why the two authors used three different MCA methods (while one is generally considered sufficient for this problem) is to avoid the well known problem of 'method uncertainty' (Voogd, 1983) which states that the results of a MCA application are fettered by the mathematical structure on which the method is based. Therefore, a comparison of the results obtained by different methods to the same problem may be of advantage for the decision.

The present application of MCA methods devised a final ranking of alternative options which placed a mixed waste treatment system (Selection with incinerator) at the top, as best, and traditional systems (Controlled burial and incinerator) at the bottom (the worst).

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

In devising the criteria weights for evaluation, experts have followed a 'precautionary principle' which emphases ecological issues. A minor weight has been assigned to both technological and economical criteria mostly because technical solutions may change over a long-term scenario and the economical issues are simply understood as cash flows and financial resources rather than the management of physical (renewable and non renewable) resources.

The multicriteria 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). All the three methods are illustrated in Appendix A. In the context of this case study, the main benefits and disadvantages of the above approaches, including E.I.A., may be illustrated by the following SWOT analysis:

Strengths: MCA methods have the merit of providing a unique information synthesis that can be a valuable aid for the final decision-maker, on conclusion of the assessment process.

Weaknesses: Methodological problems associated to E.I.A. are related to: difficulties of predicting impacts, absence of specific methods and consultation and participation (Wood 1995). The skill of the assessor comes heavily to bear in selecting an appropriate mix from all the different approaches, tools and techniques that are available.

Opportunities: MCA are able to determine lists of priorities from a finite series of choice options (alternatives) on the basis of identifying characteristics of the problem (criteria), which is appropriately broken down into its fundamental elements (Voogd, 1983).

Threats: Lack of definition, monitoring of on-going environmental change.

As in the previous examples, an application of the multimodal structure of the analytical framework shows a number of problems in terms of threats to sustainability, particularly with regards to the aspects which have not been included in the above analysis. In particular, it shows the lack of the issue of commitment due to the absence of community non-expert participation in the evaluation (see Table 7.7).

Table 7.7 – Analysis of the MCA application on the basis of the aspects included in the framework

ASPECTS	MAJOR CONCERNS REGARDING SUSTAINABILITY
Numerical accounting	A cardinal scale with decimal indices is 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 sustainability
Spaces, shape and extension	The analysis does not take into consideration spatial location of a waste treatment system. The only spatial concern is '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	Consideration of the landscape on one hand and the impacts to the human system from hazardous materials on the other hand
Health, bio-diversity and ecological protection	A number of environmental criteria are used in this evaluation, such as: Safeguarding the atmosphere, Safeguarding both the surface and underground water supply, Protection of public health in term of maximisation of hygiene
Perceptions of people	Not considered in the above decision making.
Analysis and formal knowledge	A criterion used to compare the relative strengths of alternative waste treatment systems is related to the analytical level as 'Easy to operate'
Creativity and cultural development	Two different criteria are used in this level, i.e. Minimisation of technological risks and maximisation of safety and Maximum life of a plant. Both are important for the sustainability principle of futurity
Communications 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 & Economical appraisal	An evaluation criterion refers to the 'Maximisation of cost/revenue ratio derived from economic analysis'
Visual appeal of buildings and settings	The visual impact of alternative waste treatment systems is not considered as such but in terms of protection of the landscape
Rights and responsibilities	Not considered. The evaluation is explicitly limited to technical issues and has no reference to political and legal structures
Ethical issues (equity)	Not considered in the above decision making
Commitment, interest and vision	Not considered. In the above decision making

Although some major environmental-technological and social-economical impacts have been taken into consideration in the assessment, the lack of elements related to users perception and to social or ethical factors, may have influenced the output, leading to a strictly 'expert-oriented' decision. For instance, the concern for non renewal 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 when placed in relation to people and the value system of the community. Outside this context, however, all these factors cannot be precisely defined and assessed in terms of sustainability. The above decision making process does not however considers these aspects.

In 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 and, in many contexts, particularly in Italy, very few, sporadic and mainly theoretical experiments are available and the results are not all satisfactory. MCA requires an explanation of the individual preferences of each decision-maker in an explicit manner (see Appendix A). They require *a priori* agreement on the criteria to be included and the weights to be assigned, avoiding interrelations between them (Zeppetella, 1997). This is not always possible or easy to carry out, therefore discussions and negotiations cannot take place.

7.3 An Assessment of the Challenge of "Opening up"

In the previous section, the three examples of the ex-ante evaluation problem have illustrated that the aspects cover a wide range of issues which are rarely addressed by current methods. Yet, this suggests that not just one but a variety of methods are required to deal with sustainability in planning and decision making, as assumed in the analytical framework developed in this research (see Appendix C). This is also the view recently supported by the BEQUEST (1999) network.

A question which arises is the following: *Can the modal structure underlying the framework be applied as such?* In other words, *Do the aspects help decision making,* *leading to an improvement in understanding, to monitoring and learning about sustainability* (final part of hypothesis 2 in Section 1.3)?

The next sections aim at answering the above question by illustrating two applications of the framework to respectively, a problem of learning and a problem of monitoring. The first application proposes an ex-post analysis of a decision making process using the aspects as a tool for detecting the stakeholders' views of the problem. The second one deals with sustainability indicators, using the modal structure as a classification system where the aspects provide the *qualifying function* (see Appendix B) for each statistical indicator. In turn, the two examples illustrate the relevance of the included aspects and, in general, the flexibility of the framework.

Details of the two examples are available in the following publications, Lombardi and Marella (1997) and Lombardi (1998b).

7.3.1 Application 1: Ex-post Analysis of a 'Typical' Decision Making Context

In current decision-making processes related to public and private sectors, conflict often occurs, for example, 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, possibility of home-ownership and social equality, mobility and conservation.

In general, urban planning laws protect the individual corporation or citizen against disadvantages and guarantees 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 lengthy negotiations without any result. In particular, there are few shared values concerning the development of the urban area nor agreement about the measures to promote development (Kaib, 1994; Koster, 1994).

If the achievements of the preferences of certain groups are in conflict, it is usually necessary to know the comparative "strengths" of the interests in order to increase the information available to assist in the resolution of conflicts through decision (Lichfield et al., 1975; Lichfield, 1996).

In this case study, the modal structure of the framework has been used as a guide for analysing the decision making process that took place in relation to the redevelopment of an ex-industrial area in Muggia (Trieste). The methodology has involved: a 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 two analyses have required investigation, collection of information and development of interviews with key actors.

The case study refers to the long decision making process that invested 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 during the year of activity of the firm by the employers, under the jurisdiction of Muggia)
- the local authority of Trieste, the biggest spatially close town to the area, which holds territorial jurisdiction over Muggia as regional capital

The opportunity of promoting a re-development of the area arose at the beginning of this decade thanks to Law n.179/92 on urban regeneration (Ministry of Public works, 1995) which facilitates public-private partnership providing national funding in order to cover the cost of the reclaimed land.

The Local Authorities and the Industrial Firm started a number of time-consuming negotiations in order to reach an agreement. The main conflicts arose in relation to the new uses to be included in the area. Muggia and Aquilinia sought residential and tourist areas, 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 cost-on of investment 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.

An analysis of the above decision-making process, using the multimodal framework in an ex-post manner, was undertaken by the author[2]. 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; the relationships between the design factors; those factors which could have led to an earlier resolution of the above conflicts. An illustration of these observations is provided in Table 7.8.

In particular, the analysis showed that there are reasons of a different nature underlying the interests of each actor (see the 'credal'), but there are also strong integrations of interest between the actors (concerning the issues of 'kinematics', 'biologic' and 'aesthetic').

The major conflicts arose in dealing with issues related to the 'economic' and 'juridical' and these have led each actor to end up with different results both in the amount of construction and in their design schemes, particularly for the land-uses and the allocation of resources (see 'numerical' and 'analytical').

For example, the purpose of the land owner was to use public resources (economic) to improve his marketing image (credal), and reduce his responsibility in construction (juridical). This results in a design scheme with a greater amount of construction (numerical) and a shopping centre (analytical). However, the same land owner was agreed with the other stakeholders with regards to the accessibility to the site (kinematics), to the land reclamation (biologic) and to a harmonisation of the re-development with the landscape (aesthetic).

[2] The author gratefully acknowledges the contribution of the civil engineer Giuliano Marella for providing all the information required for the development of this application.

Table 7.8 – Ex-post 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 vol. To increase own profit	321.000 vol. To increase young population	321.000 vol. To increase areas for tourism	352.000 vol. To increase areas for services
Spaces, shape and extension	Building layouts according to landscape	Building layouts according to landscape	Building layouts according to landscape	Building layouts according to landscape
Transport and mobility	To improve accessibility: building a new motor-way	To solve urban traffic: building a railway, a motor-way and a pedestrian street	To improve connection with Trieste: building a new motor-way	To improve connection with Muggia: building a new motor-way
Physical environment	No attention	Reduce energy use of traffic	Reduce energy use of traffic	Recycling of building materials
Health, bio-diversity and ecol. protection	Attention to reclaimed land	Attention to reclaimed land	Attention to reclaimed land & water quality	Attention to reclaimed land & water quality
Perceptions of people	To improve visual impact	To improve security	To improve visual impact	No attention
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	No attention	To break with previous activity	No attention	To develop public services and residential areas
Communications and the Media	To include signs & advertising for commercial activity	No attention	No attention	No attention
Social climate, social relations, social cohesion	No attention	To improve social interaction: e.g. design an urban square	No attention	No attention
Efficiency & Economical appraisal	To use public resources, minimising private ones	Frugality in the use of the land	To use national funding for building local infrastructures	Recycling schemes for building harbour wharves
Visual appeal	Harmony within the landscape	Harmony within the landscape	To harmonize accessibility	No attention
Rights and responsibilities	To reduce own responsibilities in construction	To move property rights from private to public sectors	To increase responsibilities of private owner in construction	No attention
Ethical issues	No attention	To improve health of families	No attention	No attention
Commitment, interest and vision	To improve its own 'image' for marketing reasons	To improve both well-being of its citizens and its-own autonomy	To improve tourism	To expand its territorial influence and develop new services

(Source: adapted from Lombardi and Marella, 1997)

This *ex-post* analysis of the conflict in this 'typical' (at least for the Italian context) decision-making process has suggested that the multi-modal structure of the framework provides a useful theoretical foundation for the comprehension of a planning (and design) process in the context of a sustainability of our built environment.

This analysis also suggests that the framework may assist in the resolution of conflicts between actors involved in a planning process. It contributes to render a number of critical factors that underlie a decision making process explicit, providing thought and 'opening up' the field to problems which were not previously evident.

An *ex-ante* application of this framework would have helped to explain the relationships between the actors, showing the aspects which qualify the interests of each actor. This, in turn, would have revealed those aspects which are in opposition and which may guide the actors towards a different result in design. Finally, it would have helped decision makers to recognise the areas where negotiation was needed.

In planning, and particularly at the strategic level, there is a great demand for but also a lack of systematic methods which are able to help the resolution of conflict between stakeholders (Bentivegna, 1999).

7.3.2 Application 2: Classification of 'Sustainability Indicators'

In this application, the framework is used as a classification system for the lists of sustainability indicators developed by different international organisations such as OECD, United Nations, EU Expert Group and European Environment Agency (see Section 2.3). In the context of this study, this application seeks to show the flexibility of the approach and the comprehensiveness of the aspects included in relation to current technical knowledge of the problem of sustainability.

As already illustrated in Chapter 2.0, the sustainability indicators are generally developed with the aim of illustrating current environmental problems, in order to assist local administration decision making processes. A general critique of these indicators has been already developed through literature, as many experts have provided their contributions to this field (see Section 2.3). This application, however, shows that the traditional indicators used in decision making for sustainability, do not put the same weight on the sustainability aspects recognised in literature. In turn, this also reveals a general imbalance in the decision making process, due to a over-emphasis of certain issues rather than others.

In this application, an analysis has been undertaken with regard to the qualifying function of each indicator, taken from the selected lists of indicators provided by official European and International sources (see OECD, 1997; UN 1995, EU, 1994). This has enabled the author to classify them, within each revised modal aspect, as shown in Table 7.9.

In this classification, the numerical dimension of each indicator is an *idiom* to represent a phenomenon qualified by a different aspect, in accordance to the *analogy* relationship between the modal aspects (see Section 3.3 and Appendix B). Only those indicators related to population (which is an issue of the 'numerical accounting') are classified within this numerical accounting aspect (Lombardi, 1998b).

This classification recognises that major information is included in the kinematics, biotic and economics while the remaining soft aspects (and particularly that of the aesthetic) are very poorly represented by means of the statistical indicator tool.

The findings of the study tend to support the view that nowadays the focus of attention is placed on the issues of 'environmental sustainability' and specifically on the threats to the natural environment due to mobility, transportation and decisions fettered by economic consideration. The extensive literature available in this area can confirm this observation (see Section 5.2).

This lack of an even distribution of indicators among the aspects may demonstrate a real gap in current technical knowledge. Certainly it is linked to the problem of measuring qualitative phenomena by means of quantitative terms. The theory of the Cosmonomic Idea supports this view suggesting that the effectiveness of an aspect as an idiom varies and the degree of correspondence declines as the distance between one aspect and another increases (see Section 3.3). Thus, the numerical aspect is not a very suitable idiom for the softer and normative aspects, such as aesthetic, juridical, and so forth. It is therefore difficult to develop numerical indicators for these soft issues (de Raadt, 1991).

Table 7.9 – A classification of statistical indicators on the basis of the revised modal aspects

ASPECTS	STATISTICAL SUSTAINABILITY INDICATORS
Numerical accounting	population density; population growth rate, number of inhabitants
Spaces, shape and extension	urban land-cover (total area; total built-up area; open area; transportation network); derelict areas; urban renewal areas; proximity to urban green area; square mitres of living space per person; average floor area per person
Transport and mobility	modal split; commuting patterns; traffic volume; transportation of goods; percentage of streets according to pedestrian accessibility criteria; number of trips pro capita in average length per mode; percentage of population living close to public transport; length of pedestrian streets; length of cycle-roads; percentage of public transport of goods (ton/km); number of private cars; length of fast motor-way; length of rail-way; length of public transport; number of people using public transport (millions); average distance from work; percentage of transport network of the total urban area; percentage of people moving in the town over the total urban population
Physical environment	energy consumption; energy production plants; surface water; percentage of listed natural areas; water consumption pro capita related to different uses; hectares of ground for agriculture
Health, bio-diversity and ecological protection	mortality rate; production of special wastes; percentage of enterprises for recycling; amount of recycled material over the total waste; waste treatment and disposal; biodiversity (e.g. number of bird species); presence of green areas (e.g. percentage of people owning a garden); air quality (long term SO_2 + TSP, short-term concentration: O_3, SO_2; TSP); quality of drinkable water; tons of white water; quality of water for swimming; quality of water on and under ground; wastewater, soil quality; contaminated lands
Perceptions of people	level of noise; noise exposition up to fixed level of decibel; percentage of housings without domestic infrastructures (gas; electricity; water); criminal rate; racism action rate; rape rate; percentage of people feeling insecure at night; fatalities and causalities from traffic accidents
Analysis and formal knowledge	Alphabetisation rate; library use rate (number of consulted books); number of research centres in the area
Creativity and cultural development	number of listed buildings; percentage of buildings needing restoration
Communications and the Media	number of principal phone-lines every 100 inhabitants; presence of information knowledge database
Social climate, social relations, social cohesion	Percentage of population participating in neighbourhood activities; percentage of population using recreational services (artistic manifestations)
Efficiency & Economic appraisal	distribution of income pro capita; rate of GNP growth pro capita; exported goods and services; imported goods and services; energy consumption pro capita per year; fuel consumption in £; energy consumption per sector and source; employment rate percentage of employment opportunities in the top-ten enterprises; real unemployment; percentage of recycled paper in public offices; number of enterprises with environmental permission; public expenditure and private investment for the environment; percentage of expenditure for environmental protection on the GNP; percentage of government funds deriving from taxes and subsides; relation between house prices and rent; percentage of people living in a state of poverty
Visual appeal	None
Rights and responsibilities	Number of juridical actions and denouncements of violation of environment regulations; percentage of control of economic activities without contravention
Ethical issues	Number of younger people participating in voluntary activities and community services; etc.
Commitment, interest and vision	Percentage of population voting in the administrative elections

With regards to an evaluation of the softer aspects, the framework developed in this research has suggested a number of alternative tools and approaches which enable decision makers and users to handle them better (see Appendix C). It has been suggested that a combination of these methods may be necessary as one alone seems insufficient to manage an evaluation of sustainability in planning (BEQUEST, 1999).

7.4 Summary and Conclusions

This chapter has tried to scientifically validate the framework established in this research by developing a number of assessment exercises within two principal fields.

The first one is related to the vocabulary included within the framework, as the issue of the comprehension and the understanding is crucial for an adoption of the framework by decision makers. The assessment has shown that although an adoption of the Dooyeweeredian terms for the modalities within the context of the built environment is reasonably understood by people, the new provided definition is useful, especially since it facilitates the comprehension of the 'more-difficult-to-grasp' aspects, such as analytical and historical. In general, the specification provided for the modalities in the context of an evaluation of sustainability in planning is clearly understood and can therefore be adopted in the evaluation framework.

The second is related to an assessment of the robustness, relevance and comprehensiveness of the framework and particularly the modal structure underlying it. In the examples related to different planning contexts provided in Section 7.2, the framework is able to make the relevant issues of a decision making process explicit and transparent in the context of sustainability. It is able to cover a wide range of issues which are rarely addressed by current methods.

Within the extraordinary variety of planning contexts and evaluation perspectives (both *ex-ante*, *ex-post* and monitoring), the framework results to be a flexible guide that is able to identify the critical factors for sustainability and the decision making problem, 'opening up' the field to problems which were not previously evident. It also shows that it is able to analyse different stakeholders' perspectives, providing useful insights for the resolution of conflicts, as illustrated in

Section 7.3.

As the planning process is itself a dynamic process that can change through time, the findings of the above assessment exercises support the view that the framework can be used in different contexts, for different problems (multi-objective), by different people (multi-person), in different periods of time (multi-period). 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 linking tools (methods) and people's views (stakeholders), a *multi-disciplinary* approach that enlarges the horizon of current practice and opens up new boundaries and directions for research work in this field.

Future, practical applications of the framework are required to test the validity of this scientific approach in real decision making, increasing the likelihood of greater sustainability in urban districts and cities. This is an evolutionary process which will develop in time but within the developed framework.

7.5 Main References

Bentivegna V., 1999, Valutazione e pianificazione strutturale, in Lombardi and Micelli (eds), *Le Misure del Piano*, Angeli, Milan, pp.41-53

BEQUEST - Building Environment Quality Evaluation for Sustainability through Time Network, 1999, *Report 1998-99*, EC Environment and Climate Research Programme, Theme 4: Human Dimensions & Environmental Change, Directorate D - RTD Actions: Environment - E.U. DG12

Bishop R.C. and Heberlein T.A., 1979, Measuring values of extramarket goods: are indirect measures biased?, in *American Journal of Agricoltural Economics*, December, pp.926-932

Bishop R.C., 1982, Option value: an exposition and extension, in *Land Economics*, n.1, pp.1-15

Bocchi M. e Ceruti M. (eds.), 1994, *La sfida della complessita*, Feltrinelli, Milano

CER-Ministero dei lavori pubblici, 1996, *Rapporto sulle condizioni abitative in Italia,* United Nations Conference on Human Settlement (Habitat II), Istanbul, 3rd – 14th June

Cole R.J., Campbell E., Dixon C. and Vrignon J. (eds.), 1995, *Linking and prioritising Environmental criteria*, Proceedings of the International Workshop CIB TG-8, 15th – 16th November, Toronto

Cooper I., 1999, Learning lessons from the UK Sustainable Cities research programme, in Lombardi (ed.), Analisi e valutazione di programmi e progetti di sostenibilità urbana. Alcune esperienze, *Urbanistica* n.112 (in press)

Cummings R.G., Brookshire D.S., Schulze W.D., 1986, *Valuing environmental goods: an assessment of the contingent valuation method*, Rowman and Allanheld, Totowa, New Jersey

de Raadt J.D.R., 1991, Cybernetic Approach to Information Systems and Organization Learning, *Kybernetes*, v.20, pp.29-48

Dixon J., Carpenter R. and Fallon L., 1986, *Economic analysis of the environmental impacts of development projects*, Earthscan, London

European Environment Agency Task Force, EEA, 1995, *Europe's Environment: The Dobris Assessment*, Earthscan, Copenhagen

Expert Group on the Urban Environment, EGUE, 1994, *European Sustainable Cities. Consultation Draft for the European Conference on Sustainable Cities and Towns*, first annual report, Aalbourg, Denmark, 24th – 27th June, Commission of the European Communities, Directorate XI, XI/307/94-EN

Gabetti R. & Isola A. in association with Oliva F., 1998, *Report of the urban design "Memoria e Oblio"*, presented to the design competition for the Urban Regeneration of the Falck areas in the city of San Giovanni (Milano), 16th October, Milan

Hinloopen E., Nijkamp P. and Rietveld P., 1983, Quantitative discrete multiple criteria choise models in regional planning, in *Regional science and urban economics*, v.13, pp.77-102

Kaib W., 1994, Urban Marketing as a third way between centrally planned economy and market economy, in Ave G. and Corsico F. (eds.), 1994, *Urban Marketing in Europe*, Torino Incontra Edizioni, Turin, pp.877-881

Koster A., 1994, Urban marketing – A new approach for town planning and a chance for reactivation of sites in old-industrial regions, in Ave G. and Corsico F. (eds.), 1994, *Urban Marketing in Europe*, Torino Incontra Edizioni, Turin, pp. 662-667

Lichfield N., 1996, *Community impact Evaluation*, UCL Press, London

Lichfield N., Kettle P. and Whitbread M., 1975, *Evaluation in the planning process*, Pergamon Press Ltd, Oxford

Lombardi P.L. and Zorzi F., 1993, Comparison between aggregated techniques for assessing the effects of decision-making processes in the environmental field, in Manso et al. (eds.), *Economic Evaluation and the Built Environment*, vol.4, Laboratorio Nacional de Engenheria Civil, Lisbon, pp.126-138

Lombardi P.L. and Marella G., 1997, A multi-modal evaluation of sustainable urban regeneration. A Case-Study related to ex-Industrial Areas in Second International Conference on *Buildings and the Environment*, CIB-CSTB, vol.2, Paris, 9th – 12th June, pp.271-279

Lombardi P.L., 1998b, Managing sustainability in urban planning evaluation, in Brandon P. (ed.), Managing Sustainability: Endurance through change, CIB World Conference on *Construction and the Environment*, Symposium D, Gavle, Sweden, 7th – 12th June, pp.2041-2050

Ministry of Public Work, 1995, *Guida ai Programmi di Riqualificazione Urbana ex law n.179/92*, Rome

Mitchell G., 1996, Problems and fundamentals of Sustainable Development Indicators, *Sustainable Development*, vol.4, n.1, pp. 1-11

Mitchell G., 1999a, A geographical perspective on the development of sustainable urban regions, in *Geographical Perspectives on Sustainable Development*, Earthscan (in press)

Nath B. and Taly I., 1996, Man, science, technology and sustainable development, in Nath, et al., (eds.) *Sustainable Development*, VUB press, Brussels, pp.17-56

OECD, 1994, Report on *Environmental Indicators*, OECD, Paris

OECD, 1997, *Better understanding our cities. The role of urban indicators*, OECD, Paris

Prizzon F., 1994, *Gli investimenti immobiliari*, Celid, Turin

Roy B., 1985, *Mèthodologie, multicritére d'aide á la dècision*, Economica, Paris

Saaty T.L. and Vargas L.G., 1982, *The logic of priorities, applications in businnes, energy, health, transportation*, Kluwer-Nijhoff, The Haugue

Saaty T.L. and Vargas L.G., 1984a, Inconsistency and Rank Preservation, *Journal of Mathematical Psychology*, vol. 28, pp. 205-214

Saaty T.L., 1980, *The Analytic Hierarchy Process*, McGraw Hill, New York

Selman P., 1996, *Local Sustainability*, Paul Chapman, London

Sirchia G., 1997, The economic valuation of cultural heritage, in Brandon et al. (eds.), *Evaluation of the Built Environment for Sustainability*, E&FN SPON, Chapman & Hall, London, pp.426-434

Stanner D. and Bourdeau P. (eds), 1995, *Europe's Environmnt: The Dobris Assessment*, European Environment Agency, Copenhagen, Chapter 10, The urban environment, pp.261-296

Strauss D.F.M., 1984, An Analysis of the Structure of analysis, *Philosophia Reformata*, vol.49, pp.35-56

United Nations Conference on Human Settlement, UNCHS, 1996, *The indicators programme: monitoring human settlements for the global plan of action*, paper - United Nations Conference on Human Settlement (Habitat II), Istanbul, June

United Nations, 1995, *Work Programme of indicators of Sustainable Development of the Commission on Sustainable Development*, Paper United Nation Department for Policy Coordinator and Sustainable Development

Voogd H., 1983, *Multicriteria evaluation for urban and regional planning*, Pion, London

Wegener M., 1994, Operational urban model: state of the art, in *Journal of the American Planning Association*, vol.60, n.1, pp. 17-29

Winfield M. and Basden, A., 1996, An ontologically based method for knowledge elicitation, in SWOT, Proceedings of the International Conference of the Swedish Operations Research Society, *Managing the Technological Society: The Next Century's Challenge to O.R.*, 1st – 3rd October, University of Lulea, Sweden, pp.72-93

Zeppetella A., 1997, Environmental assessment in land use planning:a rethorical approach, in Brandon et al. (eds.), Evaluating of the Built Environment for Sustainability, E&FN SPON, Chapman & Hall, pp.344-362

7.5.1 Papers related to this Study which have been presented at International Workshops and Conferences

Towards a multi-modal framework for evaluating the built environment quality in sustainability planning, in Proceedings of the International Workshop on *Environmental Impact Evaluation of Buildings and Cities for Sustainability,* Florence, 13th – 15th September 1995

Evaluating sustainability at a local planning level, in Proceedings of the International Workshop CIB TG-8, *Linking & Prioritising Environmental Criteria*, Toronto, Canada, 15-16th November 1995

Can multi-modal thinking represent a common understanding of sustainability?, paper discussed at the *I BEQUEST* workshop, Lake District, 16th April 1996

Sustainability indicators in urban planning evaluation. A new classification system based on multimodal thinking, in Proceedings of the II Workshop on *Evaluation in theory and practice in spatial planning*, London, 19th – 21st September 1996

A Multi-modal evaluation of Sustainable Urban Regeneration. A case-study related to ex-industrial areas, in Proceedings of the Second International Conference: *Buildings and the Environment*, Vol. 2, CIB-CSTB, Paris, June, 9th – 12th 1997

Managing sustainability in urban planning evaluation, in proceedings of the *CIB World Building Conference*, Gavle, Sweden, 7th - 12th June, 1998

Chapter 8.0 – Conclusions and further work

Do not confuse the moon with
the finger that points at it
(Zen proverb)

This study has tried to address the current need to provide a framework for making decisions that encompasses sustainability in the context of planning and design using a scientific tool which is able to structure the problem holistically.

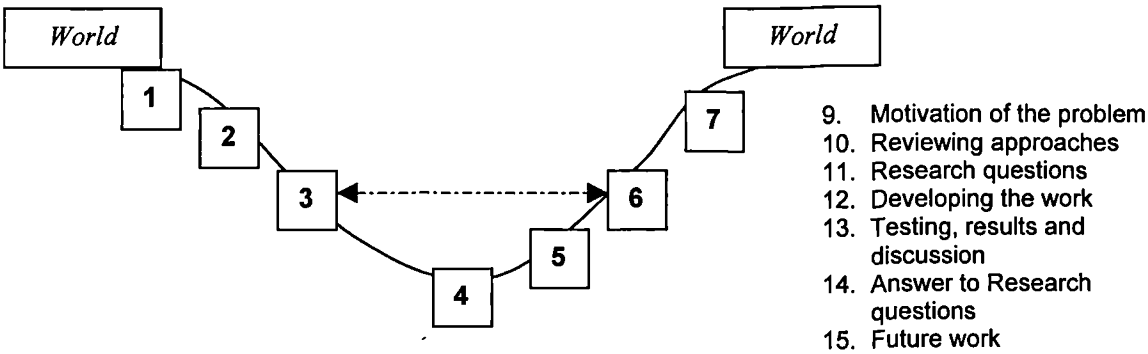
The framework has a problem solving approach but it also allows and requires the participation of citizens, as the vocabulary included is not too technical and many issues require consultation with stakeholders.

As already remarked in the conclusion of the previous chapter, this framework should not be understood as an alternative final method for problem solving in planning and design. Rather, it is intended to be an evaluation structure which makes the new perspective of sustainability in planning available, integrating the technical – scientific with the communicative approach. In other words, the framework allows a multi-disciplinary and multi-people approach to take place, enlarging and extending the horizon of current practice.

The final chapter of this thesis aims at reviewing the work that has been carried out to develop this framework, highlighting major contributions to the scientific community and discussing the main weaknesses and limitations of this study within the context of future research in this field. A number of suggestions for further developments are also made.

The research method undertaken in this research has followed a number of steps, as schematically illustrated in Figure 1.1, duplicated below. Each step has contributed to the development of the framework, addressing the hypotheses identified in Section 1.3. The main purpose of this chapter is to show how each hypothesis (and sub-hypothesis) has been tackled in each step of this study.

The chapter is structured as follows. Section 8.1 summarises the research activities and the steps undertaken in the study, reviewing the results obtained at each stage. Section 8.2 discusses the major limitations of the study, suggesting future research developments.



(Source: this scheme came out in a conversation with Dr Andrew Basden)

8.1 Review of the Performed Work and the Main Findings

The main contributions of this research to the scientific community may be summarised as follows:

- It aids definitions of sustainability, helping to resolve the 'paradox' (Merret, 1995) of sustainability (see Chapter 1.0) by using a philosophical framework which integrates subject and object and by revealing the crucial issues embodied in the concept of sustainability;
- It shows how to overcome the problems associated with the two groups of monetary and non-monetary assessment methods discussed in Chapter 2.0 by supplying a framework which includes both of them in the evaluation;
- It integrates the two streams of underpinning philosophies discussed in Chapter 3.0, realism and nominalism, in the evaluation of sustainability in planning by adopting the Cosmonomic Idea theory in the development of the framework;
- It adds value to the initial philosophical framework, by renaming the modalities in the context of urban sustainability (see Chapther 6.0);

- It identifies assessment methods for each aspect, supplying a new classification system for them (see Chapter 6.0);
- It demonstrates an approach by which this philosophy can be contextualised for the evaluation of sustainability in planning by linking questions and assessment methods to each aspect (see Chapter 7.0);
- It demonstrates that it is likely that a way can be found of making all the Dooyeweerdian aspects understandable, yet it offers an excellent simple test of understanding the modal aspects (see Section 7.1);
- It demonstrates that the Dooyeweerdian framework is usable and useful, also in conflict resolution problems and in both 'bottom-up' and 'top-down' approaches (see Section 7.3);
- It develops an initial methodology for applying Dooyeweerd's approach to a difficult new field like planning evaluation for sustainability (see Appendix C).

The motivations behind this research and which are illustrated in *Chapter 1.0* may be summarised and simply explained by saying that sustainability is a challenging concept at both scientific and practice levels. It cannot be easily defined without limiting the scope, i.e. it is beyond any definition, such as the concept of time (see Section 5.1.2). Yet, any definition requires an agreement and has to be culturally acceptable in order for it to be effective (see the example in the credal aspect in Section 5.2).

In planning for a (re)development, this implies a participation process as interests and conflicts among stakeholders occur and may stop the process. In practice, however, the sustainability concept is easily misunderstood, e.g. it is often restricted to the environment, and people have often different views and perspectives regarding it (see Section 6.1).

Therefore, decision making for sustainability, particularly in the field of planning or design, requires a framework which is able to structure the problem in order to understand and evaluate the implications that the (re)development may have in relation to the existing context. This framework should specifically enable planners and decision makers to acquire commitment and consensus among stakeholders rather than arrive at a determinative policy agenda or evaluation outcome specified by themselves.

In *Chapter 2.0* a number of existing evaluation methods have been critically reviewed and classified with the aim of discussing their major limitations in the context of decision making for sustainability and identifying the key areas and issues they are able to cover or address. Appendix A provides a summary of these methods.

This critical review was undertaken on the basis of an extensive literature search. It suggested that current technical and scientific methods are able to take only limited views. However, sustainability confronts planners and decision makers with problems which are multi-people, multi-disciplinary and multi-period (this view has been reinforced in Chapter 5.0).

At the root of many problems associated to sustainability is the difficulty of understanding the complexity underlying the planning process which, in turn, is exacerbated by the poor evidence produced by the application of a single analytical evaluation method. For example, when a method is applied with the aim of rationalising the planning process, it usually does not sufficiently encompass all those issues which lead to confidence that sustainability will be achieved (see hypothesis 1 in Section 1.3). It provides a solution which is not able to solve the problem of assessing sustainability in a comprehensive manner. This limitation has been highlighted by the literature review developed in Chapter 2.0 and it has also been verified on the basis of the application of the framework to three case studies, as shown in Section 7.2.

Often, the application of problem solving methods is currently directed to only provide a black-box solution to justify political decisions which have already been taken. This approach is called the "legitimating function" of an evaluation approach and is usually applied within the current "Ecological modernisation" planning perspective (see Section 2.3 and Section 5.1).

The application of a scientific method in planning evaluation may be useful as a basis to start discussion among stakeholders, and to allow negotiation among the parties involved. This is required, for example, within the so called "risk society" or "communicative" planning perspective. The evaluation procedure, however, calls for a method which can be understood by stakeholders, both in the vocabulary used and in what and how it is able to show or prove. In other words, it must be clear and 'accessible' to people, both experts and stakeholders, to allow a fruitful dialogue to take place in decision making. This requirement is not often met by current assessment methods.

Decision makers, experts and users must be concerned with prioritising and making trade-offs within the evaluation problem which can have the danger of losing potential solutions or interconnections, "closing off certain avenues" (Cole et al., 1995). These trade-offs are very rarely revealed to the users by an evaluation methodology, particularly those used in planning and design. These methods presuppose and implicitly use these trade-offs in their assumptions, without being made explicit. In turn, these assumptions are generally founded on a theoretical platform that is either reductionist (i.e. based on Realist philosophy) or subjectivist (i.e. based on Nominalism philosophy), both of which contain a number of problems, when dealing with sustainability, of ignoring issues and creating an imbalance in planning (see Section 3.2).

The above findings have been derived from the analysis developed in *Chapter 3.0* with focus on the theoretical structure on which the methods are founded. This philosophical level of analysis has contributed to illuminate the scientific reasons underpinning the limitations of the existing assessment methods that deal with sustainability. It has also suggested the need for an appropriate theoretical platform on which to base the development of the framework for evaluation.

A more meaningful evaluation for problem solving, for example, could be one involving constantly standing back and challenging assumptions, taking holistic perspectives to try to address what appear to be contradictions (Cole et al., 1995). Nevertheless, the problems involved in decision making for sustainability in the built environment are rarely addressed by the application of a single problem solving method and experts are now more conscious that more methods are required to address a single problem, by tackling different issues and perspectives in a combined holistic manner (BEQUEST, 1999; see also Sections 2.4 and 6.2).

The implication of this observation is that at the present there is not an available agreed structure that is able to support such an approach, a structure that is able to organise information in such a way that enable users to both identify the issues underpinning the problem and suggest problem solving methods, integrating public and private perspectives and issues related to the quality of life with those related to the environmental quality (see hypothesis 1 in Section 1.3). This cannot be just a classification system or a simple empirical list, e.g., for sustainability indicators or factors, such as the PICABUE approach, the Pentagon Prism Model, the S.L.E.P.T. system or others (see Sections 6.1 and 6.2). Rather, it should be a framework which helps users to guide the evaluation and to recognise the issues implied in the decision, allowing them to make explicit 'marks' toward sustainable development ("the journey"), "without the need to be too precise about missions and destinations" (Selman, 1995).

This need is clearly not satisfied or addressed by the above mentioned systems. Although useful, "it is recognised that PICABUE and other similar models inadequately express (other) important dimensions of sustainable urban development such as heritage, aesthetics and ethics" (BEQUEST, 1999). These systems are not only limited in scope, but also lack a scientific and theoretical sound foundation.

The critical review of the theories developed in Chapter 3.0 has suggested that an appropriate theoretical platform on which to base the development of the framework for evaluation is the theory of the Cosmonomic Idea. Among others, this theory seems better at accomplishing the task of providing structure and direction to decision making for sustainable development. It seems to provide a solution to the problem that conventional thinking cannot. Specifically, it has revealed that the Cosmonomic Idea is explicitly trans-disciplinary, yet provides integration between disciplines and a holistic approach to the problem. It considers different levels of information, nesting all aspects of reality in an ordered manner, yet provides structure and continuity. It is pluralistic in such a way that it recognises the importance of multi-person action across different time scales keeping a western view (Lombardi and Basden, 1997).

These benefits can have enormous repercussions, in the context of sustainability, for the way we see, know, act, live and be. Studies and applications of this theory in other fields, for example in information technology and social sciences, have shown that this theory is useful as it is able to explain complex systems by supplying a framework of laws which govern creation, integrating subjects and objects together (see Section 3.3).

A specific feature of the theory is its ability to explain complexity without falling into reductionism and/or subjectivism. This suggested that the theory would be useful in structuring sustainability in the built environment, overcoming the problems of current assessment methods (see hypothesis 2 in Section 1.3).

In order to see whether the Cosmonomic Theory can contribute to understand sustainability in the context of the built environment, an application has been developed in *Chapter 4.0*. This has required a deep-stead study of the philosophy, on one hand, and of the literature of the built environment and urban sustainability, on the other. The application has finally involved an accurate and detailed analysis of the built environment as a system with a proper functioning and 'cultural direction'. In addition, it has implied an understanding of the possible implications that sustainability has in relation to this system.

The previously mentioned processes of reviewing, understanding, developing and applying the Cosmonomic theory to the built environment, undertaken simultaneously, have enriched each other leading to an identification of a structured variety of key issues and sustainability themes in the built environment. These are organised as a check-list nested within the law framework of the modalities (see Table 4.1), supplying relevant factors for decision making.

In this typological system, the fifteen Dooyeweerd modalities act as *meaning-nuclei* offering a qualification system for classifying elements of the built environment, such as functions, institutions or even indicators for evaluation (see Section 7.3). Many of these issues may have been experienced in every day living; others belong to technical-scientific disciplines, as found in literature on sustainability. Thus, the typological system can act as a guide to structure random and imprecise or fuzzy information, i.e. as a *bottom-up* approach, and/or it can supply an ordered structure to experts of different disciplines to allocate their scientific knowledge, i.e. as a *top-down* approach. The two approaches of 'bottom-up' and 'top-town' are regarded as useful in planning decision making with regards to sustainability (ICLEI, 1996; Cogo, 1997).

This would suggest that Dooyeweerd's modalities can be employed to understand and evaluate sustainability in urban planning (see sub-hypothesis *b* in Section 1.3). It can help to overcome the problems of current assessment methods, leading to an improvement in the decision making process, to monitoring and to learning about sustainability (see hypothesis 2 in Section 1.3).

The analysis developed in *Chapter 5.0* helped to enrich the previously mentioned initial check-list for evaluation, focusing specifically on decision making in planning and design for sustainability. Specific emphasis was placed on the role and responsibilities that urban decision makers and, specifically, planners and designers have in ensuring a sustainable urban environment to present and to future generations of citizens. The Cosmonomic Idea proved useful in structuring the discussions, revealing non explicit implications and highlighting new directions.

The analysis has made use of case studies and planning examples with major consequences for sustainability with the aim at understanding the main problems that decision makers encounter in planning for sustainability in the built environment. This analysis helped to show that each modality contributes to the development of the true long term sustainability of a built environment and its community. Thus, sustainability in urban planning can be structured by several dimensions that correlate with the fifteen modalities of Dooyeweerd's theory (sub-hypothesis *a* in Section 1.3).

The theory was useful, not only because it recognises different levels of information but also because it suggests an integration between decision makers and the context, recognising a multi-person approach to the problem. This is linked to the question of establishing a common language between stakeholders, which is the first issue tackled in Chapter 6.0.

This issue is crucial because if planners and decision makers seek to develop sustainable developments within the present environment, it should be based on an agreed and common understanding of what the future environment will be like. In turn, this requires a shared vocabulary among experts of different disciplines and stakeholders or citizens.

Chapter 6.0 has focussed on the above issues within the general aim of developing an analytical framework to understand and evaluate sustainability in the planning and design of the built environment. In doing this, it first undertook an analysis of the various stakeholders and their views and commitment towards sustainable development, and then reviewed the criteria for an evaluation of sustainability in planning, providing a more familiar definition of each modality for the stakeholders (as suggested by an initial test, illustrated in Section 7.1).

For each sustainability aspect, a set of key-questions has been provided, using the PICABUE approach and a number of current assessment methods and tools have been selected from Chapter 2.0 (Appendix A) or elsewhere in literature. This process resulted in a structured multi-layered check-list or *tool-kit,* as illustrated in Appendix C, which can help decision makers to check the presence of all the aspects in a (re)development proposal, guiding progress towards sustainable solutions (sub-hypothesis *c* in Section 1.3).

The *tool-kit* includes a number of evaluation activities: a technical and ecological oriented assessment of the construction under development (as a "green design") illuminating the environmental compatibility of this development within the existing context; an assessment of the historical and cultural significance of the planned asset and of its social desirability; an analysis of the economic and juridical feasibility; a check of the visual appeal of this new (re)development and of its flexibility or adaptability which may allow the meeting of some assumed future user needs and finally an understanding of what interest in this (re)development is present in the Local Agenda of the city.

The assessment methods and techniques which have been selected to support the evaluation reveal that the tool-kit will be applied to *ex-ante* evaluation situations. However, it is recognised that this only represents an example and similar tool-kits could be made available for monitoring and *ex-post* planning situations with an appropriate selection of evaluation techniques. An example is illustrated in Chapter 7.0 (see Section 7.3).

Chapter 7.0 is a problematic chapter as it deals with an assessment of this research-product. Given the open/unfinished intrinsic nature of the framework (which also provides its flexibility), pragmatic testing, based on empirical applications, was not possible. A test of this kind would also have been problematic due, on one hand, to a lack of an existing data-base on sustainability and on the other hand to the poor formal knowledge of the problem, currently restricted to a few good 'local' examples, or case studies, whose applicability cannot be generalised (Selman, 1996; Cooper, 1999).

Another problem is the question of meaningfulness of such a testing, due to the fact that sustainability is not a *status quo* but a process that changes through time. In other words, true testing would have probably taken many years to generate scientific results. During this time it is likely that the concept of sustainability would change. The aim of this research was to produce a framework which would withstand this evolutionary development.

This obviously does not mean that any sort of framework for evaluation can be accepted by the scientific community; rather, it suggests that a different assessment should be taken to show the benefits of the framework. Chapter 7.0 adopted two different assessments, the first related to the issue of a user friendly vocabulary, the second to test transparency, replicability and 'opening up' (Mitchell, 1999a).

The issue of comprehension and understanding was recognised to be crucial for the adoption of the framework in practice (see sub-hypothesis *b* in Section 1.3). This assessment has shown that the new definitions of the modalities adapted from Dooyeweerd have improved understanding, particularly with regards to those terms identified as 'more-difficult-to-grasp', such as the analytical and historical terms. The understanding of the two terms, in fact, increases by about 60 percent in the second exercise on the comprehension of the aspects (see Section 7.1.2).

The second assessment focussed on an assessment of the "strength" of the framework in dealing with various different decision making problems and planning situations. An approach of real world case-studies was adopted; in each case study a prior application of some problem solving methods was illustrated to show their limitations.

Given the extraordinary variety of planning contexts and evaluation perspectives, the modal structure has enabled the decision maker to make the relevant issues of a decision making process in the context of sustainability more explicit and transparent, encompassing a number of critical sustainability factors and improving the understanding of, and confidence in, sustainability (see hypothesis 2 in Section 1.3). It has also shown that current methods are able to deal with just a few of these factors (see hypothesis 1 in Section 1.3); thus a combination of problem solving methods is necessary to address the problem of evaluating planning proposals within the context of sustainability.

Two additional examples show how the framework can be extended to other evaluation stages, specifically, in *ex-post* evaluation, to monitoring and auditing (see hypothesis 2 in Section 1.3). The two examples have contributed to produce evidence of the profitability of using the modal structure within contexts where it is required to handle either numerical statistical indicators or a multiplicity of stakeholders' perspectives.

As the planning process is itself dynamic in that it changes through time, the above findings suggest that the framework may be useful as a guide for decision making in different contexts, in relation to different problems (multi-objective), different people (multi-person), and different time-stages (multi-period).

Future knowledge on sustainability, further implementation of the information on which the framework relies and pragmatic testing in real world-wide contexts will certainly be required. Practical applications could also be improved if the model is linked to expert systems or G.I.S. (Betty, 1995; 1998; Nijkamp and Scholter, 1993; 1999). At the 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.

The next section discusses some limitations and several future developments of this research.

8.2 Main Limitations, Further Developments and Future Work

This study has drawn on an understanding of the nature of sustainability on the basis of Dooyeweerd's philosophy of the Cosmonomic Idea. As previously stated, this has been selected from others after a comparison of various theories and philosophies (see, Chapter 3.0). Another approach would have been to use empirical observation or experience, employing statistical inferencing or inductive approaches. Although this is not realistic at the present, it could become a practical possibility in the future (see Chapter 7.0). However, even this ('bottom-up') approach would have required an interpretation of the results and again, a theoretical understanding.

A further option would have been to draw understanding from sciences such as biology, psychology, computer science, sociology and so forth. As acknowledged in Section 3.1, some work has already been done in these areas, for instance, in economics, within the special area of ecological economics. However, it can be criticised as being reductionist (see Chapter 3.0).

The approach that was here chosen has led to the development of a number of contributions to knowledge, as already mentioned in Section 8.1 (see also Table 8.1).

In conclusion, a change of the theory underpinning this research would not appear to provide the same benefits. Moreover, Dooyeweerd's approach is innovative and it may be worthwhile to extend it in different ways, as illustrated later in this section.

However, it is worth noting the main limitations of such a research approach. One limitation is related to the analytical framework. The framework enables the linking of aspects for evaluation with questions for examining sustainability and, finally, with a number of problem solving assessment methods. However, in order to operationalise, in practice, it needs further work and possibly the support of an I.T. tool, such as a knowledge based system which can evolve and cope with incomplete and uncertain information (see Section 8.2.f). It requires pragmatic testing, revision, implementation and a convenient users friendly interface .

A major problem is the amount of information required for an evaluation of this type. This is time consuming and certainly costly. Chapter 5.0 has already pinpointed some major problems faced in decision making, such as the variety of vocabulary employed and required by each assessment method, the elements of uncertainty included in the available data, the difficult access to different data-bases, etc. The framework, as it has been developed in this thesis, does not overcome all of these problems directly but it shows how it is possible to use current assessment methods within the framework. However, it does provide new opportunities for collaboration between disciplines, experts and people; it adds new dimensions that were traditionally uncovered in the evaluation (e.g. aesthetics) and it links all the knowledge and the special contributions of 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 (see hypothesis 2 in Section 1.3), answering current demands for higher education in the field of planning (see Section 5.1).

Table 8.1 summarises this discussion under the headings of the main strengths, weaknesses, opportunities and threats of this research on the basis of a SWOT analysis and also adds other issues relevant to an assessment of the research.

The foregoing discussion leads to the need for further developments of this study. Some suggestions are here proposed.

(a) Implementing the information on the aspects

One problem that this research had to deal with was the wide range and diversity of disciplines involved in an evaluation of sustainability in planning and design for the built environment. In order to keep the approach holistic, it was forced to develop a strategic level of analysis for each aspect and their evaluation.

Further work could be carried out in this direction, extending the information included within the framework and populating and implementing the knowledge in each aspect for the evaluation of sustainability. This can be done, e.g., by following a similar case study approach as the one adopted in this study and feeding back the results into the framework.

This development of the research would result in a complete methodological procedure for the evaluation of each aspect which makes use of the I.T. support. It would contribute to overcome a number of weaknesses and specifically n. 2, 3, 6, 7 and threats n. 2, 4 of Table 8.1.

It is worth remarking, however, that this process of knowledge implementation does not end and that the strength of the framework is that it will allow evolutionary development whilst still retaining the original classification system.

Table 8.1 – A SWOT analysis related to this research

STRENGTHS	WEAKNESSES
1. It is founded on philosophical underpinning 2. It shows a way of addressing sustainability on the basis of philosophy 3. It contributes to the understanding of sustainability in the built environment 4. It guides users towards an assessment of the problems identified 5. It allows users to make trade-offs between elements easier 6. It contributes to evaluate sustainability in planning and design 7. It provides structure and continuity to the evaluation 8. It enriches traditional classification systems recognising a greater variety of themes within a holistic hierarchy of issues 9. It identifies different levels of information and problem solving methods, linking them in a holistic structure for decision making 10. It is comprehensive of both technical and non technical aspects, integrating them without resulting in a black-box 11. It integrates public and private viewpoints in decision making 12. It provides transparency in decision making 13. It is flexible and replicable 14. It is easy to adopt 15. It uses a common vocabulary over a wide range of disciplines 16. It allows a learning process to take place and evolutionary development 17. It acknowledges the need for a shared vision, or commitment, and for participation 18. Planning is seen as an activity which is leading rather than following the state's policies	1. Pragmatic testing is difficult to develop 2. It is merely a benchmark for future development 3. It demands laborious evaluation 4. It does not provide prioritization or a weight scheme on which to evaluate or rank the results, relying on the availability of existing methods 5. There may be too many aspects for a human mind to handle simultaneously 6. Interaction among the issues is not made explicit within the framework for evaluation 7. The uncertainty underlying many issues is not tackled or addressed 8. It does not discriminate between decision makers 9. It does not specifically refer to official data-bases or sources 10. It does not include decision making related to other stages of the development of the built environment
OPPORTUNITIES	**THREATS**
1. It may contribute to philosophical thinking 2. It may lead to operationalise the principles embodied in concept sustainability 3. It may help to improve current evaluation in planning, enlarging the assessment to non technical issues 4. It may facilitate multi-disciplinary work 5. It may help participation in decision making, linking experts to non experts 6. It may render the complexity of a planning problem comprehensive by using a common language among disciplines, experts and stakeholders 7. It may help planners to defend the environment and the local identities against the risk associated to contemporary economic processes 8. It may contribute to expand the horizon of current planning practice towards greater sustainability in the built environment	1. It requires changes in traditional thinking 2. The multiplicity of aspects can be discouraging for users 3. The evaluation process can be difficult, time consuming and costly 4. The users may be unable to use all the methods included 5. The decision makers can be confused at the end of the evaluation process without providing a synthesis unless the evaluation methods guide them in this way.

(b) Enlarging the perspectives and viewpoints

A second limitation in the scope of this research is related to the users of this evaluation framework. Although a detailed analysis of the stakeholders of a planning process was developed (see Section 6.1), the framework addresses the problem from the viewpoint of planners and/or official (public) evaluators. In order to be used by private developers and other interested parts, e.g., to check their proposal before official submission, the framework requires some changes and adaptations both in the vocabulary used and in the information required. These would address the weakness identified in point n.8.

(c) Extending the research to other built development stages

The framework and the general objective of this research was limited to urban planning and design within the general context of local decision making. Thus, a possible development of this research could be the extension to other activities of the process of development of the built environment, such as Strategic Planning; Procurement; Architectural Design; Construction; Use; Facilities Management; Repair & Maintenance; Adaption/reuse & Refurbishment; Deconstruction, Demolition & Disposal (see Section 5.2).

This extension could use a similar framework for each activity. Once it has been carried out for each stage, it can be extended to the various users, modelling according to different viewpoints. This would specifically solve the weaknesses of n.8 and 10

(d) Expanding the evaluation stages

A further development of this research could relate to the evaluation perspective, i.e. the evaluation stage (see Section 2.1). The framework developed in this study adopts an ex-ante evaluation perspective, but decision makers may be interested in an *ex-post* or a monitoring evaluation, at each different built development stage. Monitoring and *ex-post* activities are strongly emphasised in the latest planning guides (DoE, 1992) in relation to a plan-led system advocated by the 1990 Town and Country Act, asking for more attention to the evaluation of plans in order to be more up-to-date, responsive and accountable (Lichfield and Prat, 1998).

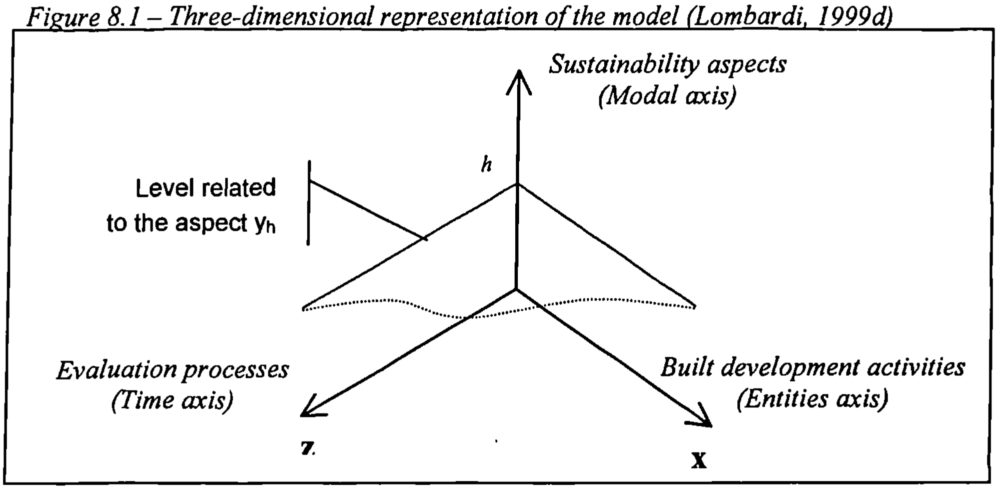
The analytical framework adopted in this study could be kept but both the key-questions examining sustainability and the selection of evaluation methods would need to be changed. In monitoring, more emphasis would be placed on statistical indicators, surveys, questionnaire research techniques (Bezzi and Palumbo, 1998). As a starting point, the example illustrated in Section 7.3 could be useful.

Considering all the developments illustrated in preceding points (a), (b), (c) and (d), the *tool-kit* can take the form of a multi-layered practical informatory tool for decision making, at any evaluation stage (*ex-ante*, *ex-post* and monitoring) and at any stage of development of the built environment (local planning, infrastructure planning, building design, construction, etc.).

Figure 8.1 provides a graphical representation of the model on three-Cartesian axes (Lombardi, 1999d). It shows, for example, the level of the *Modal axis y* related to the historical-cultural aspect, y_h. This would provide a number of assessment methods and evaluation tools that could be profitably adopted to address this aspect, in each evaluation planning stage or process (*Time axis z*) and in each activity or built development stage (*Entities axis x*). The users would be guided in this selection and supplied with related information, e.g., to official data-bases and sources.

The development of this model would also contribute to solve weaknesses n. 9 and 10 of Table 8.1.

Figure 8.1 – Three-dimensional representation of the model (Lombardi, 1999d)



(e) Increasing the scale "from local to global"

The study has focused on "local" sustainability and, very superficially, it has referred to the "global" scale. A major reason underlying this choice concerns the fact that sustainability in the built environment may be more effectively achieved at the local level. This is reflected in the well-known statement: "Think globally, act locally" reported by several International organisations, such as the United Nations, OECD and ICLEI. Nevertheless, an analysis of higher levels of decision making, e.g. at national or European levels, can be useful and has certainly been of benefit to recent European Commissions on Co-operation, Spatial development perspectives, Planning system and policies (EC, 1994; ESDP, 1997, ECRPC, 1997, ESDP, 1998).

(f) Modelling a decision support system in the field of design

The theory of the Cosmonomic Idea can be adopted to develop a decision support system in the field of design (or in construction, or any other built development activity), as suggested by the theory of the multimodal system thinking approach. This requires some changes in the adopted methodology and greater emphasis on mathematical modelling, risk analysis, modelling of the design approach and I.T. This could result in the development of an expert system that is capable of overcoming a number of weaknesses, e.g. n. 4, 5, 6, 7 and threats n.2, 3, 4, 5.

Although outside the aim of this research, the following suggestions are offered and have partially been developed.

The first one is related to the work by Lombardi and Basden (1997) which focuses on the modal theory. This suggests using the modalities as an exhaustive check-list of aspects, which are understood as a list of design requirements. These need to be addressed in any design scheme. The authors have illustrated this through the example of a car park.

This work on the check-list can be profitably implemented and developed. It will require a weight scheme on which to base the assessment of each requirement (aspect). Literature suggests using interval scales for subjective assessment (Voogd, 1983; Clough, 1984; Zavadskas et al., 1994; Zeleny, 1994). Thus, the level of achievement of each requirement can be measured on a weigh scheme based, for instance, on a 5-point measurement scale which is recommended by psychologists (Saaty and Vargas, 1984a) and also from literature on the Delphi forecasting method (Martino, 1970; Shields, 1987; Rowe, 1991).

Scores are given where satisfactory attention is paid to the items specified in each performance criterion, by answering the question: "How well does the evaluation approach perform this criterion on a 5-point scale?"

The check-list should offer a useful guide to decision makers to understand the weakness and strengths of the proposal in the context of sustainability. Therefore, for instance, if low consideration is paid to the aspects related to *environmental quality*, the physical sustainability of the area may suffer in the long term. Alternatively, a little consideration paid to the *quality of life* issues may lead to a solution which is socially harmful and can lead to conflicts within the community in the short or long term. Finally, insufficient consideration paid to the elements related to *quality of planning* may lead to a poor design in the short or long term.

Some difficulties and criticisms may be derived from the fact that design is a creative activity and a modelling of it is very hard (Lawson, 1990). Moreover, the list of modalities is too long and difficult to be simultaneously handled by human minds (Saaty and Kearnes, 1985; Saaty and Vargas, 1987). It might be helpful to group some aspects together, for example, identifying those that directly contribute to improve the *quality of planning and design,* and those connected, respectively, to the *quality of life* and *quality of the environment.* An attempt was made to group the modalities in three sets to assist initial understanding, but this was abandoned because doing so reduced the richness and meaning of the analytical framework.

The proposed modelling of an assessment method could make use of the work of Lawson (1990) to understand design processes. Lawson suggests that a design process follows three major cyclic stages: *Analysis* of the design problem (ordering and structuring); *Synthesis* (an attempt to move forward and make a response to the problem); *Appraisal* (critical evaluation of solutions against the objectives identified in the analysis phase). These stages are understood as interrelated steps of a unique cyclic and dynamic process in design. At the same time, they can act as an integration level for all the other aspects. Following Lawson's conception of a design process, some work has already been done in linking the three steps to the fifteen modalities of Dooyeweerd (Lombardi, 1999a).

Further research could be carried out in the field of design for a decision making tool, by following the suggestion of Winfield and Basden (1996). This proposes a distinction between tasks, processes and results. By identifying the guiding function of each actor's task in a planning process, it might be possible to build a goal-achievement method in planning evaluation which is linked to the hierarchy of modalities (see also the example in Section 7.3.1).

A third suggestion can be to use the Dooyeweerdian concept of analogy to build a new general, common and integrated syntax for evaluation among the disciplines. An integrated matrix to allocate information collected and produced within a ('bottom-up') participative decision making process (or, alternatively, a top down development approach of sustainability indicators), has been developed by the author, as illustrated in Lombardi (1998a). This work could be implemented to develop an integrated data-base for organising the information.

(g) Changing the objective of decision making

Although, nowadays, urban sustainability is of major concern, as the world is becoming increasingly urbanised with all the advantages and disadvantages that go with it (see Section 5.2), it might be meaningful to cover other fields which are important for sustainability at both the global and local scale. A significant example is agricultural and rural sustainability, a second example is water sustainability, at both the regional or national scale, a third is the built heritage sustainability, and so forth.

(h) Modifying the subject field, keeping the framework

This research has focussed on decision making in planning for sustainability of the built environment. It has implied the concept of sustainable urban development.

However, there are other fields in which the same concept of sustainable development can be applied, e.g. in business, in large or multinational companies, and so forth. A similar framework may be employed but the work will require the review of different decision theories, primarily those of management and organisation, such as the following: Taylor's scientific management movement, which focuses on the means to achieve operational efficiency; Weber's burocracy theory, which focuses mainly on the means to maintain bureaucratic control based on legal authority; Mayo's human relations movement, which has pointed the way to the adoption of humanistic management criteria (Clough, 1984). Very few of these have had important repercussions on the evaluation planning theory. One exception is Herbert A. Simon who provided a specific focus on organisational decision processes as a means to achieve operational and economic efficiency, in the spirit of Taylor's scientific management movement (Simon, 1945).

(i) Focusing more strictly on the philosophical field

An extremely interesting development of this research and of the field of sustainability in the built environment may be achieved by focusing more strictly and deeply on philosophical underpinning. For example, in this study the original structure of the fifteen modalities has been adopted for the reasons explained in Section 3.3. Nevertheless, it may be worth trying and verifying different schemes and orders of the modalities to understand sustainability in the built environment, until the most appropriate one is defined. This requires the adoption of a comparative approach to develop different tests on this subject.

(j) Focusing on the concept of Time

A second direction is to focus on the Time element as this has been recognised as being crucial to understand sustainability (see Section 5.1.3). The theory of the Cosmonomic Idea seems to provide meaningful suggestions in this field which may be profitable to explore and investigate further.

(k) Two problems with the research itself

1) The author's understanding of the meaning of the modal aspects differs from the understanding of others, e.g. de Raadt (1997). Therefore the setting of the assessment and the precise application to sustainability evaluation can be influenced by this.
2) The redefinition of the modalities was based on a review of current literature. There may be a danger here that this would merely reinforced the *status quo.*

A final remark.

(l) A good reason why it is worth developing further research in this field

This study has some policy relevance at a European level. In many ways it fits (answering) a number of the policy developments which have been included in Framework 5 (CEC, 1993), and thus is very relevant to the new Programme Key Action 4: City of Tomorrow and Cultural Heritage.

At a National & Local level, the National Government can take a lead through the signals it gives to other developers. For example, the UK has adjusted the brief of the Commission for new Towns so that sustainability benefits are considered alongside economic returns on development. In larger re/development schemes leverage over developers to deliver more sustainable development proposals can be more effectively achieved by retaining leasehold of land until the project is completed and occupied (BEQUEST, 1999).

The ultimate aim of this research was to produce a more integrated approach to the sustainability assessment of urban re/development that will reduce the current uncertainties facing decision-makers at the urban planning level as well as at the level of urban district developments.

The outcome helps decision makers to critically identify the sustainability aspects involved in a (re)development planning project, guiding them in the evaluation on the basis of a number of problem solving methods. Yet, the resulting framework assists understanding of the capabilities and inadequacies of various assessment techniques in assessing the sustainability dimensions of urban re/development. It also assists in harmonising re/development proposals with local Agenda 21objectives and indicators.

Finally, the framework represents a significant step forward in evaluating the built environment in the context of a sustainable urban development. It also has the potential of allowing an understanding and evaluation of the concept of sustainability over time.

8.3 Main References

BEQUEST - Building Environment Quality Evaluation for Sustainability through Time Network, 1999, *Report 1998-99*, EC Environment and Climate Research Programme, Theme 4: Human Dimensions & Environmental Change, Directorate D - RTD Actions: Environment - E.U. DG12

Betty M., 1995, Planning support systems and the new logic of computation, *Regional development dialogue*, vol. 16, n.1, pp.1-17

Betty M., 1998, Evaluation in the digital age, in Lichfield et al. (eds.), *Evaluation in Planning*, Kluwer Academic Publisher, Dordrecht, pp.251-274

Bezzi C. e Palumbo M. (eds.), 1998, *Strategie di valutazione,* Gramma – Linee di ricerca sociale, Perugia

Clough D.J., 1984, *Decisions in public and private sectors: theories, practices and processes,* Prentice-Hall Inc., New Jersey

Cogo M., 1997, *Progetto Venezia 21*, Fondazione Eni Enrico Mattei, Venice

Cole R.J., Campbell E., Dixon C. and Vrignon J. (eds.), 1995, *Linking and prioritising Environmental criteria*, Proceedings of the International Workshop CIB TG-8, 15th – 16th November, Toronto

Cooper I., 1999, Learning lessons from the UK Sustainable Cities research programme, in Lombardi (ed.), Analisi e valutazione di programmi e progetti di sostenibilità urbana. Alcune esperienze, *Urbanistica* n.112 (in press)

de Raadt J.D.R., 1997, A sketch for human Operational research in a technological society, System Practice, vol.10, n.4, pp.421-442

DoE - Department of the Environment, 1992, *Assessing the impact of urban policy*, Inner Cities Research Programme, HMSO, London

European Commission, EC, 1994, *Europe 2000+ Cooperation for European territorial development*, Office of Publications of the European Commission, Luxembourg, Brussels

European Commission, ESDP, 1997, *European Spatial Development Perspective*, first official draft, paper presented to the Informal meeting of Ministers responsible for spatial planning of the member states of the European Union, Noordwijk, 9^{th} – 10^{th} June

European Commission, ESPD, 1998, *European Spatial Development Perspective*, Complete draft, paper presented to the Meeting of Ministers responsible for spatial planning of the member states of the European Union, Glasgow, 8^{th} June, Office for the Official Publications of the European Commission, Luxembourg, Brussels

European Commission, Regional Policy and Cohesion, ECRPC, 1997, *The EU Compendium of Spatial Planning System and Policies*, Office for the Official Publications of the European Commission, Luxembourg, Brussels

European's Fifth Environmental Action Programme, 1993, *Toward Sustainability,* Commission of the European Community, CEC.

ICLEI - International Council for Local Environmental Initiatives, 1996, *The Local Agenda 21 Planning Guide,* Handbook, ICLEI and IDRC, Toronto (website: http://www.iclei.org)

Lawson B., 1990, *How designers think. The design process demystified*, Butterworth-Heinemann ltd., Cambridge

Lichfield N. and Prat A., 1998, Linking *ex-ante* and *ex-post* evaluation in British town planning, in Lichfield et al. (eds.), 1998, *Evaluation in Planning. Facing the challange of complexity*, Kluwer Acc. Press, Dordrecht, pp.283-298

Lombardi P.L. and Basden A., 1997, Environmental Sustainability and Information Systems, *Systems Practice,* vol. 10, n. 4, pp.473-489

Lombardi P.L., 1998a, Sustainability indicators in urban planning evaluation, in Lichfield N. et al. (eds.), *Evaluation in Planning*, Kluwer Academic Publishers, Dordrecht, pp.177-192

Lombardi P.L., 1999a, Riferimenti metodologici e strumenti di valutazione per la sostenibilità urbana, in Lombardi and Micelli (eds.), *Le misure del piano*, F.Angeli, Milan, pp.96-114

Lombardi P.L., 1999d, Aspetti di sostenibilità e approcci di valutazione. Illustrazione di un sistema decisionale di tipo multimodale, in *Proceedings of the XXIX CeSET Seminar*, Padoa, 8^{th} October, (in press)

Martino J., 1970, The consistency of Delphi forecasts, *The Futurist*, v.4, pp.63-64

Mitchell G., 1999a, A geographical perspective on the development of sustainable urban regions, in *Geographical Perspectives on Sustainable Development*, Earthscan (in press)

Nijkamp P. and Scholten H., 1999, New interoperable planning tools for Sustainable land use, in Lombardi (ed.), Analisi e valutazione di progetti e programmi di sostenibilità urbana, *Urbanistica* n.112 (in press)

Nijkamp P. and Scholten H.J., 1993, Spatial Information Systems: design, modelling and use in planning, *International Journal of Geografical Information Systems*, vol. 7, pp.85-96

Rowe D., 1991, Delphi - a re-evaluation of research and theory, *Technological Forecasting and Social Change*, v.39, pp.235-251

Saaty T.L. and Kearnes K.P., 1985, *Analytical Planning,* Pergamon Press, Oxford

Saaty T.L. and Vargas L.G. (eds.), 1987, The Analytic Hierarchy Process. Theoretical developments and some applications, *Mathematical Modelling,* v.9, n.3-5, pp.161-395

Saaty T.L. and Vargas L.G., 1984a; Inconsistency and Rank Preservation, *Journal of Mathematical Psicology,* vol. 28, pp. 205-214

Selman P., 1995, Local sustainability, *Town Planning Research*, vol. 66, n.3, pp.287-302

Selman P., 1996, *Local Sustainability*, Paul Chapman, London

Shields T.J., 1987, Methodological problems associated with the use of the Delphi technique, *Fire Technology*, v.23, n.3, pp.173-183

Simon H. A, 1947, *Administrative Behaviour*, The Macmillan Co, New York.

Voogd H., 1983, *Multicriteria evaluation for urban and regional planning*, Pion, London

Winfield M. and Basden, A., 1996, An ontologically based method for knowledge elicitation, in SWOT, Proceedings of the International Conference of the Swedish Operations Research Society, *Managing the Technological Society: The Next Century's Challenge to O.R.,* 1st – 3rd October, University of Lulea, Sweden, pp.72-93

Zavadskas E., Peldschus F. and Kaklauskas A., 1994, *Multiple criteria evaluation of projects in construction,* Vilniaus Technikos Universitetas, Russia

Zeleny M., 1994, In Search of Cognitive Equilibrium: Beauty, Quality and Harmony, *Journal of Multi-Criteria Decision Analysis*, vol. 3, pp.3-13

APPENDIX A – A Collection of planning evaluation methodologies and tools

Cost-benefit analysis and non-market economic techniques

The beginning of cost-benefit analysis (CBA) dates back over a century to the work of Jules Dispuit, who introduced the concept of the consumer surplus, i.e. the fact that benefits are measured by an area under a demand curve, not by what is actually paid. The next major contribution to cost-benefit analysis is the formulation of the marginal cost pricing by Harold Hotelling (1938, p.158):

The efficient way to operate a bridge is to make it free to the public, so long at least as the use of it does not increase to a state of overcrowding.

The United States Flood Control Act of 1936 introduced the principle that a project is desirable if 'the benefits, to whomsoever they accrue, are in excess of the estimated costs'. Beginning in the fifties, an extensive literature on the foundations of cost-benefit analysis emerged, Krutilla and Eckstein (1958), Marglin (1967), Musgrave (1979), Arrow and Kurz (1970), Dasgupta et al. (1972), just to mention a few.

CBA is applied welfare economics. The principle on which it works is the notion of 'potential Pareto improvement', which says that an activity should proceed if it generates benefits for the gainers which are more than enough to compensate those who will lose (Mishan 1971, p.316). Compensation might be considered where: gainers and losers can be clearly identified, the extent of their gains and losses can be roughly and unambiguously estimated, losers have clear rights which are being infringed, gainers are able to pay, and there is popular support for the principle of compensation (Winpenny 1991 p.64).

CBA is concerned with setting the costs of construction, maintenance, renewals and other servicing costs over the life of a development against the benefits of function, convenience and appearance. In other words, 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. The rate of discount affects the weight given to the items. The higher the rate, the less weight is given to costs and benefits arising well into the future. This tends to lead to the choice between alternatives being based on short-term considerations. The lower the rate of discount the more weight is given to items in the future. At zero rate of discount, equal weight is given to initial costs and benefits and to those in the future.

As far as possible each cost and benefit is evaluated in money terms. Problems arise in obtaining a cash value for the intangible. The benefit side is extremely important in assessing environmental projects. The problem of predicting or forecasting the environmental impact is that impacts arise in the more or less distant future. This prediction process will not result in firm figures for a number of reasons: the unknowns in the data input into any forecasting method; dispute over the forecasting method to be used, and lack of knowledge about the ways in which environmental impacts are generated. Ranges for scale and timing of the predicted impacts are more likely than single figures and for some types of impact it may not even be possible to give any figures. Even when the scale and timing of impact can be identified, problems remain as to assessing the environmental significance of the impact and its incidence in the future (Rydin 1992).

There is an extensive literature in both the economic theory and the measurement of such benefits, considering that many of the services provided by the environment are "un-priced". There is therefore a need for money measures of utility change caused by 'commodities' that can be viewed as public goods or externalities, and for a method for the practical evaluation of such money measures. Although there has been a great deal of development in the theory as well as the measurement of environmental benefits and costs (Johansson 1993), this analysis remains imperfect for use in decision-making. Some of the existing limitations to the economic measurement of sustainability and environmental effects are as follows:

- Income distribution (infra-generation equity). One of the assumptions that underlies CBA is that a society will be economically efficient in its use of resources when net monetary social benefits - that is the difference between total monetary benefits and total monetary costs measured in socially desirable prices - are maximised. Efficiency is measured without regard to whom the benefit and costs accrue and irrespective of whether society considers the prevailing distribution of income to be desirable.
- Intergenerational equity. Both the choice of project selected and the discount rate to be used will affect the inter-temporal allocation of resources and thus have implications for intergenerational equity. In fact, the impacts of many projects will be felt for long periods of time, and not all future impacts will be positive. Discounting results can mean less attention being given to successive generations.
- Risk and uncertainty. All projects face some degree of uncertainty. The most common way of dealing with this is to use 'expected values' for prices, quantities and other variables whose precise values cannot be known in advance. Essentially, each potential outcome is weighted by the probability of its occurrence, and the weighted outcomes are then summed to arrive at a mean, or expected, value. Alternatively, it is possible to use 'sensitivity analysis', in which the project analysis is modified to examine the effects of different assumptions about key variables, and their effect on the project's overall profitability.
- Irreversibility. Many projects entail the modification of natural areas, reducing the supply of these and endangering the continued existence of plants or animal species, causing irreversible consequences.
- Incrementalism. This is the term used to denote problems which arise from making decisions on an individual project basis without consideration of the cumulative effect of many such decisions.
- Cultural, historical and aesthetic resources. Losses of these resources are difficult to quantify and express in monetary terms because the perceptions of these losses depend on cultural traditions and value systems.

ILLUSTRATION OF SOME MONETARY AND COST-BENEFIT METHODS

Changes in productivity	Physical changes in production are valued using market prices. This approach is based directly on neo-classical welfare economics and the determination of social welfare. The benefits and the cost of an action are counted regardless of whether they occur within the project boundaries or beyond them. The steps to be taken in using this technique are the followings: 1) changes in productivity caused by the project have to be identified both on site and off site; 2) the effects on productivity both of proceeding with the project and of not going ahead should be assessed; 3) assumptions have to be made about the time over which the changes in productivity must be measured, the 'correct' prices to use, and any future changes expected in relative prices.
Loss of earnings	This technique is similar to that for changes in productivity, except in this case changes in human productivity are measured. The lost earnings and medical costs that result from the environmental damage caused by a project, or the comparable savings which would accrue from preventing that damage, become the standard of valuation. In applying this approach the analyst needs to identify clearly the cause-and-effect relationship and its implications on net social welfare. Candidates for the use of this technique would include projects designed to improve public water supplies or waste disposal systems which will ultimately improve human health and productivity.
Opportunity cost	This approach is based on the concept that the cost of using resources for unpriced or unmarket purposes can be estimated by using the forgone income from other uses of the resources as a proxy. Rather than attempting to measure directly the benefits gained from preserving a resource for these purposes, we measure what has to be given up for the sake of preservation. The first step of the analysis is a conventional cost-benefit analysis of the proposed project. Then, net positive benefits of the proposed project must be weighted against the benefits of the preservation alternative which can be measured easily. When it is necessary, the unquantified benefits of it are weighted qualitatively against the amount of benefits by which the proposed project exceeds the preservation alternative. This technique is used to evaluate the benefits of preservation, which are not themselves valued by means of estimating extra costs entailed in using an alternative. In terms of development projects it can also be used when deciding where major infrastructure projects or industrial facilities are to be site. Similarly, it can value the effect on the environment of different technological options.
Cost-effectiveness analysis	This technique is useful for all projects whose benefits are difficult to measure in monetary terms, since no attempt is made to monetize benefits. The focus is entirely on meeting a predetermined standard or goal. Consequently, the first step in cost-effectiveness analysis is to fix a target. The policy maker must consider the possible trade-offs between different standards and the costs associated with achieving them. The standard economic principle normally applied to this kind of decision is the equation of marginal costs with marginal benefits, where standards are increased to the point at which the additional costs of raising the standard further are just equal to the additional benefits from raising the standard. However, when benefits are difficult or impossible to monetize, this approach becomes primarily conceptual.

(cont.)

Preventive expenditures	This approach treys to establish the minimum value that an individual will put on the quality of his/her environment by determining just how much people are prepared to spend in preventing damage either to it or to themselves. Thus, whereas the cost-effectiveness approach examines the direct cost of meeting some predetermined target or standard, this technique examines actual expenditure in order to determine the importance individuals attach to impacts on the environment. This is understood as a minimum value because actual expenditure may be constrained by income and because there may be an additional amount of consumer's surplus even after the preventive expenditure has been made. The assumptions implicit in this kind of analysis are that: 1) accurate data on costs of the mitigating expenditures are available; 2) there are no secondary benefits associated with the expenditures.
Replacement and relocation costs	The basic premise of these approaches is that the cost incurred in replacing or relocating productive assets damaged by a project can be measured, and that these costs can be interpreted as an estimate of the benefits presumed to flow from measures taken to prevent that damage from occurring. The rationale for these techniques is similar to that for preventive expenditures except that the replacement or the relocation costs are not a subjective valuation of the potential damages but, rather, are the true costs of replacement or relocation if damage has actually occurred. The assumptions implicit in this type of analysis are: 1) the magnitude of damage is measurable; 2) the replacement (or relocation) costs are calculable and are not greater than the value of the productive resources destroyed; and therefore it is economically efficient to make the replacement; 3) there are no secondary benefits associated with the expenditures.
Shadow project approach	This has been suggested in cases where locally irreversible environmental losses (such as the destruction of a particularly valuable wetland) are likely because of economic development. The costs of the development scheme responsible for these losses should be increased by an amount sufficient to fund a 'shadow' project designed to substitute for the lost environmental asset. The assumptions implicit in this type of analysis are: 1) the endangered resource is scarce and highly valued; 2) the human-built alternative would provide the same quantity and quality of goods and services as does the natural environment; 3) the original level of goods and services is desirable and should therefore be maintained; 4) the costs of the shadow project do not exceed the value of the lost productive service of the natural environment.

(cont.)

Property (and land) value approaches – Hedonic price method	These are surrogate-market approaches which use an actual market price with which to value an non-market quality of the environment. The basic assumption is that the price differential, arrived at after all other variables except environmental quality have been controlled for, reflects a purchaser's valuation of the environmental qualities at issue. These approaches are designed to control for certain variables so that any remaining price differential can then be assigned to the un-priced environmental good. Similarly, environmental 'bad' can be measured, as with a drop in property value to increased noise or air pollution, or view obstruction. A multiple regression analysis is then undertaken and a coefficient is estimated for the environmental bad; this coefficient is then used to value changes in environmental quality. The theoretical framework is based on the concept that there is a correspondence between price variation and quantity of single attributes of goods. The presumption is that there exists a market in which an item of a generic commodity can embody various amounts of different attribute vectors. One immediate, empirical consequence of this relates to the possibility of determining increment of price in function of a unit change in the attributes of goods. This method partially overcomes the difficulty posed by relevant simultaneity in implicit markets. This results, in fact, from the quantity dependence of marginal prices, and from the source of exogenous changes in the market price structures.
Travel cost method	The travel cost method is based on the simple proposition that observed behaviour can be used to derive a demand curve and to estimate a value (including consumer's surplus) for an unpriced environmental good by treating increasing travel costs as a surrogate for variable admission prices. In other words, since market prices are unavailable, the travel cost uses variable costs incurred by the recreationist as surrogates for site prices in the estimation of the demand curve. In practice, the costs incurred by individuals (potential users) in order to benefit from a resource are evaluated by a function which links the number of visits per resident in a particular area to the cost of travel from this area to the location of the resource in question. In order to derive the demand curve, a number of assumptions must be made and a number of steps must be taken, as follows: 1) individuals can be grouped into residential zones where the inhabitants have similar preferences; 2) people will react to increasing travel costs in much the same way as they would react to increased admission charges at the recreational site; 3) then a calculation of visitation rates from all origin zones is made, taking into account a number of variables related to income, cost of travel and other elements. A regression equation is derived that relates visitation rates to the cost of travel. this is then used to determine the area of consumer's surplus for users in each zone. The consumer's surplus from all zones is added together to estimate the total consumer's surplus for users of the recreational site. With regard to contingency valuation method, however, the travel cost method - in the opinion of various specialists (Bishop and Heberlein, 1979; Bishop, 1982) - is less suitable for discerning certain details of the value (such as the "option price" or "existence price") since it is unable to recognise visual, aesthetic or ecological qualities.

(cont.)

Contingent valuation	Contingent valuation deduces the value of a product not on the basis of the effective observed behaviour of subjects on the market, but with reference to an artificially structured market (hypothetical market). By means of surveys of potential purchasers, the necessary information is obtained in order to estimate the price consumers would be prepared to pay if the product were launched on the market. Thus, CVM starts with the individual and his or her perception of change. Once values for a representative set of people have been determined, they are aggregated to a total value directly dependent on the number of individuals affected. The concepts of "willing to pay" and of "willing to accept" are used as Hicksian equivalent or compensating measures of welfare change depending upon the circumstances facing the consumer (Sellar, Stoll and Chavas, 1985). Compensating variation is the amount of payment or change in income necessary to make an individual indifferent between an initial situation and a new situation with different prices. Equivalent variation may be viewed as a change in income equal to a gain in welfare resulting from a change in price. Alternatively, it may be considered as the minimum payment needed to persuade an individual voluntarily to forgo a price decrease. Bidding approaches are by far the most widely recognised form of contingent valuation. In a bidding game, each individual is asked to evaluate a hypothetical situation and to express his or her willing to pay for, or willing to accept compensation for a certain change in the level of provision of a good. This technique is most often used to value public goods like access to parks, clean air or water or unobstructed views. There are two major types of bidding games: single bid games and iterative bid games. In this last one, the respondent, rather than being asked to name a sum, is asked whether he should or would pay $X for the situation or good described. This amount is then varied iteratively until a maximum willingness to pay is reached. Other CVM techniques are the followings: take-it-or-leave-it experiments; trade-off games; costless choice; delphi technique. Survey techniques are subject to a number of biases which may affect the reliability of the result. The main ones are the followings: 'starting-point bias', hypothetical bias, strategic bias, information bias, instrument bias. They are discussed in detail in: Dixton et al. (1988), Pearce et al. (1989; 1990).

Environmental impact analysis and multicriteria techniques

Environmental Impact Analysis (E.I.A.) is a comprehensive procedure which involves different dimensions of a planning problem, such as social, administrative and physical. Thus it has been widely applied to planning processes which have strong environmental implications. Experience has shown that project level E.I.A. is feasible, that E.I.A. has altered decision-making to give more weight to the environment and that E.I.A. costs very little in relation to the costs of implementing the actions assessed.

This procedure was born in USA in 1969 by means of the National Environmental Policy Act, aiming to protect natural resources. Later, the Economic Community introduced a common directive to all Member States (85/337/CEE) which imposed the application of this E.I.A. to all those projects having strong impacts on environmental resources.

More recently, the United Nations Economic Commission for Europe has recommended the extension of E.I.A. principle to policies, plans and programmes. It has long espoused the desirability of extending E.I.A. from projects to higher tiers of actions and began consultations on a Strategic Environmental Assessment (S.E.A.) directive in 1991. This is a consequence of the growing belief that project E.I.A. may occur too late in the planning process to ensure that all the relevant alternatives and impacts are adequately considered (Wood 1994). 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, utilising a form of S.E.A. basically similar in nature to that employed for projects. In fact, S.E.A. would involve screening, scooping, predicting, consulting, public participation, mitigation of impacts and monitoring (Therivel et al., 1992). As with project E.I.A., the skill of the assessor comes to bear in selecting an appropriate mix from all the different approaches, tools and techniques available.

Methodological problems associated with S.E.A. are related to: difficulties of predicting impacts, lack of definition, monitoring of on-going environmental change, absence of specific S.E.A. methods and consultation and participation (Wood 1995). It is recognised that a number of steps are necessary to overcome these problems:

increasing the general understanding of S.E.A.; clarifying procedural issues and methodological issues; straightening the capacity for the practical application of appropriate S.E.A. methods; reviewing existing environmental data sources to assess their potential use in S.E.A. and prioritising measures for correcting any deficiencies

In the context of E.I.A. (and S.E.A.), the adopting of techniques that are able to rank projects objectively on the basis of the impact each project will have on the environmental eco-system is justified, among other reasons, by the requirement for the team of multi-disciplinary experts to put their study of environmental impact before the community and to substantiate the results and the reliability of the opinions expressed. Procedures of this type, named multicriteria methods, have the merit of providing a unique information synthesis that can be a valuable aid for the final decision-maker, on conclusion of the assessment process.

Multicriteria analysis techniques (MCA) are able to determine lists of priorities from a finite series of choice options (alternatives) on the basis of identifying characteristics of the problem (criteria), which is appropriately broken down into its fundamental elements (Voogd, 1983). They consider the objectives and strategies of the various subjects involved in the decision-making process with respect to the resources available and the general goal of the evaluation. The criteria are measured according to suitable scales of measurement and different measurement units.

Multicriteria methodologies are often used in decision making processes with two purposes: a) giving a better definition of the parameters used in the selection process and when defining the action to be taken; b) providing a back-up for the decision-maker (or decision-makers) when one option is preferred to others or in order to know the possible consequences of an action that is about to be undertaken. All these methods require, on the part of the decision-makers, an explanation of the individual preferences assigned to the various objectives-criteria calling for decision. Therefore, discussion and negotiations should be made available where exponents of different groups of opinion, political currents and lobbies, as well as the promoters and executors of the proposed actions, may be represented (Zeppetella et al., 1992).

ILLUSTRATION OF SOME MULTICRITERIA AND DECISION SUPPORT SYSTEMS

SEL – Systeme de Evaluation des Logement	This method aims to evaluate the quality level of the final design solution (project) for buildings. The quality evaluation consists of a comparison between values derived from design solutions (for instance room areas, thermal and acoustic coefficients, specified finishes) and weight-scales. The characteristics of a building project (performances) are related to the needs, requirements and preferences of the users, and are expressed in terms of weight objectives. These objectives refer to: a single unit (e.g. spaces, flexibility, orientation, adaptability, etc.); a building (e.g. presence of business premises, parking, etc.); and, lastly, the environment (e.g. presence of social services and urban facilities). They are translated into linear utility functions in order to relate the changes of every characteristic of the project with the consequent changes of utility, and measuring them on a cardinal scale. The evaluation, therefore, expresses the degree of fulfilment of the whole objectives in relation to the characteristics of the project, i.e. its "use-value". The evaluation outcome (the quality of the design solution) is a final synthetic index which expresses the relation between the performances of all the single elements of a building and the user' requirements. This use-value reflects only the utility related to the direct users of the building, without considering all the other members of the community (indirect, potential and future users). This method can be applied only to new buildings.
Concordance - Discordance Analysis	This is a method used with non comparable criteria and which bear a different importance in terms of the decision or result. Alternatives can be ranked according to their response to a series of point of view, and the best fit can be identified. It requires quantitative score indices to be assigned when comparing the alternatives with the criteria for compiling the impact matrix (cardinal scale with decimal indices) and furthermore, quantitative estimates of the relative importance assigned to the criteria considered in the assessment. The vector for the weighting of the criteria must then be normalised so that the summation results in the value 1. The analysis assumes the existence of suitable techniques for this purpose and makes no reference to its own techniques for assigning the scoring. Then, the procedure is based on the calculation of a concordance index and of a discordance index. These are obtained, respectively, from the ratio between the summation of the weightings of the criteria that respond positively and those that respond negatively to the hypothesis that alternative 1 is preferable to alternative 2, and the summation of all the criteria weightings. To each alternative are associated as many concordance indices and as many discordance indices as there are alternatives less one (because an alternative cannot be compared with itself). For each pair of alternatives 1 and 2, the closer the concordance index is to unity and the discordance index to zero, the more preferable 1 is to 2. Furthermore, the summation of the concordance indices of an alternative gives, in relative terms, its degree of overall preference; while the summation of the weighted and normalised discordance indices enables its degree of total discordance (or deviation) to be measured with respect to the other alternatives. Lastly, it is still possible to establish a priori threshold indices to be attributed to the concordance and discordance indices, respectively, to be used as terms of comparison with respect to the values obtained during the assessment phase.

(cont.)

AHP – Analytic Hierarchy Process	A.H.P. allows to reach at a set of ratings for the decision alternatives by aggregating the relative weights of decision elements. The procedure starts by breaking down the decision problem into a hierarchy of interrelated decision elements. At the top of the hierarchy lies the most macro decision objective, such as that of selecting the best alternative. The lower levels of the hierarchy contain attributes which contribute to the quality of the decision. Details of these attributes increase at the lower levels of the hierarchy. The last levels of the hierarchy contain decision alternatives. In setting up the decision hierarchy, the number of levels depends on the complexity of the problem and on the degree of detail the analyst requires to solve the problem. Since each level entails pairwise comparison of its elements, Saaty suggests the number of elements at each level to be limited at a maximum of nine. The input data for the problem consist of matrices of pairwise comparisons of elements of one level that contribute to achieving the objectives of the following higher level. Pairwise comparison data are collected for only half of the matrix elements: diagonal elements always equal one, and the lower triangle elements of the matrix are the reciprocal of the upper ones. Pairwise comparisons give to the evaluator a basis to reveal his preference by comparing two elements. Additionally, the evaluator has the option of expressing preferences between the two as equally preferred, weakly preferred, strongly preferred, or absolutely preferred, which would be translated into pairwise weights of 1, 3, 5, 7 and 9, respectively, with 2, 4, 6 and 8 as intermediate values ('Saaty's scale'). The technique takes in as input the above comparisons and produces the relative weights of elements at each level as output using the "eigenvalue" method. Additionally, the method includes consistency checks for input matrices. The consistency index (CI) is: *(eigenvalue maximum - n)/(n-1)* and the consistency ratio (CR) is: *(CI/RI)*100*, where RI is the average index of randomly renerated weights. A CR value of 10 percent or less is considered acceptable. Otherwise, it is recommended to resolve inconsistencies in pairwise comparisons. The last step of the procedure aggregates relative weights of various levels obtained from the previous step in order to produce a vector of composite weights which serves as ratings of decision alternatives in achieving the most general objective of the problem.
Regime Method	The Regime Method is a qualitative multiple analysis, developed in the area of soft econometrics. It is based on a combination of Kendall's paired comparison method for ordinal data and logit analysis. It proceeds by comparing alternatives two by two within an impact matrix (J*I) to create vectors indicating preference for an alternative. These vectors are then used to produce a "regime matrix" containing +, - or 0 signs only, of a J*I (I-1) order. The regime matrix is simply a transformation of the initial impact matrix. Multiplied by the weighting vector, this matrix enable the aggregated probability (or success) indices to be calculated. The method does not require cardinal data, but only a classification of the criteria in increasing or decreasing order of importance. This is the greatest advantage of this method. An aggregated probability index equal to unity indicates absolute preferability; and equal to zero, no preferability. A value between 0 and 1 means preferability of the alternative is uncertain. In the latter case, attempts are made to draw by lot a series of cardinal numbers, that satisfy the conditions set by the ordinal vector of the criteria weightings, a finite number of times until the doubt is settled.

(cont.)

Benchmarking	Benchmarking has up to now mainly been applied as a management tool within companies. The history of benchmarking began in the 1960s and 1970s when Japanese visitors investigated many European and American firms, organizations, exchanges, etc. However, hardly anyone expected the way they started to produce their products after this 'learning period': they sold products for prices which were below even the production costs of their Western competitors. The benchmarking project was apparently very successful (Camp, 1989). In the meantime, benchmarking has become a kind of 'fashion' in economic research, especially as a management tool for improving the productivity and the competitive position of organizations. A 'benchmarking' tool aims to compare the performance of a company with the performance of other companies, and to analyse why these changes occur. In this way it can be analysed why a company is more successful than another company. It is important that not in the first place products and financial figures are compared, but merely underlying processes which cause the differences. As a result also an analysis why differences occur is presented, and eventually indications how a company may perform better. In a benchmarking project, activities are split up in small activities (e.g. invoicing, maintenance), so that the analysis takes place at a rather detailed level. When successful, this leads to the most interesting information, but it should be acknowledged that such an analysis takes a lot of efforts and time. There is a lot of data necessary, but also insights in the contents of data (every organisation may have different definition for a certain activity). Its aim is to learn where improvements in policies may occur. The best performing country in the benchmark study may then provide a future target value, to which a organization should aim. For carrying out a benchmarking study many data are needed on all targets and other determinants of the transport sector. In addition, much information is necessary on underlying processes as well as on the specific definitions used in the data sets of the various countries and regions. This requires discussion and data search. See also Nijkamp et al., 1999; Ruddock, 1999.
Spider Model	A way to analyse, assess and visualize internal factors in a scenario is the so-called Spider model. Its aim is both to analyse, and to visualize scenarios for the future. In the model, it is first necessary to identify the main four fields of building blocks within the scenario. These four fields are internal factors within the scenario analysis. Next, the main developments, factors or policies within these fields have to be identified and put on these axes. In this way, the analysis is structured which makes it easy to compare various scenarios. This stage is very important, as the ordinal ranking of the outcomes of future scenarios on the axes of the spider allows one to make normative judgements - in a comparative sense - on the desirability of the various images. This makes the spider approach more practical than just a visualization method. A policy initiative can be represented and assessed by a combination of 8 points on the successive axes of the spider model. This is a meaningful visualisation of the main characteristics and driving forces of such a system, as a confrontation of different 'spiders' (concerned with different driving forces) will immediately pinpoint the most important underlying factors. The extreme points on each axis have only a qualitative meaning; they do not represent numerical information, but only a rank order (in terms of more or less). This is also important for scenario design, as the axes present underlying forces which are more or less likely, but not precise assessments of all consequences of such options. For this model scores have to be given on the several axes. Up to now this has been done via expert opinions (questionnaire survey) and logical reasoning. For more details : Nijkamp *et al.* (1999), and Rienstra *et al.* (1999).

(cont).

Meta-Regression Analysis	The meta-approach or meta-analysis was introduced by social study researchers in the early 1970s to overcome common problems such as the lack of large data sets in order to induce general results and the problem of uncertainty of information and of data values. Meta-analysis is a systematic framework which synthesizes and compares past studies and extends and re-examines the results of the available data to reach more general results than earlier attempts had been able to do. In particular, meta-regression analysis is a statistical technique widely applied in biometrics and sociometrics with very successful results. The application of a meta-regression analysis can define the results we want to achieve in our assessment analysis. However, standard precautions in the regression analysis need to be taken so as to obtain valuable results. After having estimated the regression, we must evaluate various tests that can verify the correctness of our result. Such tests generally try to assess the effect sizes in the examined study and the accuracy of the results. In the case of meta-regression analysis, the data that needs to be collected must be quantitative data. Given this condition, a general guideline for deciding whether or not a particular study should be considered in the meta-analytical formulation is based on commonality in research issues. With regard to this criteria for the selection, particular care must be taken to ensure similarity among the studies. Moreover, we need to verify uniformity and standardization in order to minimize possible errors in the calculation. To avoid this problem it may be necessary to conduct further experiments or simulations or carry out new elaborations and estimations of the data presented in the individual studies (Van den Bergh *et al.*,1997)
Flag Model *(cont.)*	The flag model is a methodology that has been developed to offer a broad framework for decision support for regional sustainable development. The flag model has the objective to operationalize the concept of sustainability by defining a multi-criteria approach in which the indicators are represented through ranges of values by using the normative concept of critical threshold values. The model develops an operational description and definition of the concept of sustainable development. There are three important components of the model: a) identifying a set of measurable sustainability indicators; b) establishing a set of normative reference values; c) developing a practical methodology for assessing future development. The input of the program is an impact matrix with a number *n* of variables; the matrix is formed by the values that the variables assume for each considered scenario. Such values are defined by non-partisan experts. The main purpose of the model is to analyse whether one or more scenarios can be classified as sustainable or not; such an evaluation is based upon the indicators. The methodology therefore requires the identification and definition of policy relevant indicators, which are suitable for further empirical treatment in the assessment procedure. For each sustainable indicator we have to define the critical threshold values. The third component of the model, the impact assessment, provides a number of instruments for the analysis of the sustainability issue. One of the major aspects of the flag model is its representation module. There are three approaches to the representation: a qualitative, a quantitative and a hybrid approach (Nijkamp et al., 1999).

Rough Set Analysis	Rough set analysis has been developed within the areas of artificial intelligence; its main emphases are how to define knowledge and the learning process through induction or deduction mechanisms, and how to differentiate between imprecision and vagueness. In rough set analysis we examine how to draw out conclusions, e.g. decisions from imprecise data and how to determine correlation and relationship among data. We can summarize by saying that the aim of the rough set analysis is to recognize possible cause-effect relationships between the available data and to underline the importance and the strategic role of some data and the irrelevance of other data. The approach focuses on regularities in the data in order to draw aspects and relationships from them which are less evident, but which can be useful in analyses and policy-making. For this reason rough set analysis overlaps other mathematical ideas developed to deal with imprecision and vagueness, such as fuzzy logic theory, the theory of evidence, and the discriminant analysis. Other comparative analyses have discussed the links among these different mathematical concepts and pointed out the intrinsic relationships of these methods with rough set analysis. It appears evident how rough set analysis optimally has been applied as an assessment policy method, where imprecise information are classified and reduced to determine a coherent policy choice. The definition of the upper and lower approximation sets assumes an important role in the rough set methodology. Through these sets we can classify and examine the load of uncertain information which we have collected. Consequently, this approach could lead to an imprecise representation of reality by reducing the information specific sets. Such an objection to this methodology might be better understood when we remember that the capacity to manipulate uncertain information and the consequent capability of reaching conclusions is one of the most essential assets of the human mind in obtaining knowledge. Therefore, the representation of reality by means of rough set analysis is indeed a reduction of the perceived real phenomena, but it is done in such a way as to enable us to classify, distinguish, and express judgements about it. One of the most important features of this approach is the capacity to examine quantitative as well as qualitative data. Such data can define vague information and uncertain knowledge that will then be manipulated by the model in the approximation of the data set. The decision rules and the table of information are the basic elements needed to solve multi-attribute choice and ranking problems. The binary preference relations between the decision rules and the description of the objects by means of the condition attributes determine a set of potentially acceptable actions. In order to rank such alternatives, we need to conduct a final binary comparison among the potential actions. This procedure will define the most acceptable action or alternative. The model in its version for Windows '95 is potentially able to visualize the obtained results in a user friendly environment.
Pentagon Prism Model	The Pentagon Prism model classifies factors within the following five main headings: *Hardware* - factors refer to the level of technological sophistication of the renewable energy system used; *Software* - factors refer to information provision and communication to citizens in order to induce environmentally-begin behaviour; *Orgware* - concerns the institutional and managerial efficiency in the urban energy-environmental sector; *Finware* - is concerned with the cost saving and financial aspects of new energy initiatives; *Ecoware* - deals with the urban social and quality of life conditions for the implementation of new energy initiatives in a sustainable city context. See: Nijkamp and Pepping, 1998; Capello et al., 1999.

APPENDIX B – Glossary of the main technical terms and neologisms

This glossary aims at providing a short definition of the main terms and neologisms used in multimodal thinking and in this study, with the aim of making the reader feel more familiar with this new terminology. Although it does not provide an exhaustive technical definition, each term is explained by means of some accepted definitions from literature. Among others, the following references are used: Kalsbeek (1975); *Oxford Advanced Learner's Encyclopedic Dictionary* (1993).

AGENDA 21 (LOCAL) – It is a large project elaborated in the 1992 Earth Summit (UNCED, 1992). This nominated local authorities as major agencies for promoting sustainable development. The project is primarily an action plan for sustainable development that includes goals, actions to be taken, commitments by the stakeholders and strategic "programme areas". It was subsequently developed at the 1994 European Aalborg Conference (EGUE, 1994). It is implemented by ICLEI, the International Council for Local Environmental Initiatives (ICLEI, 1996).

AESTHETIC – Name of a SOFT *(later)* modality, which is characterised by harmony and beauty. Synonym in this study for ***Visual appeal and architectonic style of buildings and settings.***

ANALOGY – Collective name for a RETROCIPATION or ANTICIPATION, equivalent of *meaning-moment* (Kalsbeek). It means that components of each modality are mirrored, echoed in others. See also IDIOM/SOURCE. Ref. Oxford Dictionary: "partial similarity between two things that are compared".

ANALYTICAL – Name for the seventh modality, characterised by logical distinction. Synonym for ***Analysis and Formal Knowledge***

ANALOGY MOMENTUM – An analysis of the complexity of sensitive reality. It shows that reality is rich and various, since it is organised in such a way to explicitly show interrelations between parts (Kalsbeek)

ANTICIPATION – An ANALOGY within one modality referring to a later modality. Contrast with RETROCIPATION (Kalsbeek). Ref. Oxford Dictionary: "action or state of anticipating". To *anticipate* "1) to expect; 2) to see (what needs to be done) and act accordingly; 3) to do before it can be done by sb. else; 4) to deal with or use (sth) before the right or natural time".

ASPECT – A synonym for MODALITY (Kalbeek). Ref. Oxford Dictionary: "Particular part or feature of sth. being considered". In this study, it refers to both the original Dooyeweerdian fifteen modalities and their new definition (or specification) for the evaluation of sustainability.

BIOLOGICAL or BIOTIC – Name of the fifth modality which is characterised by life function. Synonym for ***Health, Bio-diversity, Ecological protection.***

CARRYING CAPACITY – An recognition that there are limits to economic growth and urban expansion. The limits are usually given by the scarcity of space and the absorption capacity of the natural and living environment (Rees, 1992).

COMMUNICATIVE – Name of the ninth modality, often used as synonym for Lingual or Informatory, which is characterised by symbolic representation. Synonym in this study for ***Communication and the Media.***

CREDAL – Name of the fifteenth and highest modality, synonym for Pistic or Pistical which is derived from *pistis*, the New Testament Greek word for faith. Dooyeweerd distinguishes it from religion which is central and underlies all man's functions. All men have faith in the sense of ultimate allegiance (Kalsbeek). It is characterised as a terminal sphere. In this study, it is synonymous for ***Commitment, Interest and Vision***.

DEPENDENCE – "State of having to be supported by others" (Oxford Dictionary). The laws of later modalities depend on and require those of earlier ones (Kalsbeek).

DESIGN – Ref. Oxford Dictionary: "1) drawing or outline from which sth. may be made; art of making such drawings etc.; 2) general arrangement or planning (of a building, book, machine, picture, etc.); 3) arrangement of lines, shapes or figures as decoration on a carpet, vase, etc., pattern; 4) purpose, intention". To *design*: "decide how sth will look, work, etc. especially by making plans, drawings or models of it; think and plan (a system, a procedure, etc.), devise".

DEVELOPMENT DIRECTION – An interpretation of the modal order where each MODALITY is analysed as enrichment of the previous ones (Clouser, 1991).

ECOLOGICAL FOOTPRINT – It refers to the area of land required to biologically produce all the resources consumed by a community and to assimilate its waste, indefinitely (Wackernagel et al., 1993)

ECONOMIC – Name of the eleventh modality, characterised by the handling of limited resources. Synonym in this study for ***Efficiency & Economical appraisal.***

ENKAPSIS – Dooyeweerd uses the term *enkapsis*, inherited from the biologist Heinemann, to designate the intertwinement of differently qualified structures. It refers to the structural interlacements which can exist between things which have their own internal structural principle and independent qualifying function. As such, it is to be distinguished from the part-whole relation, in which there is a common internal structure and qualifying function (Kalsbeek). Dooyeweerd discusses several types of enkapsis: Foundational Enkapsis (marble - statue); Subject-Object Enkapsis (snail - shell); Symbiotic Enkapsis (clover - nitrogen-fixing bacterium); Correlative Enkapsis (community - person); Territorial Enkapsis (city - its university).

ENTITY (SIDE) – It concerns "things with distinct and real existence"; "thing's existence (contrasted with its qualities, relations with other things, etc.)" (Ref. Oxford Dictionary). Entity is also synonym for system, and in fact anything that does something: e.g. a person, a flower, a house, a government, a symphony, a town (Kalsbeek).

ETHICAL – Name for the fourteenth and penultimate modality, characterised according to Dooyeweerd by "love in temporal relationships" or by altruism.

EVALUATION (EVALUATE) – Ref. Oxford Dictionary: "to find out or form an idea of the amount or value of (sb/sth)" or "synonym of assess". To *assess*: "decide or fix the value of (sth)".

FOUNDING or FOUNDATIONAL FUNCTION – The lower (earlier) of the two modalities which characterise certain types of structural wholes. The other is called GUIDING or QUALIFYING FUNCTION (Kalsbeek).

FRAMEWORK – Ref. Oxford Dictionary: "structure giving shape and support" or "set of principles or ideas used as a basis for one's judgement , decisions, etc.".

FUNCTION – Ref. Oxford Dictionary, *function:* "1) a special activity or purpose of a person or thing; 2) a thing whose size, importance, etc. depends on something else; 3) any of the basic operations of a computer".

FUNCTIONING – Individuality structures (a systems) function in all modalities and serve as an integration point for the modalities; there is no direct causal link between modalities (Basden, 1996).

GUIDING FUNCTION – The highest subject-function of a structural whole. This function is also said to QUALIFY the structural whole (except in the case of man). Also called "leading function" because it guides or leads its substrate functions (Kalsbeek).

HARD/SOFT – See SOFT/HARD

HISTORICAL – Name for the post-analytical modality, synonymous in Dooyoweerd's theory for technical and cultural-historical, denoting the aspect of *formative power*. Synonym, in this study, for ***Creativity and Cultural Development***.

IDIOM/SOURCE – It concerns to the correspondence between the orders of different modalities which allows one modality, *source,* to be used as a metaphoric representation of another or several other modalities, idiom (de Raadt, 1991). Ref. Oxford Dictionary: *idiom* "phrase or sentence whose meaning is not clear from the meaning of its individual words and which must be learnt as a whole unit"; *source*: "1) place from which sth. comes or is obtained; 2) person or things supplying information, esp. for study".

INDIVIDUALITY STRUCTURE – The general name or the characteristic lawful order of concrete things, as giving by virtue of creation (e.g. there is an ≈ for the state, for the marriage, for mosquitoes, for sodium chloride, etc.). A theoretical analysis of the modal structure is the indispensable precondition for an analysis of individuality structure. See MODALITY (Kalsbeek).
Ref. Oxford Dictionary: *individuality* "1) all the characteristics that belong to a particular person and that make him/her different from others; 2) state of separate existence"; *structure* "1) way in which something is put together, organised, built, etc.; 2) anything made of many parts, any complex whole, building".

IRREDUCIBLE (IRREDUCIBILITY) – Incapability of theoretical reduction. It refers to the unique distinctiveness of things which we can find everywhere in creation (Kalsbeek). Ref. Oxford Dictionary: "1) that cannot be reduced or made smaller; 2) that cannot be made simpler".

JURIDICAL – Name of a SOFT modality which is characterised by *Retribution, fairness, rights*. In this study, synonym for ***Rights and responsibilities.***

KINEMATIC – Name of the third modal aspect, deriving its name from a Greek word for movement (*kinema*), which is nuclear moment. In this study, it is synonym for ***Transport and Mobility***.

LAW – This is central to all the theory. Everything in creation is subject to God's law for it, and accordingly law is the boundary between God and creation. Dooyeweerd stresses that law is not in opposition to, but the condition for true freedom (Kalsbeek). Ref. Oxford Dictionary: "1) rule established by authority or custom, regulating the behaviour of members of a community, country; 2) body of such rules; 3) such rules as a science or subject of study; 4) rule of action or procedure; 5) factual statement of what always happens in certain circumstances, scientific principles".

LAW SIDE – The created cosmos for Dooyeweerd has two sides, the low side and the subject side- The former is simply the aggregate of God's laws, the latter the totality of created reality, which is subject to those laws. The law-side is unfettered by sin and it is always universally valid (Kalsbek).

LAW SPHERE – Equivalent of MODALITY used by Dooyeweerd to stress the fact that each modal aspect answers to its own peculiar laws.

MANAGEMENT – From the Websters Comprehensive Dictionary: "to bring about" or "to direct or conduct the affairs of something" .

MEANING – In Dooyeweerd's theory it is a synonym for reality. It means "the referential, in-self-sufficient character of created reality in that it points beyond itself to God as Origin" (Kalsbeek). This is an unusual way of using the term. Ref. Oxford Dictionary: "what is conveyed or signified, sense; or purpose, significance".

MEANING MOMENT – A synonym for ANALOGY, referring to ANTICIPATION, RETROCIPATION, MEANING-NUCLEUS.

MEANING NUCLEUS – Synonym for NUCLEUS MOMENTUM or *meaning kernel*

MEANING SIDE – Synonym for MODALITY or ASPECT

METHOD – Ref. Oxford Dictionary: "way of doing sth.". Synonym for *Approach*: "way of dealing with a person or thing".

MODALITY – An irreducible area of functioning of a system or thing (de Raadt, 1991). On of the fifteen fundamental ways of being, distinguished by Dooyeweerd. As modes of being, they are distinguished by the concrete things to which they belong. Some synonyms are ASPECT, FUNCTION, LAW-SPHERE, MEANING-SIDE, MODUS-QUO (Kalsbeek). Ref. Oxford Dictionary: "relating to mode or manner, in contrast to substance".

MODUS QUO – Latin for 'manner in which".

MUTUAL CORRELATION – It characterises the ways modalities possess properties. Ref. Oxford Dictionary: *mutual* "1) (of a feeling or an action) felt or done by each towards the other; 2) (of people) having the same specific relationship to each other; 3) shared by two or more people"; *correlation* "mutual relationships".

NORM (NORMATIVE) – Post-sensitive laws, i.e. modal laws from the analytical through pistic (credal) law-spheres (Kalsbeek). These laws are norms because can be violated in distinction to the natural laws which are obeyed involuntarily. Ref. Oxford Dictionary: *normative* "describing or setting standards or rules of language, behaviour, etc. which should be followed"

NUCLEUS MOMENTUM (NUCLEAR MOMENT) – An essential characteristic of a modality which makes it irreducible to any other. It provides a modality with an internal order and a particular position within the modal order. Synonym for *meaning-kernel* (Kalsbeek).

PHYSICAL – Name of the fourth modality qualified by mass and energy. In this study it is synonymous for ***Physical environment, mass and energy***.

PLAN – Ref. Oxford Dictionary: "detailed, large-scale diagram of part of a town, district, group of buildings, etc.; outline drawing (of a building or structure) showing the position and size of the various parts in relation to each other; way of arranging something, esp. when shown on a drawing, scheme".

PRECAUTIONARY PRINCIPLE – It states that policy makers take initially a cautious approach which may be relaxed as evidence becomes more available (UNCED, 1992).

PROCEDURE – Ref. Oxford Dictionary: "1) order or way of doing things; 2) action or series of actions to be completed in order to achieve sth.".

OBJECT – Something qualified by an object-function and thus correlated to a subject-function. For example, a work of art is qualified by its correlation to the human subjective function of aesthetic appreciation (Kalsbeek).

OPENING PROCESS – The process by which latent modal anticipations are "openend" or actualized. The modal meaning is then said to be "deepened". It is this process which makes possible the cultural development of society. For example, by the "opening" (or disclosure) of the ethical anticipation in the juridical, the modal meaning of justice is deepened and society can move from the principle of "an eye for an eye" to the consideration of extenuating circumstances in the administration of justice (Kalsbeek). In this study, the term *"open(ing) up"* may also refer to a specific feature of the framework, i.e., to show problems (or issues) which were not evident previously, enlarging the field of the evaluation for sustainability (Wegener, 1994).

QUALIFY (QUALIFYING ASPECT) – It is the modality whose laws guide and regulate the internal organisation or development of a system and which is also the highest modality in the modal order. See GUIDING FUNCTION.

QUANTITATIVE or NUMERICAL – Name of the first modality. It means 'awareness of how much of things' or arithmetic. It is characterised as terminal sphere. In this study, it is synonymous for ***Numerical accounting.***

RETROCIPATION – A feature in one modality which refers an earlier one, yet retaining the modal qualification of the aspect in which it is found (Kalsbeek). See ANTICIPATION.

SENSITIVE – Name of the sixth modality, which is qualified by sensation or feeling as its nuclear moment. Dooyeweerd has often used the term Psychic for it but this has proved misleading (Kalsbeek). In this study, it is synonymous for ***Perceptions of people toward the environment.***

SOCIAL – Name of the tenth modality which is characterised by *social intercourse* (nuclear moment). Synonym, in this study, for ***Social climate, social relationship, social cohesion.***

SOFT/HARD – It concerns categories of issues or aspects (de Raadt, 1991). It is synonymous for higher/lower; later/earlier; NORMATIVE/determinative. In this study, it is also used for classifying assessment methods, as synonym for non-monetary and monetary or qualitative and quantitative information.

SPATIAL – Name of the second modality, characterised by continuous extenstion. It is synonymous in this study for ***Space, shape and extension***.

SPHERE SOVEREIGNTY – It means the irreducible functioning of the modalities. This is the ontological principle on which the sociological principle is based, since each of the various distinct spheres of human authority, such as family, church, school and business enterprise, is qualified by a different irreducible modality (Kalsbeek). See also SPHERE UNIVERSALITY

SPHERE UNIVERSALITY – The definite relationships between the modalities. It is the principle that all the modalities are intimately connected with each other in an unbreakable coherence. It emphasises that every modality depends for its meaning on all the others, especially as evidenced by the ANALOGIES in the MODAL STRUCTURE for each (Kalsbeek).

SUBSTRATUM (SPHERES) – The aggregate of modalities, *preceding* a given aspect in the modal order. The foundational modal aspects in the cosmic order of time. Those which are based on them are called SUPERSTRATUM SPHERES (Kalsbeek).

SUPERSTRATUM (SPERE) – The aggregate of modalities *following* a given aspect in the modal order (Kalsbeek).

SUSTAINABILITY (URBAN) – This study does not provide a single or unique definition for this concept, assuming it is beyond definition (such as TIME). It is not a theory or a thing but rather an *intermodal process of development* which is *multi-aspectual* (multi-modal or multi-dimensional), requiring *multi-people* effort and *multi-period* verification, particularly in planning. It generally refers to the need to improve the human condition (or a community) while at the same time caring for and protecting the natural (and cultural) environment. It is also synonym for Sustainable Development, embodying a number of principles within it (such as intergenerational equity, social equity, carrying capacity, etc.) and translating them into a planning approach for developing communities (Moffat and Campbell, 1998). The word *sustainable* suggests the idea of constant, permanent or continuous (and, in fact, it is translated "*durable*" in Dutch, Finnish and French) but this may change the meaning of the concept. In this study, it refers to the OPENING PROCESS of all the fifteen ASPECTS in a built environment and its community. A more specific definition has been provided by Lombardi and Basden (1997), saying that: "*Sustainability in the built environment is a result of the subjects related to the built environment acting in line with the laws of all aspects in an integrated and balanced manner over the long term, and threats to sustainability come from going against or ignoring the laws of one or more aspects*".

TIME – A general ontological principle of intermodal continuity. It is not co-ordinated with space. It has much wider application than our common notion of time which is equated by Dooyeweerd with the physical manifestation of this general cosmic time (Kalsbeek). In this study, it is closely linked to the concept of SUSTAINABILITY.

APPENDIX C – An Analytical Framework for Evaluation

Examples related to the (re)development of an urban area

MODAL ASPECTS	SUSTAINABILITY ASPECTS AND DEFINITION	KEY-QUESTIONS	EVALUAT. TOOLS
Credal	**Commitment, Interest and Vision** It identifies the motivation for human actions and choices, reasons and goals underpinning urban policies and political strategies, the political point of view, the peoples vision of a community development, etc.	Futurity: Is the political situation stable? Equity: Does the (re)development scheme meet with regional – national plans? Environment: Has a Strategic Environmental Assessment been undertaken? Will finance be available for environmental protection? Participation: Has the (re)development scheme been agreed on by stakeholders?	Strategic regional plan Focus groups Consultation ....
Ethical	**Ethical issues** It refers to a particular attitude towards the others, both living creatures or inanimate ones, which is governed by altruistic motives. It suggests that stakeholders go beyond mere duty in consideration of ownership and responsibility allowing collaboration and co-operation.	Futurity: Does the development scheme provide the same or improved opportunities for people in the future as in the present? Equity: Does the development scheme reduce social inequalities? Does it support the action of voluntary groups? Environment: Does the scheme provide a protection of biosphere, ecosystem and animal species? Participation: Have the stakeholders been involved in the development of the scheme?	Community Impact Evaluation Environmental impact analysis ....

(cont.)

MODAL ASPECTS	SUSTAINABILITY ASPECTS AND DEFINITION	KEY-QUESTIONS	EVALUAT. TOOLS
Juridical	**Rights and responsibilities** It expresses the human need for justice, usually institutionalised and formalised in a body of laws, regulating social justice. It also deals with property and planning laws, legal institutions and political structure, land titles regulations and other policy.	Futurity: What are the modifications in current property structure? Have the rights and the responsibilities of all developers, land and building owners and users, been accounted for in the long term? Equity: Does the scheme provide an identification of those who benefit and those who pay for the development? Does it include some possibilities for the reimbursement of damage and a payment for the rights received? Environment: Is there compliance with the technical - planning standards related to the protection of the environment? Participation: What is the degree to which people can change their environment either directly or through elected representatives? What citizen groups are entitled to participate in the decision making process?	Public Committees Public advisory boards Public Planning Councils European, National and Local Planning Laws and Regulations ....
Aesthetic	**Visual appeal and architectonic style of buildings and settings** It means beauty and harmony within the settlement. In design it also means aesthetic quality related to architectonic style and decoration.	Futurity: Does the development scheme improve the artistic character and significance of buildings and settlements in the short and long term? Does the condition of the built environment enhance the visual appeal? Equity: Are the planned interventions aesthetically satisfying to all the stakeholders? Environment: Is the development in harmony with the context, the surroundings and the eco-system? Does the scheme improve the visual appeal of natural settings? Participation: Have the viewpoints of both stakeholders and experts been taken into account in the development of the proposed design?	Design approach and methodologies Lynch approach to design Polls and surveys Workshops, meetings and consultation ....

(cont.)

MODAL ASPECTS	SUSTAINABILITY ASPECTS AND DEFINITION	KEY-QUESTIONS	EVALUAT. TOOLS
Economical	**Efficiency & economic appraisal** It is not concerned so much with finance, but rather with wise use of limited resources Efficiency is defined as the ability to achieve desirable goals by managing limited resources. It asks developers and designers to consider how to make best use of all the available resources.	Futurity: Has a long term financial appraisal been undertaken? Equity: What is the financial distribution for the stakeholders? Has employment of the local labour force in construction activities been considered? Environment: Is there an efficient environmental management system? Is there an exhaustive city-wide recycling programmes from which the development could benefit? Participation: How many of the stakeholders have committed themselves to the financial appraisal?	Life cycle costing of buildings Cost benefit analysis Comminity Impact Evaluation Multicriteria analysis ....
Social	**Social climate, social relationship, social cohesion** It refers to a relationship which links people together, developing co-operation and association. Key concepts related to it are: "Sociophilia", cohesion, synergy and plurality.	Futurity: 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? Equity: 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? Environment: Does the plan consider the impacts of tourism on the cultural and natural settings? Participation: Have social clubs, voluntary groups and cultural associations been involved in the development of the scheme?	Polls and surveys Questionnaire techniques Audit and monitoring ....

(cont.)

MODAL ASPECTS	SUSTAINABILITY ASPECTS AND DEFINITION	KEY-QUESTIONS	EVALUAT. TOOLS
Communicative	**Communication and the Media** Advertising and urban signs, information facilities, media and networking are common means for transferring information in a built and urban environment. It may also refer to the communicative role of a planning activity with the meaning to inform and in turn to get information from stakeholders, developers and community in general.	Futurity: 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? Equity: Does the plan improve the accessibility to communication facilities for all citizens, including poor and disadvantaged? Environment: Does the plan include environmental audits? Is an environmentally oriented advertising available for the area? Participation: Is information on the development scheme available to all stakeholders? Are all relevant citizen groups able to take part to the discussion, argument and evaluation in planning? Does everyone understand the language used?	Monitoring and audit Argumentative approaches in planning evaluation Technical and non technical languages I.T. tools Virtual reality ....
Historical	**Creativity and cultural development** It means "formative power" for a human community, change and creativity in planning and design. It deals with all those active, creative and designing activities within a community, such as conservation strategies for the built heritage, effective technologies employed in construction.	Futurity: Does the urban plan include a restoration programme for cultural heritage? Is the innovation based on local practice? Equity: Does the plan improve the living standards of the poor and disadvantaged and their cultural aspirations? Environment: Are the technologies employed environmentally friendly? Participation: Does the city have a well established consultation process? Has consultation successfully been undertaking in relation to the proposal?	Design approaches Technological analyses Goals achievement matrix ....

(cont.)

MODAL ASPECTS	SUSTAINABILITY ASPECTS AND DEFINITION	KEY-QUESTIONS	EVALUAT. TOOLS
Analytical	**Analysis, formal knowledge** It governs the process of understanding, reasoning and deductive thinking. It refers to the activity of scientists, researchers and all those people who use scientific tools in their professional work. It is related to quality of analysis for planning, research, education and teaching.	Futurity: Has scientific analysis been applied to the problem, including consideration of the long term perspective? Does the funding provided evidence and support the solution in the long term? Equity: Is an educational scheme available for citizens ? Environment: Is there an educational programme relating to the environment available for the community? Participation: Has the developed analysis been accessed and agreed on by most of the stakeholders?	Analytical hierarchy process Analytical approaches in planning evaluation Logic, scientific reasoning and deductive thinking ....
Sensitive	**Perceptions of people towards the environment** It deals with senses, feelings and emotions, such as the feeling of well-being, the feelings engendered by living there, security, privacy, noise, comfort, etc.	Futurity: Is a long term security scheme available for the area? Equity: 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 children's viewpoint taken into consideration? Environment: Does the plan solve the problems of noise in the area? Does it take into account the visual impact? Participation: Are the viewpoints of all stakeholders, including those who have no voice, taken into consideration? Have the groups for the rights of children been active in decision making?	Lynch's theoretical outlook approaches I.T. tools Virtual reality Surveys and polls Questionnaires techniques ....

(cont.)

MODAL ASPECTS	SUSTAINABILITY ASPECTS AND DEFINITION	KEY-QUESTIONS	EVALUAT. TOOLS
Biological	**Health, bio-diversity and ecological protection** It defines the "vitality" of a system and its ability to survive, or to live, grow and develop. It refers to the carrying capacity of an urban environment. In terms of system ecology, it refers to the concept of "autopoiesis" and of metabolism of a urban system.	Futurity: 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 renewal resources in the long term? Equity: Is every stakeholder able to enjoy an appropriate level of quality of air, water and soil in the developing area? Does he/her feel happy with the presence of green areas, hygiene, health and health services, hospitals, gyms, etc.? Environment: 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? Participation: Are the community groups active on environmental issues? Have all the stakeholders taken part in the development of the environmental planning scheme?	Ecological footprint approach Carrying capacity Environmental impact analysis ....

(cont.)

MODAL ASPECTS	SUSTAINABILITY ASPECTS AND DEFINITION	KEY-QUESTIONS	EVALUAT. TOOLS
Physical	**Physical environment, mass and energy** It is characterised by energy and mass which often represents the minimum level of functioning for a living entity. In planning, it refers to the physical environment, energy, water, air, soil, natural materials, resources, and land on which to build. Within a quantitative meaning, it refers to the prosperity of the built environment, i.e. the amount of available capital of natural non-renewal resources.	Futurity: Is an energy scheme available which takes into account a long term perspective? Is a maintenance scheme for the buildings available? Equity: Does every stakeholder feel happy with the level of quality of housing and physical facilities? Environment: Has the development been based on an energy saving scheme? Participation: Have Local Environmental Action Groups such as Friends of the Earth, Greenpeace, Civic Trust association, Wwf, Ambiente Italia, etc. been involved in the development of the scheme?	Strategic environmental analysis Environmental impact analysis Multicriteria methods Energy planning schemes Physical indicators ....
Kinematics	**Transport and mobility** It deals with "movement" (a concept derived from science and mechanics). It is related to: transportation, wildlife movement, accessibility to services and parking, drainage systems.	Futurity: Does the development scheme for the area improve the mobility in and out of the area in the long term? Equity: Is every stakeholder able to move using public transport? Are transport facilities available to all stakeholders? Environment: Is the transport planning scheme environmentally friendly? Will it improve the air quality? Participation: Have all the stakeholders taken part in the development of the transport planning scheme?	Transport and traffic planning scheme Transport evaluation tools Infrastructure capacity ....

(cont.)

MODAL ASPECTS	SUSTAINABILITY ASPECTS AND DEFINITION	KEY-QUESTIONS	EVALUAT. TOOLS
Spatial	**Space, shape and extension** It means "continuous extension". It deals with: shape and layout of buildings, terrain shape, density, location, geographical position, proximity, spatial differentiation, areas and form.	Futurity: Is the development sufficiently flexible to take into account future development schemes for the area? Will the urban form be stable in time? Equity: Is the urban density appropriate for every stakeholder? Environment: Is the new urban density and form environmentally friendly? Participation: Have all the stakeholders taken part in the development of the shape and layout of the buildings and settings?	Design approaches Planning approaches G.I.S. C.A.D. ....
Quantitative	**Numerical accounting** It means 'awareness of how much of things'. It refers to the number of people, inhabitants, metre squares, hectares of ground on which to build, etc. It deals with numerical data, statistics and mathematics.	Futurity: How long is the development process? Equity: How much redistribution of wealth is contained within the scheme? Environment: How much is the development in terms of natural and non renewal resources? Participation: How many stakeholders have taken part to the decision making?	Numerical indicators Mathematics and algebra Quantitative index ....

BIBLIOGRAPHY

The headings under which this bibliography is structured are:

A. *Sustainability, Sustainable development and the Environment.* Reports and documents, guidelines and handbooks or studies

B. *Evaluation methodologies.* Approaches, tools, procedures and applications of techniques related to various evaluation stages (ex ante, ex post, monitoring)

C. *Philosophies and general theories* (Theories underlying applied sciences)

D. *Built development activities* (Planning and design, construction, management, etc.)

A. Sustainability, Sustainable development and the Environment

ATEQUE, 1994, *Identification of Actors Concerned with Environmental Quality of Buildings,* Technical Document No.1, Paris, December

Barney G.O., 1980, *The Global 2000 Report to the President of the US*, vol.2, Pergamon Press, Oxford

Baumol W.J. and Oates W.E., 1988, *The theory of Environmental Policy*, Cambridge Univ. Press, Cambridge

BEQUEST - Building Environment Quality Evaluation for Sustainability through Time Network, 1996-1999, EC Environment and Climate Research Programme, Theme 4: Human Dimensions & Environmental Change, Directorate D - RTD Actions: Environment - E.U. DG12

BEQUEST - Building Environment Quality Evaluation for Sustainability through Time Network, 1999, *Report 1998-99*, EC Environment and Climate Research Programme, Theme 4: Human Dimensions & Environmental Change, Directorate D - RTD Actions: Environment - E.U. DG12

Blowers A., 1992, Sustainable Urban Development: Political Prospective, in Breheny (ed.), *Sustainable Development and Urban Form*, Pion London, pp.24-38

Breheny M.J. (ed.), 1992, *Sustainable development and urban form*, Pion Limited, London

British Standard (BS 7750), 1992, *Specification for Environmental Management Systems*

British Standards (BS5750), 1991, *Guide for Services*, , part 8, Page 2 para 3.7.

CER-Ministero dei lavori pubblici, 1996, *Rapporto sulle condizioni abitative in Italia,* United Nations Conference on Human Settlement (Habitat II), Istanbul, 3rd – 14th June

CER-Ministero dei lavori pubblici, 1996, *Piano Nazionale di Azione*, United Nations Conference on Human Settlement (Habitat II), Istanbul, 3rd – 14th June

Cooper I. (ed.), 1994, *Cities, Sustainability and the Construction Industry*, Proceeding of the Contruction , ESPC/SERC, Eclipse Research Consultants Committee N+N Meeting, Sleeple Ashton, 20th – 22nd May

Curwell S., Hamilton A. and Cooper I., 1998, The BEQUEST Network: Towards Sustainable Urban Development, *Building Research and Information*, n.1, vol. 26, pp. 56-65

DoE - Department of the Environment, 1991, *Policy appraisal and the environment*, HMSO, London

DoE - Department of the Environment, 1992, *Assessing the impact of urban policy*, Inner Cities Research Programme, HMSO, London

DoE - Department of the Environment, 1996, *City Challenge Interim National Evaluation*, Regeneration Research Report, HMSO, London

Engineering and Construction for Sustainable Development in the 21st Century, 1996, *Bridging the Globe: Highlights from the Symposium*, Sheraton Washington, D.C., 4th – 8th February

Engineering and Physical Science Research Council, 1998, Review Summary: management audit of the Sustainable Cities programme, EPSRC, Swindon, England

Engineering and Physical Science Research Council, Natural Environment Research Council, and Economic and Social Research Council, 1998, *Urban sustainability initiatives of the Research Councils*, Joint EPSRC/NERC/ ESRC/LINK pamphlet, Swindon, England

European Commission, 1990, *Green paper on the urban environment*, Commission of the European Communities, COM (90) 218 CEC, Office of Publications of the European Commission, Luxembourg, Brussels, 27th June

European's Fifth Environmental Action Programme, 1993, *Toward Sustainability,* Commission of the European Community, CEC.

European Commission, 1994, *Europe 2000+ Cooperation for European territorial development*, Office of Publications of the European Commission, Luxembourg, Brussels

Expert Group on the Urban Environment, EGUE, 1994, *European Sustainable Cities. Consultation Draft for the European Conference on Sustainable Cities and Towns,* first annual report, Aalbourg, Denmark, 24th – 27th June, Commission of the European Communities, Directorate XI, XI/307/94-EN

European Environment Agency Task Force, EEA, 1995, *Europe's Environment: The Dobris Assessment*, Earthscan, Copenhagen

European Commission, Regional Policy and Cohesion, ECRPC, 1997, *The EU Compendium of Spatial Planning System and Policies*, Office for the Official Publications of the European Commission, Luxembourg, Brussels

European Commission, ESDP, 1997, *European Spatial Development Perspective*, first official draft, paper presented to the Informal meeting of Ministers responsible for spatial planning of the member states of the European Union, Noordwijk, 9th – 10th June

European Union, EU, 1997, Ministers of Regions and Political Leaders, Third Conference on the Environment, *The Göteborg Resolution*, Göteborg, Sweden, 18th – 20th June

European Commission, ESPD, 1998, *European Spatial Development Perspective*, Complete draft, paper presented to the Meeting of Ministers responsible for spatial planning of the member states of the European Union, Glasgow, 8th June, Office for the Official Publications of the European Commission, Luxembourg, Brussels

Freeman C, Littlewood S., Whitney D., 1996, Local Government and emerging Models of Participation in the Local Agenda 21 process, *Journal of Environmental Planning and management,* n.1, vol. 39, pp.65-78

Friends of the Earth Scotland, 1995, *Draft, Strategy for a Sustainable Scotland*, FoE Scotland, Edimburgh

Hens L., 1996, The Rio Conference and Thereafter, in Nath et al. (eds.) *Sustainable Development*, VUB press, Brussels, pp.81-110

HMSO – Her Majesty's Government, 1994, *Sustainable Development: The UK Strategy*, HMSO, London.

ICLEI - International Council for Local Environmental Initiatives, 1996, *The Local Agenda 21 Planning Guide,* Handbook, ICLEI and IDRC, Toronto (website: http://www.iclei.org)

IIUE - International Institute of Urban Environments, 1995, *The ABC Approach*, Delft

Istituto Ambiente Italia (ed.), 1995, *Ambiente Italia 1995. Rapporto annuale di Legambiente*, Edizione Ambiente, Milan

Istituto di Ricerche Ambiente Italia (ed.), 1997, A*mbiente italia. Rapporto annuale 1997,* Edizioni Ambiente, Milan

IUCN - International Union for the Conservation of Nature, 1980, *World Conservation Strategy* , Gland, IUCN-UNEP-WWF

LUCC - Land-Use and Land-Cover Change, 1995, *Science/Research Plan*, IGBP/HDP, Stockholm/Geneva

Ministry of Public Work,, 1995, *Guida ai Programmi di Riqualificazione Urbana ex law n.179/92*, Rome

Merloni Law n.109, 1994, *Gazzetta Ufficiale Repubblica Italiana*, Rome

Moffat S. and Campbell E., 1998, *Vision, Tools and Targets. Environmentally sustainabile development guidelines for Southeast false creek*, The Sheltair Group inc., Submitted to Central Area Planning, City of Vancouver, 18th April

Nath B., Heans L. and Devuyst D. (eds.) 1996, *Sustainable Development*, VUB press, Brussels

OECD, 1994, Report on *Environmental Indicators*, OECD, Paris

OECD, 1997, *Better understanding our cities. The role of urban indicators*, OECD, Paris

Salford (City of), 1994, *Sustainable Salford: an internal environmental audit*, Salford ,UK

Salford (City of), 1996, *A Physical Regeneration Strategy for Salford: 1996 -2001*, Salford, UK

Salford (City of), 1998, *Chapel Street Regeneration Strategy*, Salford, UK

Simon J. and Kahan H., 1984, *The Resourceful Earth: A Response to Global 2000*, Basil Blackwell, Oxford

SoE Canada, 1991, A report on Canada's progress towards national set of environmental indicators, *SOE Reports* 91-1

Stanner D. and Bourdeau P. (eds), 1995, *Europe's Environmnt: The Dobris Assessment*, European Environment Agency, Copenhagen, Chapter 10, The urban environment, pp.261-296

Sustainable Seattle, 1993, *1993 Indicators of a Sustainable Community*, Sustainable Seattle Network and Civic Forum, Washington

United Nations, 1972, Programme for the Environment, Stockholm International Conference on the Environment

United Nations Conference on Environment and Development, UNCED, 1992, *Earth Summit '92 (Agenda 21)*, Regency Press, London

United Nations, 1995, *Work Programme of indicators of Sustainable Development of the Commission on Sustainable Development*, Paper United Nation Department for Policy Coordinator and Sustainable Development

United Nations Conference on Human Settlement, UNCHS, 1996, *The indicators programme: monitoring human settlements for the global plan of action*, paper - United Nations Conference on Human Settlement (Habitat II), Istanbul, June

United Nations, 1996, *The Lisbon Action Plan,* Second European Conference on sustainable cities, Lisbon, 8th October

University of Leeds, *A consultant document for the "Quantifiable City" project*, July 1994

University of Salford (Research Centre for the Built & Human Environment) & Polytechnic of Turin (Dipartimento Casa-Citta), 1997, *Sustainable Urban Renewal* - Collaborative Research Project, Turin-Salford, Interim Report, December

WCED - World Commission on Environment and Development, 1987, *Our Common Future (The Brundtland Report*), Oxford University Press, Oxford

Whittaker S., 1995, *An international guide to Local Agenda 21*, HMSO, London

B. Evaluation methodologies

Aczél J. and Saaty T.L., 1983, Procedures for synthesizing ratio judgements, in *Journal of Mathematical Psychology*, vol. 27, pp.93-102

Aho I., 1995, Theoretical and Pragmatic Aspects of the Priorization of Environmental Criteria for Buildings, in Cole et al. (eds.), *Linking & Prioritizing Environmental Criteria*, Proceedings of the CIB TG-8 International Research Workshop, Toronto, Canada, 15th – 16th November, pp.5-10

Albers L. and Nijkamp P., 1989, Multidimensional analysis for plan or project evaluation. How to fit the right method to the right problem, in Barbanente (ed.), *Evaluation Methods for Urban and Regional Planning*, IRIS-CNR, vol.6, Bari, pp.29-46

Alberti M., Bettini V. and Falqui E., 1984, *Bilancio d'impatto ambientale*, Clup, Milan

Alexander E.R. and Faludi A., Planning and plan implementation: notes on evaluation criteria, *Environment and Planning B*, 16, 1989, pp.11-16

Andrews F.M. and Withey S.B., 1976, *Social indicators of well-being,* Plenum Press, New York

Bana C. and Costa A. (eds.), 1990, *Readings in multiple criteria decision aid,* Springer-Verlag, Berlin

Barbanente A. (ed.), 1989, *Evaluation Methods for Urban and Regional Planning*, IRIS-CNR, vol.6, Bari

Barbier E.B. (ed.), 1993, *Economics and ecology,* Chapman & Hall, London

Basden A., 1994, *A multi-modal approach to knowledge based system*, Information technology Institute, University of Salford, UK (unpublished)

Bentivegna V., 1995, Il contributo della valutazione alla razionalità e legittimazione del piano, *Urbanistica,* n.105, pp.66-71

Bentivegna V., 1997, Limitations in environmental evaluations, in Brandon et al., (eds.), 1997, *Evaluation in the Built Environment for Sustainability,* E&FN SPON, Chapman&Hall, London, pp.25-38

Bentivegna V., 1999, Valutazione e pianificazione strutturale, in Lombardi and Micelli (eds), *Le Misure del Piano*, Angeli, Milan, pp.41-53

Bentivegna V., Mondini G., Nati Poltri F. and Pii R., 1994, Complex Evaluation Methods. An Operative Synthesis on Multicriteria Techniques, in Proceedings of the IV International Conference on *Engineering Management*, Melbourne, Australia, April, pp.1-18

Bertin G., 1995, *Valutazione e pensiero sociologico*, Angeli, Milan

Bertuglia C.S., Clarke G.P. and Wilson A.G. (eds), 1994, *Modelling the city. Performance, policy and planning*, Routledge, London

Bettini V., 1988, *Metodologie d'impatto ambientale*, Angeli, Milan

Bettini V., 1996, *Elementi di ecologia umana*, Einaudi, Turin

Betty M. and Densham P., 1996, Decision support, G.I.S. and Urban Planning, *Sistema Terra*, year 1, issue 1, pp.72-76

Betty M., 1976, *Urban modelling,* Cambridge Univ. Press., Cambridge

Betty M., 1995, Planning Support Systems and the New Logic of Computation, *Regional Development Dialogue*, vol. 16, n.1, pp.1-17

Betty M., 1998, Evaluation in the digital age, in Lichfield et al. (eds.), *Evaluation in Planning*, Kluwer Academic Publisher, Dordrecht, pp.251-274

Bezelga A. and Brandon P.S. (eds.), 1991, *Management, quality and economics in buildings*, E&FN SPON, Chapman & Hall, London

Bezzi C. and Palumbo M. (eds.), 1998, *Strategie di valutazione,* Gramma, Perugia

Birtles T., 1997, Environmental impact evaluation of buildings and cities for sustainability, in Brandon et al. (eds.), 1997, *Evaluation in the Built Environment for Sustainability,* E&FN SPON, Chapman & Hall, London, pp. 211-223

Bishop R.C. and Heberlein T.A., 1979, Measuring values of extramarket goods: are indirect measures biased?, *American Journal of Agricoltural Economics*, vol.12, pp.926-932

Bishop R.C., 1982, Option value: an exposition and extension, *Land Economics*, n.1, pp.1-15

Bobbio L., 1996, *La democrazia non abita a Gordio*, Angeli, Milan

Bonnes M. and Bonaiuto M., 1993, Users' perceptions and experts' evaluations of the quality of urban environment: some comparative results from the MAB-

ROME project, in Bonnes M. (ed.), *Perception and evaluation of urban environment quality*, Proceeding of the Int. Symposium, Edigraf, Rome, 28th – 30th November, pp.179-193

Bonnes M., (ed.), 1993, *Perception and evaluation of urban environment quality*, Proceedings of the MAB-UNESCO International Symposium held in Rome, 28th – 30th November, Edigraf, Rome

Bosco B., 1995, Meccanismi d'asta e allocazione di contratti pubblici: una introduzione elementare alla letteratura, *Politica Economica*, XI, n.1, April, pp.61-83

Brandon P.S. and Lombardi P.L., 1995, L'approccio multimodale per la valutazione della qualità dell'ambiente costruito nella pianificazione sostenibile, *Genio Rurale*, n.12, pp.57-63

Brandon P.S. and Betts M. (eds.), 1995, Integrated Construction Information, E&F SPON, Chapman & Hall, London

Brandon P.S. and Powel J.A. (eds.), 1984, *Quality and profit in building design*, F&FN SPON, London

Brandon P.S., 1992, *Quantity surveying techniques*, Blackwell Science, Oxford

Brandon P.S., Lombardi P.L. and Bentivegna V. (eds.), 1997, *Evaluation in the Built Environment for Sustainability*, E&FN SPON, Chapman & Hall, London

Brandon, P.S., Basden A., Hamilton I. and Stockley J., 1988, *Expert Systems: Strategic Planning of Construction Projects*, The Royal Institution of Chartered Surveyors, London, UK

Bravi M. and Lombardi P.L., 1994, *Tecniche di valutazione. Linguaggi e organizzazione di database*, CELID, Turin

Bresso M., Russo R. and Zeppetella A., 1990, *Analisi dei progetti e valutazione di impatto ambientale*, Angeli, Milan

Brooks C., Cheshire P., Evans A. and Stabler M., 1997, The economic and social value of the conservation of historical buildings and areas: economics of conservation, in Brandon et al. (eds), *Evaluation of the Built Environment for Sustainability*, Chapman & Hall. London, pp.276-294

Brosio G., 1992, *Economia e finanza pubblica*, La Nuova Italia Scientifica, Rome

Bruinsma F., Nijkamp P. and Vreeker R., 1999, Experts at Arm's Length of Public Policy-Makers. A Case Study on Utrecht (forthcoming)

Bruschi S. and Gisotti G., 1990, *Valutare l'ambiente*, La Nuova Italia Scientifica, Rome

Bruschi S., 1984, *Valutazione di impatto ambientale*, Edizioni delle Autonomie, Rome

Camp R.C., 1989, *Benchmarking - The Search for Industry Best Practices that Lead to Superior Performance*, ASQC Quality Press, Milwaukee

Capello R., Nijkamp P. and Pepping G., 1999, *Sustainable cities and energy policies*, Springer-Verlag, Berlin

Castell, A.C., Basden A., Erdos G., Barrows P. and Brandon P.S., 1992, Knowledge Based Systems in Use: A Case Study, Proceedings of *Expert Systems 92* (Applications Stream), British Computer Society Specialist Group for knowledge based systems

Cecchini A. and Fulici F., 1994, *La valutazione di impatto urbano. Una proposta metodologica,* Angeli, Milan

Cecchini A. and Taylor J.L. (eds.), 1987, *La simulazione giocata,* Angeli, Milan

Cecchini A., 1997, *Usare le Tecnologie: Analisi e Simulazione,* DAEST – Department of Analisi Economica e Sociale del Territorio, University Institute of Architecture of Venice, Venice, 15th October (unpublished)

Checkland P.B., 1981, *System Thinking, System Practice*, John Wiley, New York

Checkland P.B., Forbes P. and Martin S., 1990, Techniques in soft systems practice, Part 3: Monitoring and control in conceptual models and in evaluation studies, *Journal of applied system analysis*, vol.17, pp. 29-37

CIPE - Comitato Interministeriale per la Programmazione Economica, 1988, Direttive per l'applicazione della normativa per il finanziamento di interventi pubblici di rilevante interesse economico immediatamente eseguibili ed atti applicativi, *Gazzetta Ufficiale della Repubblica Italiana*, n.161, 11 July, Rome, pp.11-34

Clark B.D., 1995, Improving Public Participation in Environmental Impact Assessment, *Built Environment,* vol.20, n.4, pp.294-307

Clark D., 1997, Hedonic values of noxious activity: a comparison of US worker responses by race and ethnicity, in Brandon et al. (eds.), 1997, *Evaluation in the Built Environment for Sustainability,* E&FN SPON, Chapman & Hall, London, pp.382-398

Clough D.J., 1984, *Decisions in public and private sectors: theories, practices and processes,* Prentice-Hall Inc., New Jersey

Coccossis H. and Nijkamp P., 1995, *Planning for our cultural heritage,* Avebury, Hants

Coeterier J.F., 1994, *Liveliness in Town centres*, in Neary et al. (eds.), *The Urban Experience. A people-environment perspective,* Proceedings of the 13th Conference of the Int. Assoc. for People-Environment Studies, Manchester, 13th – 15th July, E&F SPON, London, pp.297-310

Cogo M., 1997, *Progetto Venezia 21*, Fondazione Eni Enrico Mattei, Venice

Cole R.J., Campbell E., Dixon C. and Vrignon J. (eds.), 1995, *Linking and prioritising Environmental criteria*, Proceedings of the International Workshop CIB TG-8, 15th – 16th November, Toronto

Cole R.J., Rousseau D. and Theaker I.T., 1993, *Building Environmental Performance Assessment criteria,* Version 1, Office Buildings, The BEPAC Foundation, Vancouver

Coombes M. et al., 1992, *Developing indicators to assess the potential for urban regeneration*, HMSO, London.

Costanza R. (ed.), 1991, *Ecological Economics,* Columbia University Press, New York

Costanza R., 1993, Ecological economic systems analysis: order and chaos, in Barbier (ed.), *Economics and Ecology*, Chapman & Hall, London, pp.29-45

Costanza R., d'Arge R., de Groot R., Farber S., Grasso M., Hannon B., Limburg K., Naeem S., O'Neill R.V., Paruelo J., Raskin R.G., Sutton P. and van den Bely M., 1997, The value of the world's ecosystem services and natural capital, in *Nature*, vol. 15, n.387,pp.253-260

Cummings R.G., Brookshire D.S., Schulze W.D., 1986, *Valuing environmental goods: an assessment of the contingent valuation method,* Rowman and Allanheld, Totowa, New Jersey

Curti F., 1992, *La valutazione dei grandi progetti come strumento di implementazione urbanistica*, Archivio di Studi Urbani e Regionali, n.44-45, Angeli, Milan

Dalkey N.C., 1967, *Delphi*, Rand Corporation, New York

Daly H.E. and Cobb J.B., 1989, *For the common good: redirecting the economy towards the community, the environment and a sustainable future*, Beacon Press, Boston

Daly H.E., 1990, Towards some operational principles of sustainable development, *Ecological Economics,* vol.2, n.1, pp.87-102

Dasgupta P. and Pearce D.W., 1972, *Cost-benefit analysis: theory and practice*, Barnes and Nobes, London

Dasgupta P.S., Sen A. and Marglin S.A., 1972, *Guidelines for project evaluation*, United nations Industrial Development Organisation, Vienna

Dasmann R.F., Milton J.P. and Freeman P.H., 1973, *Ecological principles for Economic Development,* John Wiley & Sons Ltd, New York

Davies L. and Ledington P., 1991, *Information in action. Soft systems methodology,* Macmillan Education Ldt., Hong Kong

de Raadt J.D.R., 1991, Cybernetic Approach to Information Systems and Organization Learning, *Kybernetes,* vol.20, pp.29-48

de Raadt J.D.R., 1994, Expanding the Horizon of Information Systems Design, *System Research,* vol.2, n.3,pp.185-199

de Raadt J.D.R., 1997, A sketch for human Operational research in a technological society, *System Practice*, vol.10, n.4, pp.421-442

Deakin M., 1997, An Economic Evaluation of the Effects of Obsolescence and depreciation have on the Built Environment, in Brandon et al. (eds), *Evaluation of the Built Environment for Sustainability,* Chapman & Hall, London, pp.235-262.

Dente B. and Fareri P., 1992, *La valutazione dell'efficacia dell'intervento amministrativo nel Mezzogiorno: l'approccio dell'analisi delle politiche pubbliche,* IRS-FORMEZ, Naples

Dixon J., Carpenter R. and Fallon L., 1986, *Economic analysis of the environmental impacts of development projects*, Earthscan, London

Dunn R.P., 1983, *Scaling Methods*, Lawrence Eribaum Association Inc., New Jersey

Faludi A. and Voogd H. (eds), 1985, *Evaluation of complex policy problems*, Springer-Verlag, Delft

Ferry D.J. and Brandon P.S., 1991, *Cost Planning of Buildings*, VI edition, Blackwell Science Ltd, Oxford

Fischer M.M., Scholten H.J. and Unwin D. (eds.), 1996, *Spatial Analytical Perspectives on G.I.S.,* Taylor and Frances, London

Fishburn P.C., 1982, *The foundation of expected utility*, Reidel Publ. Co., Dordrecht

Fisher F. and Forester J. (eds.), 1993, *The argumentative turn in policy analysis and planning,* Duke University press, Durham

Florio M., 1991, *La valutazione degli investimenti pubblici*, Il Mulino, Bologna

Forester J., 1996, Argument, power and passion in planning practice, in Mandelbaum S.J., Mazza L. and Burchell R.W. (eds.), *Explorations in Planning Theory*, Urban Policy Research Centre, Rudgers State Univ., New Brunswick, New Jersey, pp.241-262

FORMEZ, 1978, *Analisi costi benefici: esperimenti ed applicazioni*, Quaderni regionali n.10, Naples

Forte C. and De Rossi B., 1974, *Principi di economia ed estimo*, Etas Libri, Milan

Forte C., 1968, *Elementi di Estimo* Urbano, Etas Kompass, Milan

Francescato G., 1991, *Housing quality: technical and non-technical aspects,* in Bezelga A. and Brandon P. (eds.), *Management, quality and economics in buildings*, E&FN SPON, Chapman & Hall, London, pp.602-609

Frederick K.D. and Rosenberg N.J., 1994, *Assessing the Impacts of Climate Change in Natural Resource Systems,* Kluwer Academic Publisher, Dordrecht

Fusco Girard L., 1987, *Risorse architettoniche e culturali,* Angeli, Milan

Fusco Girard L. (ed.), 1990, *Conservazione e sviluppo: la valutazione nella pianificazione fisica,* Angeli, Milan

Fusco Girard L. (ed.), 1993, *Estimo ed economia ambientale: le nuove frontiere nel campo della valutazione. Studi in onore di C.Forte*, Angeli, Milan

Fusco Girard L., 1991, Verso una valutazione della qualità, *Genio Rurale,* n.1, pp.13-24

Fusco Girard L and Nijkamp P., 1997, *Le valutazioni per lo sviluppo sostenibile della città e del territorio,* Angeli, Milan

Geenhuizen M. van, Banister D. and Nijkamp P., 1995, Adoption of New Transport Technology: A Quick Scan Approach, *Project Appraisal*, vol.10, n.4, pp.267-275

Giaoutzi M. and Nijkamp P., 1993, *Decision support model for regional sustainable development*, Avebury, Aldershot

Glasser H., 1998, On the evaluation of "wicked problems". Guidelines for integrating qualitative and quantitative factors in environmental policy analysis, in Lichfield et al. (eds.), *Evaluation in Planning*, Kluwer Academic Publisher, Dordrecht, pp.229-250

Graham A. and Bergvall B., 1994, Performance indicators in soft systems methodology, in Proceedings of the 17th IRIS Conference on *Information Systems Research,* Oslo, 6th – 9th August, pp.890-910.

Gray J. and Tippett H., 1993, Building quality assessment: a prerequisite to economic analysis, in Manso et al. (editors), *Economic Evaluation and the Built Environment,* vol.4, Laboratorio Nacional de Engenheria Civil, Lisbon, pp.79-89

Grillenzoni M. (ed.), 1993, *Valutazione delle risorse ambientali*, Edagricole, Bologna

Grillenzoni M. and Ragazzoni A., 1995, *Valutazione multicriteriale 'ex post' della diga di Ridracoli*, Maggioli Editore, Santarcangelo di Romagna

Grittani G. and Grillenzoni M. (eds.), 1994, *Estimo: teoria, procedure di valutazione e casi applicativi*, Edagricole, Bologna

Guba E.G. and Loncoln Y.S., 1989, *Fourth Generation Evaluation*, Sage, London

Haines Y.Y. and Changkong V. (eds), 1985, *Decision making with multiple objectives,* Springer, Berlin

Ham C. and Hill M., 1986, *Introduzione all'analisi delle politiche pubbliche*, Bologna

Hargreaves H.S., Hillis M., Lyons B., Sugden R. and Weale A., 1992, *The Theory of Choice. A Critical Guide*, Blacwell Publishers, Cambridge

Hausman J.A. (ed.), 1993, *Contingent valuation. A critical assessment*, North-Holland, Amsterdam

Hill M., 1968, A goals-achievement matrix for evaluating alternative plans, *Journal of the American Institute of Planners*, vol.34, n.1, pp.19-28

Hinloopen E., Nijkamp P. and Rietveld P., 1983, Quantitative discrete multiple criteria choise models in regional planning, in *Regional science and urban economics,* vol.13, pp.77-102

Hotelling H., 1938, The general welfare in relation to problems of taxation and of railway and utility rates, *Econometrica,* vol.6, pp. 242-69.

Hubbard P.J., 1994, Diverging evaluations of the built environment: planners versus public, in Neary et al. (eds.), *The Urban Experience*, Proceedings of the 13th Conference of the International Association for People-Environment Studies, Manchester, 13^{th} – 15^{th} July, E&F SPON, London, pp.125-133

IRER, 1984, *Valutazione di impatto ambientale e calcolo economico*, Angeli, Milan

Jackson P., 1990, *Introduction to Expert Systems*, Addison-Wesley, New York

Janssen R. and Herwijnen van M., 1992, *Multiobjective decision support for environmental management,* Kluwer Academic Publishers, Dordrecht

Janssen R., 1991, *Multiple Decision Support for Environmental Problems,* Kluwer Academic Publishers, Dordrecht

Johansson P.O., 1993, *Cost-benefit analysis of environmental change*, Cambridge University Press, Cambridge

Jones P., Vaughan N., Cooke P. and Sutcliffe A., 1997, An energy and environmental prediction model for cities, in Brandon et al. (eds), *Evaluation of Sustainability in the Built Environment*, E&FN SPON, Chapman & Hall, London, pp.53-66

Kaib W., 1994, Urban Marketing as a third way between centrally planned economy and market economy, in Ave and Corsico (eds.), 1994, *Urban Marketing in Europe*, Torino Incontra Edizioni, Turin, pp.877-881

Keeney R.L. and Raiffa H., 1976, *Decisions with multiple Objectives, Preferences and Value Tradeoffs,* John Wiley & Sons, New York

Khakee A., 1997, Evaluation and planning process: methodological dimension, in Brandon et al. (eds.), *Evaluation of the Built Environment for Sustainability,* E&FN SPON, Chapman & Hall, pp.327-343

Khakee A., 1998, The communicative turn in planning and evaluation, in Lichfield et al., *Evaluation in Planning*, Kluwer Academic Publishers, Dordrecht, pp.97-111

Kilbert C.J., 1997, Environmental cost internalisation for sustainable construction, in Brandon et al. (eds.), *Evaluation of the Built Environment for Sustainability,* E&FN SPON, Chapman & Hall, pp.200-210

Klosterman R.E., 1983, Fact and value in planning, *Journal of the American Institute of Planners*, vol. 49, pp. 216-225.

Krutilla J. and Fisher A., 1975, *The economics of natural resources: studies in the valuation of commodities and amenity resources*, J. Hopkins University Press, Baltimore

Krutilla J.V. and Eckstein O., 1958, *Multiple purpose river development*, John Hopkins University Press, Baltimore

Laniado E. and Cappellin R., 1989, *La valutazione di impatto ambientale come scelta tra progetti alternativi,* 1° Corso Internazionale su Gestione dei Conflitti Ambientali e Valutazione di Impatto, Ervet, Bologna

Lichfield N., Kettle P. and Whitbread M., 1975, *Evaluation in the planning process,* Pergamon Press Ltd, Oxford

Lichfield N., 1988, *Economics in Urban Conservation*, Cambridge Univ. Press., Cambridge

Lichfield N., 1991, La conservazione dell'ambiente costruito e lo sviluppo: verso il valore economico totale, *Genio Rurale*, n.10, January LIV, pp.25-34

Lichfield N., 1996, *Community impact Evaluation*, UCL Press, London

Lichfield N., Barbanente A., Borri D., Kakee A. and Prat A. (eds.), 1998, *Evaluation in Planning. Facing the challange of complexity,* Kluwer Acc. Press, Dordrecht

Lichfield N. and Prat A., 1998, Linking ex ante and ex post evaluation in British town planning, in Lichfield et al. (eds.), 1998, *Evaluation in Planning. Facing the challange of complexity*, Kluwer Acc. Press, Dordrecht, pp.283-298

Linstone H.A. and Turoff M. (eds), 1976, *The Delphi Method, Techniques and Applications*, Addison-Wesley, Reading, Mass. USA

Lombardi P.L. and Zorzi F., 1993, Comparison between aggregated techniques for assessing the effects of decision-making processes in the environmental field, in Manso et al. (eds.), *Economic Evaluation and the Built Environment,* vol.4, Laboratorio Nacional de Engenheria Civil, Lisbon, pp.126-138

Lombardi P.L., 1994, Marketing urbano: strumento e condizione per lo sviluppo sostenibile delle città, in Ave and Corsico (eds.), 1994, *Urban Marketing in Europe*, Torino Incontra Edizioni, Turin, pp.889-897

Lombardi P.L., 1995a, Evaluating sustainability at a local planning level, in Cole et al. (eds.), *Linking & Prioritising Environmental Criteria*, Proceedings of the International Workshop CIB TG-8, Toronto, 15th – 16th November, pp. 89-100

Lombardi P.L., 1995b, Non-market and multicriteria evaluation methods for public goods and urban plans, in Proceedings of the International Conference on *Financial management of property and construction*, Newcastle, Northern Ireland, 15th – 17th May, pp.231-245

Lombardi P.L., 1997, Decision making problems concerning urban regeneration plans, in *Engineering Construction and Architectural Management*, v.4, n.2, pp.127-142

Lombardi P.L. and Basden A., 1997, Environmental Sustainability and Information Systems, *Systems Practice,* vol. 10, n. 4, pp.473-489

Lombardi P.L. and Brandon P.S., 1997, Towards a multimodal framework for evaluating the built environment quality in sustainability planning, in Brandon et al. (eds.), *Evaluation in the Built Environment for Sustainability,* E&FN SPON, Chapman & Hall, London, pp.6-21

Lombardi P.L. and Marella G., 1997, A multi-modal evaluation of sustainable urban regeneration. A Case-Study related to ex-Industrial Areas in Second International Conference on *Buildings and the Environment*, CIB-CSTB, vol.2, Paris, 9th – 12th June, pp.271-279

Lombardi, P.L., 1998a, Sustainability indicators in urban planning evaluation, in Lichfield et al. (eds.), *Evaluation in Planning*, Kluwer Academic Publishers, Dordrecht, pp.177-192

Lombardi P.L., 1998b, Managing sustainability in urban planning evaluation, in Brandon (ed.), *Managing Sustainability: Endurance through change*, CIB World Conference, Symposium D, Gavle, Sweden, pp.2041-2050

Lombardi P.L. and Micelli E. (eds.), 1999, *Le misure del piano,* Angeli, Milan

Lombardi P.L., 1999a, Riferimenti metodologici e strumenti di valutazione per la sostenibilità urbana, in Lombardi and Micelli (eds.), *Le misure del piano*, F.Angeli, Milan, pp.96-114

Lombardi P.L., 1999b, Agenda 21 e monitoraggio dello sviluppo urbano sostenibile, in Lombardi (ed.), Analisi e valutazione di progetti e programmi di sostenibilità urbana, *Urbanistica,* n.112 (in press)

Lombardi P.L. (ed.), 1999c, Analisi e valutazione di progetti e programmi di sostenibilità urbana, *Urbanistica* n.112 (in press)

Lombardi P.L., 1999d, Aspetti di sostenibilità e approcci di valutazione. Illustrazione di un sistema decisionale di tipo multimodale, in *Proceedings of the XXIX CeSET Seminar*, Padoa, 8th October, (in press)

Lombardi P.L. and Nijkamp P., 1999, A new geography of hope and despair for the periphery. An illustration of the Border Temple Model, in Proceedings of the *Geo-Symposium of the Aegean: Geographies on/of/along the EU border*, Mytilini, 23rd – 27th June (in press)

Manso A., Bezega A. and Picken D. (eds.), *Economic Evaluation and the Built Environment,* vol.4, Laboratorio Nacional de Engenheria Civil, Lisbon

Marangon F. and Rosato P., 1995, L'analisi multi criteri nella gestione delle risorse naturali. Il caso delle risorse agroambientali, *Economia delle fonti di energia e dell'ambiente*, n.2, pp.87-101

Marglin S., 1967, *Public investment criteria: benefit-cost analysis for planned economic growth,* MIT Press, Cambridge

Markandya A. and Richardson J. (eds.), 1992, *Environmental Economics,* Earthscan, London

Martino J., 1970, The consistency of Delphi forecasts, *The Futurist*, vol.4, pp.63-64

May A.D., Mitchell G. and Kupiszewska D., 1997, The Development of the Leeds Quantifiable City Model, in Brandon et al. (eds), *Evaluation of Sustainability in the Built Environment*, E&FN SPON, Chapman & Hall, London, pp.39-52

Mishan E.J., 1971, *Cost-benefit analysis*, George Allen & Unwin, London

Mitchell G., 1996, Problems and fundamentals of Sustainable Development Indicators, *Sustainable Development*, vol.4, n.1, pp. 1-11

Mitchell G., 1999a, A geographical perspective on the development of sustainable urban regions, in *Geographical Perspectives on Sustainable Development*, Earthscan (in press)

Mitchell G., 1999b, Planning, Environmental Assessment and Catchment Management: UK Experiences on the Sustainable Development of Land and Water, in Lombardi (ed.), Analisi e valutazione di progetti e programmi di sostenibilità urbana, *Urbanistica*, n.112 (in press)

Mitchell G., May A. and McDonald A., 1995, PICABUE: a methodological framework for the development of indicators of sustainable development, *Int. Journal Sustainable Development World Ecol.*, vol.2, pp. 104-123

Moffat S., 1995, The missing ingredients: a look at how to improve methods for linking and prioritizing environmental criteria for assessing buildings, in Cole et al. (eds.), *Linking & Prioritizing Environmental Criteria*, Toronto, Canada, 15th – 16th November, pp.115-120

Monnier C., 1987, *Evaluation de l'action des pouvoirs publics*, Economica, Paris

Musgrave R., 1979, Cost -benefit analysis and the theory of public finance, *Journal of Economic Literature,* vol. 7, pp.797-806

Nijkamp P. (ed.), 1991, *Urban sustainability*, Gower, Aldershot

Nijkamp P. and Pepping G., 1998, A meta-analytic evaluation of sustainable city initiatives, *Urban Studies*, vol. 35, pp.1481-1500

Nijkamp P. and Perrels A.H., 1994, *Sustainable cities in Europe*, Earthscan, London

Nijkamp P. and Scholten H., 1999, New interoperable planning tools for Sustainable land use, in Lombardi (ed.), Analisi e valutazione di progetti e programmi di sostenibilità urbana, *Urbanistica* n.112 (in press)

Nijkamp P. and Scholten H.J., 1993, Spatial Information Systems: design, modelling and use in planning, *International Journal of Geographical Information Systems*, vol. 7, pp.85-96

Nijkamp P., 1980, *Environmental Policy Analysis*, Wiley, Chichester

Nijkamp P., Bal F. and Medda F., 1999, A survey of methods for sustainable city planning And cultural heritage management (forthcoming).

Nijkamp P., Rietveld P. and Voogd H., 1990, *Multicriteria evaluation in physical planning,* North Holland Publ., Amsterdam

Nijkamp P., Vleugel J., Maggi R. and Masser I, 1994, *Missing transport networks in Europe*, Avebury, Aldershot

Ott W.R., 1978, *Environmental Indexes: Theory and Practice*, Ann Arbour Science, Ann Arbor

Papa R. and Galderisi, 1993, Toward a definition of urban quality indicators as innovative tools for the urban environment management, in Bonnes M. (ed.), *Perception and evaluation of urban environment quality*, Proceeding of the Int. Symposium, Edigraf, Rome, 28th – 30th November, pp.179-193

Parelman C., 1982, *The Realm of Rhetoric*, University of Notre Dame

Pasqui G., 1995, Pianificazione come argomentazione e comunicazione. Riflessioni su alcuni recenti programmi di ricerca nella Planning Theory, *Archivio di studi urbani e regionali*, XXVI, n. 52, pp.89-128

Patassini D., 1995, Paradigmi e strategie di valutazione di piani, programmi e politiche, *Urbanistica* n.105, pp.50-59

Patassini D., 1997, *Valutare le politiche nella pianificazione urbana e territoriale*, Dipartimento di Analisi Economica e Sociale del Territorio, DAEST-IUAV, Venezia.

Pearce D. and Turner R.K., 1990, *Economic of natural resources and the environment*, Harvester Wheatsheaf, Hamel Hempstead

Pearce D. and Warford J.J, 1993, *World without end: Economic, Environment and Sustainable Development*, Oxford University Press, Oxford

Pearce D., 1993, *Measuring Sustainable Development*, London, Earthscan

Pearce D., Markandya A. and Barbier E.B., 1989, *Blueprint for a green economy*, Earthscan Publications Ltd, London

Pearce D., Markandya A. and Barbier E.B., 1990, *Sustainable development*, Earthscan Publications Ltd, London

Perrings C., 1991, Reserved rationality and the precautionary principle: technological change, time and uncertainty in environmental decision making, in Costanza R. (ed.) *Ecological Economics: the Science and Management of Sustainability*, Columbia University Press, New York, pp.153-66

Prior J. (ed.), 1993, *Building Research Establishment Environment Assessment Method, BREEAM, Version 1/93, New Offices*, Building Research Establishment Report, Second Edition

Prizzon F., 1994, *Gli investimenti immobiliari*, Celid, Turin

Rees W.E., 1992, Ecological footprints and appropriated carrying capacity: what urban economics leaves out, *Environment and Urbanisation*, vol. 4, n.2, pp.121-130

Repetto R. (ed.), 1985, *The Global Possible*, New Haven, Yale University Press

Repetto R., McGrath, W., Wells M., Beer C. and Rossini F., 1989, *Wasting assets: natural resources in the national income accounts*, World Resources Institute, Washington

Rietved P., 1979, *Multiple objective decision methods and regional planning*, Studies in Regional Science and Urban Economics, North Holland

Rivlin L.G, 1994, Public spaces and public life in urban areas, in Neary et al. (eds.), *The Urban Experience. A people-environment perspective*, E&F SPON, Chapman & Hall, London, pp.289-296

Rizzo F., 1989, *Economia del patrimonio architettonico e ambientale*, Angeli, Milan

Roscelli R.(ed.), 1990, *Misurare nell'incertezza,* Celid, Turin

Rostirolla P., 1992, *Ottimo economico: processi di valutazione e di decisione,* Liguori, Naples

Rotheroe C., 1997, Do the indicators of sustainable development produced by the UK Government and indicators developed within various local Agenda 21 initiatives have common characteristics from which core indicators can be developed?, in ERP Environment, *Proceedings of the 1997 International Sustainable Development Research Conference*, Manchester, pp. 238-245

Rowe D., 1991, Delphi - a re-evaluation of research and theory, *Technological Forecasting and Social Change*, v.39, pp.235-251

Roy B., 1985, *Mèthodologie, multicritère d'aide á la dècision*, Economica, Paris

Ruddock L. (ed.), 1999, *Information support for Building Economics*, proceedings of the CIB-W55 Building Economics International Workshop, Salford, 1st – 5th September, CIB publication n.210

Ruddock L., 1992, *Economics for Construction and Property*, Edward Arnold, London

Ryding S.O., 1992, *Environmental Management Handbook*, IOS Press, Amsterdam.

Saaty T.L. and Vargas L.G., 1979, Estimating Technological coefficients by the Analytical Hierarchy Process, *Socio-Economic Planning Science*, vol. 13, pp. 333-336

Saaty T.L., 1980, *The Analytic Hierarchy Process*, McGraw Hill, New York

Saaty T.L. and Vargas L.G., 1982, *The logic of priorities, applications in businnes, energy, health, transportation*, Kluwer-Nijhoff, The Haugue

Saaty T.L. and Vargas L.G., 1984a, Inconsistency and Rank Preservation, *Journal of Mathematical Psychology,* vol. 28, pp. 205-214

Saaty T.L. and Vargas L.G., 1984b, Comparison of eigenvalue, logarithmic least squares and least squares methods in estimating ratios, *Mathematical Modelling*, vol.5, pp.309-324

Saaty T.L and Kearnes K.P., 1985, *Analytical Planning,* Pergamon Press, Oxford

Saaty T.L., 1986a, Absolute and relative measurement with the AHP The most liveable cities in the United States, *Socio-Economic Planning Science*, vol.20, pp.327-331

Saaty T.L, 1986b, Axiomatic foundation of the AHP, *Management science*, vol. 32, n. 7, pp.841-855.

Saaty T.L. and Vargas L.G. (eds.), 1987, The Analytic Hierarchy Process. Theoretical developments and some applications, *Mathematical Modelling*, vol.9, n.3-5, pp.161-395

Sanderson W.C., 1994, Simulation Models of Demographic, Economic and Environmental Interactions, in Lutz W. (ed.), *Population, development,* *Environment: understanding their interactions in Mauritius*, Springer-Verlag, Berlin, pp.1-23

Sellar C., Stoll J.R., and Chavas J.P., 1985, Validation of empirical measures of welfare change: a comparison of non-market techniques, *Land Economics*, n.2, pp.1-19

Shields T.J., 1987, Methodological problems associated with the use of the Delphi technique, *Fire Technology*, vol.23, n.3, pp.173-183

Simonotti M., 1996, *Principi di metodologia estimativa*, Etas libri, Milan

Sirchia G., 1997, The economic valuation of cultural heritage, in Brandon et al. (eds.), *Evaluation of the Built Environment for Sustainability*, E&FN SPON, Chapman & Hall, London, pp.426-434

Skitmore M., 1989, *Contract bidding in construction*, Longman Group Ltd., Hong Kong

Smith V.K., 1974, *Technical Change, Relative Prices, and Environmental Resource Evaluation,* John Hopkins Univ. Press, Baltimore

Spendolini M.J., 1992, *The Benchmarking Book,* American Management Assoc., New York

Stanghellini S. (ed.), 1995, La valutazione del piano: le istanze, gli approcci, *Urbanistica* n. 105, pp.48-89

Stanghellini S. (ed.), 1996, *Valutazione e processo di piano*, INU n.7, Allinea Ed., Florence

Stanghellini S. and Stellin G., 1996, Politiche di Riqualificazione delle Aree Metropolitane: domanda di valutazione e contributo delle discipline economico-estimative, *Proceedings of the XXVI CeSET Seminar*, Milan, 17th – 18th October, pp.34-52

Stanghellini S. (ed.), 1997, *Valutare per la trasformazione urbana*, Satura, Venezia

Stauth R., Sowman M. and Grindly S., 1993, The panel evaluation method: an approach to evaluating controversial resource allocation proposals, in *Environmental Impact Assess rev*, vol.13, pp.13-35

Stellin G. and Rosato P., 1990, Un approccio multicriteriale alla gestione del territorio. Il caso del Parco Naturale Regionale delle Valli Caorle e Bibione, in *Genio Rurale* n.9, pp.31-45

Stellin G. and Rosato P., 1998, *La valutazione economica dei beni ambientali*, Utet, Turin

Stone P.A., 1989, *Development and planning economy*, E&F SPON, Chapman & hall, London

Taylor N. and Hancock M., 1993, Quality and the quantity surveying service in a multi-disciplinary environment, CIB Proceeding of the 7th International Symposium on *Organization & Management of Construction*, Port of Spain, Trinidad, vol. 1 of 3, pp.579-588

Therivel R, Wilson E., Thompson S., Heaney D. and Pritchard D., 1992, *Strategic Environmental Assessment*, Earthscan, London

Thrilwall A.P., 1994, *Growth and Development*, MacMillan, London

Topham N., Marketing Greater Manchester Technopolis, in Ave and Corsico (eds.), 1994, *Urban Marketing in Europe*, Torino Incontra Edizioni, Turin, pp.704-724

Torgenston W.S., 1958, *Theory and Methods of scaling*, Wiley, New York

Turner R.K. (ed.), 1988, *Sustainable Environmental management: Principles and Practice,* London, Belhaven Press, Boulder, Westview

van Pelt M.J.F., 1994, *Ecological Sustainability and Project Appraisal* Averbury Aldershot

Vargas L.G., 1982, Reciprocal matrices with random coefficients, in *Mathematical modelling,* vol.3, pp.69-81

Voogd H., 1983, *Multicriteria evaluation for urban and regional planning*, Pion, London

Voogd H., 1995, Environmental management of social dilemmas, in *European Spatial Research and Policy,* vol. 2, pp.5-16

Voogd H., 1998, The communicative ideology and ex ante planning evaluation, in Lichfield et al. (eds.), *Evaluation in Planning*, Kluwer Academic Publisher, Dordrecht, pp.113-126

Wackernagel M., Mcintosh J., Rees W. and Woollard R., 1993, *How big is our ecological footprint? A handbook for estimating a community's appropriated carrying capacity*, Taskforce on Planning Healthy and Sustainable Communities, University of British Columbia, Vancouver, Canada

Wegener M., 1994, Operational urban model: state of the art, in *Journal of the American Planning Association*, vol.60, n.1, pp. 17-29

Wilson A. and Malin N., 1995, Establishing Priorities with Green Building, in Cole et al. (eds.), *Linking & Prioritizing Environmental Criteria*, Toronto, Canada, 15th – 16th November, pp.107-114

Winfield M. and Basden, A., 1996, An ontologically based method for knowledge elicitation, in SWOT, Proceedings of the International Conference of the Swedish Operations Research Society, *Managing the Technological Society: The Next Century's Challenge to O.R.,* 1st – 3rd October, University of Lulea, Sweden, pp.72-93

Winpenny J.T., 1991, *Values for the environment*, HMSO, London

Wong C., 1998, Determining Factors for Local Economic Development, *Regional Studies,* vol. 32, n. 8, pp. 707-721

Wood C., 1995, *The environmental assessment of plans programmes and policies: a comparative review*, EIA Centre, Planning and Landscape Department, University of Manchester, Manchester M13 9PL

Zavadskas E., Peldschus F. and Kaklauskas A., 1994, *Multiple criteria evaluation of projects in construction,* Vilniaus Technikos Universitetas, Russia

Zeleny M., 1994, In Search of Cognitive Equilibrium: Beauty, Quality and Harmony, *Journal of Multi-Criteria Decision Analysis*, vol. 3, pp.3-13

Zeppetella A., 1995, *Retorica per l'ambiente*, Angeli, Milan

Zeppetella A., 1997, Environmental assessment in land use planning:a rethorical approach, in Brandon et al. (eds.), Evaluating of the Built Environment for Sustainability, E&FN SPON, Chapman & Hall, pp.344-362

Zeppetella A., Bresso M., Gamba G., 1992, *Valutazione ambientale e processi decisionali*, La Nuova Italia Scientifica, Rome

C. Philosophies and general theories

Aay H. and Griffioen S. (eds.), 1998, *Geography and worldview*, University press of America, Boston

Ackoff R.L., 1981, *Creating the corporate future*, Wiley, New York

Arrow K. J., 1951, *Social Choice and individual Values*, John Wiley & Sons. Inc., New York

Arrow K.J. and Kurz M., 1970, *Public investment, the rate of return and optimal fiscal policy,* John Hopkins University Press, Baltimore

Arrow K.J., 1987, *Equilibrio, incertezza, scelta sociale*, Il Mulino, Bologna

Apel K.O., 1992, *Etica della comunicazione,* Jaca Book, Milan

Ashby .R., 1976, *An Introduction to Cybernetic*, Methuen, London

Ashby R., 1956, *Introduction to Cybernetics*, John Wiley & Sons. Inc., New York

Basden A., *Cosmonomic Philosophy (with special relevance to Information Technology)*, (http://www.basden. demon.co.uk/Dooy/summary.html)

Basden A., 1996, Towards an understanding of contextualized technology, in Proceedings of the International Conference of the Swedish Operations Research Society on *Managing the Technological Society: The Next Century's Challenge to O.R.,* University of Lulea, Sweden, 1st – 3rd October, pp.17-32

Beer S., 1967, *Decision and control*, John Wiley & Sons, Chichester

Beer S., 1981, *Brain of the firm*, John Wiley & Sons, Chichester

Bertalanffy L. Von, 1968, *General System Theory*, Braziller, New York

Bocchi M. e Ceruti M. (eds.), 1994, *La sfida della complessita*, Feltrinelli, Milano

Boulding K., 1956, General System Theory - The Skeleton of Science, *Management Science*, vol. 2, pp.197-214

Brennan A., 1995, Ethics, ecology and economics, *Biodiversity and Conservation*, vol. 4, pp.798-811

Bresso M., 1982, *Pensiero economico e ambiente*, Loescher, Turin
Brown S., 1996, *Feng Shui*, Armenia, Milan
Calvino I., 1972, *Le città invisibili*, Einaudi, Turin
Capra F., 1989, *Il Tao della Fisica*, Adelphi, Milan
Capra F., 1996, *The web of life*, Doubleday-Anchor, New York
Choay F., 1965, *L'Urbanisme. Utopies et rèalitiès*, Editions du Seuil, Paris
Clouser R., 1991, *The Myth of Religions Neutrality*, University of Notre Dame, London
Comstock G.L., 1995, An extensionist environmental ethic, *Biodiversity and Conservation*, vol.4, pp.827-837
D'Agostini F., 1997, *Analitici e continentali*, Cortina Editore, Milan
Descartes R., 1637, *Le discours de la méthode pour bien condure sa raison et chercher la vérité dans les sciences,* Paris
DeWitt C.B., 1995, Ecology and ethics: relation of religious belief to ecological practice in the Biblical tradition, *Biodiversity and Conservation*, vol.4, pp.838-848
Dooyeweerd H., 1958, *A new critique of theoretical thought*, 4 vols, Presbyterian and Reformed Publisher Company, Philadelphia, Pennsylvania
Dooyeweerd H., 1968, *In the twilight of Western thought*, Nutley, New Jersey
Dooyeweerd H., 1979, *Roots of Western culture*; Pagan, Secular and Christian options, Wedge Publishing Company, Toronto, Canada
Dupuit J., 1933, *De l'utilité et de la mesure*, La Riforma sociale, Turin
Eriksson D., 1996, System Science: A guide for postmodernity? A proposition, in Proceedings of the International Conference of the Swedish Operations Research Society, *Managing the Technological Society: The Next Century's Challenge to O.R.,* University of Lulea, Sweden, 1st – 3rd October, pp.57-71
Eriksson D., 1997, Postmodernity and System Science: An evaluation of J.L. Le Moigne's contribution to the Management of the present civilization, *System Practice,* vol.10, n.4, pp.395-408
Fishburn P.C., 1970, *Utility theory for decision making*, Wiley, New York
Fisher, F. 1990 *Technocracy and the Politics of Expertise*, Nebury Park, California
Fourier C.H., 1845, *Des modifications à introduire dans l'architecture des villes*, Paris
Fromm E., 1982, *Il linguaggio dimenticato*, Bompiani, Milan
Geddes P., 1915, *Cities in Evolution*, Williams and Norgate, London
Granaglia E., 1988, *Efficienza ed equità nelle politiche pubbliche,* Angeli, Milan
Griffioen S. and Balk B.M. (eds.), 1995, *Christian Philosophy at the Close of the Twentieth Century*, Uitgeverij, Kampen
Griffioen S. and Balk M.B. (eds.), 1995, *Christian philosophy at the close of the twentieth century*, Uitgeverij, Kampen

Griffioen S. and Mouw J., 1983, *Pluralism & Horizons*, Eerdmans Publisher, USA

Griffioen S., 1995, The relevance of Dooyeweerd's Theory of Social Institutions, in Griffioen and Balk (eds.), 1995, *Christian philosophy at the close of the twentieth century*, Uitgeverij, Kampen, pp. 139-158

Hall P., 1994, *Cities of Tomorrow*, Blackwell, Oxford

Hart H., 1984, *Understanding our world*, Univ. Press of America, USA

Hatcher L.R., 1996, Business and Sustainability, in Nath et al. (eds.), *Sustainable Development*, VUBpress, Brussels, pp.207-232

Henderson R.D., 1994, *Illuminating Law; the construction of Herman Dooyeweerd's philosophy*, Free University, Amsterdam

Hirsch F., 1977, *Social Limits to Growth*, Routledge and Kegan Paul, London

Hirschman A.O., 1975, *I progetti di sviluppo*, Angeli, Milan

Hirschman A.O., 1982, *Lealtà defezione protesta. Rimedi alla crisi delle imprese, dei partiti e dello stato,* Bompiani, Milan

Hirschman A.O., 1987, *L'economia politica come scienza morale e sociale*, Liguori, Naples

Hirschman A.O., 1995, *Fèlicità privata e felicità pubblica*, Il Mulino, Bologna

HOLY BIBLE, 1906, W.Aleiter Co., Catholic Supply House, Indianapolis Ind.

Holland A., 1995, The use and abuse of ecological concepts in environmental ethics, *Biodiversity and Conservation*, vol.4, pp.812-826

Howard E., 1946, *Garden City of Tomorrow,* London

Hugo V., 1832, *Notre-Dame de Paris*, Gosselin, Paris

Joad C.E.M., 1975, *Philosophy*, The Chaucer Press, Ltd., Bungay, Suffolk

Kalsbeek L., 1975, *Contours of a Christian Philsophy*, Wedge Publishing Company, Toronto

Kant I., 1988, *Critique of pure reason*, J.M.Dent & Sons Ldt., London

Kuhn, T.S., 1970, *The Structure of Scientific Revolutions*, University of Chicago Press, Chicago

Le Moigne J.L., 1990, *La modélisation des systèmes complex*, Dunod, Paris

Le Moigne J.L., 1994, *La théorie du systeme général*, PUF, Paris

Lindblom C., 1965 *The Intelligence of Democracy*, Free Press, New York

Lynch K., 1960, *The image of the City*, The Technology Press & Harvard University Press, Cambridge

Lynch K., 1990, *Progettare la città*, Etaslibri, Milan

Lyon D., 1995, *Postmodernity,* Open University Press, Buckingham

Mandelbrot B., 1983, *The fractal geometry of nature*, Freeman, New York

Maturana H and Varela F., 1987, *The tree of knowledge*, Shambhala, Boston

Maturana H. and Varela F., 1980, *Autopoiesis and Cognition*, D.Reidel, Dordrecht, Holland

Meadows H., 1972, *The Limits to Growth*, Universe Books, New York

Merkhofer M.W., 1987, *Decision Science and Social Risk Management*, D.Reidel Pub. Co., Boston

Napoleoni C., 1974, *Elementi di economia politica*, La Nuova Italia, Firenze

Nath B. and Taly I., 1996, Man, science, technology and sustainable development, in Nath et al. (eds.) *Sustainable Development*, VUB press, Brussels, pp.17-56

Neumann J.. von and Mongerstern O., 1944, *The theory of games and economic behaviour, University Press.*, Princeton

Nietzsche F., 1972, *Così parlò Zarathustra*, vols. 2, Longanesi & C., Milan

Oxford Advanced Learner's Encyclopedic Dictionary, 1993, Oxford University Press, Oxford

Piaget J., 1968, *Le Structuralism*, PUF, Paris

Pirsig R.M., 1974, *Zen and the Art of Motorcycle Maintenance*, Corgi Books, London

Polanyi M., 1967, *The Tacit Dimension*, Routledge and Kegan Paul, London

Prigogine I. and Stenger I., 1984, *Order out of Chaos*, Bantam, New York

Prigogine I., 1997, *El Fin de las Certidumbres*, Taurus, Madrid

Proudon J., 1865, *Du principe de l'art et de sa destination sociale*, Paris

Ravetz J.R., 1971, *Scientific Knowledge and its Social Problems*, Oxford University Press, Oxford

Rawls J., 1971, *A theory of justice*, Harvard UP, Cambridge

Ruskin J., 1849, *The Seven Lamps of Architecture*, London

Ryle G., 1960, *Dilemmas*, Cambridge University press, Cambridge

Sachs W., 1993, *Global Ecology. A new arena of political conflict,* Fernwood books Ltd, Canada

Sartre J.P., 1979, *Il muro*, Oscar Mondadori, Milano

Schultz J., 1996, What has Sustainability to do with Ethics?, in Nath et al. (eds.) *Sustainable Development*, VUB press, Brussels, pp.137-157

Simon H.A, 1947, *Administrative Behaviour*, The Macmillan Co, New York.

Simon H.A., 1982, *Models of bounded rationality*, vol.2, MIT press, Cambridge, Mass

Simon H.A., 1985, *Casualità, razionalità, organizzazione*, Il Mulino, Bologna

Starke L., 1990, *Signs of hope*, Oxford University Press, Oxford

Strauss D.F.M., 1984, An Analysis of the Structure of analysis, *Philosophia Reformata*, vol.49, pp.35-56

Strauss D.F.M., 1995, The Significance of Dooyeweerd's Philosophy for the Modern Natural Sciences, in Griffioen and Balk (eds.), 1995, *Christian philosophy at the close of the twentieth century*, Uitgeverij, Kampen, pp.127-138

Strijbos S., 1997, Wisdom, Ethics, and Information Technology: Some Philosophical Reflections, *System Practice*, vol.10, n.4, pp.443-457

SWEHOL, 1996, *Managing our Technological Society*, Proceedings of the Second Working Conference, Priorij Emmaus, Maarssen, April 15th – 19th

Valéry P., 1991, *Eupalino o l'architetto*, Biblioteca dell'Immagine, Pordenone

Varela F.J., 1992, *Un know how per l'etica,* Laterza, Rome

von Beralanffy L., 1971, *General System Theory*, Penguin, London

Waters B., 1995, Christian theological resources for environmental ethics, *Biodiversity and Conservation*, vol.4, pp.849-856

Witte J. (ed.), 1985, *Herman Dooyeweerd, A Christian Theory of Social Institutions*, The Herman Dooyeweerd fondation, Canada

Zevi B., 1973, *Spazi dell'architettura*, Einaudi, Turin

Zevi B., 1975, *Storia dell'architettura*, Einaudi, Turin

D. Built development activities

Adams D., 1994, *Urban Planning and the development process,* UCL press, London

Alexander C., 1966, A city is not a tree, *Design*, n.206, pp.44-55

Allwinkle S.J. and Speed C.E., 1997, Sustainability of the Built Environment - Tourism Impacts, in Brandon et al. (eds.), *Evaluation of the Built Environment for Sustainability*, E&FN SPON, Chapman & Hall. London, pp.263-275

Archibuchi F., 1997, *The Ecological City and the City Effect*, Avebury, Aldershot

Ashworth G.J. and Voogd H., 1988, Marketing the city: concepts, processes and Dutch applications, *Town Planning Review,* vol.59, pp.65-79

Asimow M., 1962, *Introduction to design*, Prentice Hall, Englewood Cliffs, N.J.

Ave G. and Corsico F. (eds.), 1994, *Urban Marketing in Europe*, Torino Incontra Edizioni, Turin

Banister D., 1992, Energy Use, Transport and Settlement Patterns, in Breheny (ed.), *European Research in Social Science 2. Sustainable Development and Urban Form*, Pion Limited, London, pp.39-57

Barret P. and Holling J., 1991, *The future direction of quality management for the construction professions in the UK*, Department of Surveying, University of Salford

Barret P., 1993, *Profitable practice management*, E&F SPON, London

Barret P., 1994, Quality management for the Construction Professional: What a Mess!, in Proceedings of the International Seminar on *Strategic planning in Construction*, Technion-Israel Institute of Technnology, Haifa, Israel, 8th-9th June, pp.66-88

Biraghi S., 1996, *Le forme e i luoghi,* Guerini, Milan

Brandon P.S. (ed.), 1998, Managing Sustainability: Endurance through change, CIB World Conference on *Construction and the Environment*, Symposium D, Gavle, 7th – 12th June

Brandon P.S., 1998, Sustainability in management and organisation: the key issues?, in Brandon (ed.), Managing Sustainability: Endurance through change, CIB World Conference on *Construction and the Environment*, Symposium D, Gavle, Sweden, 7th – 12th June, pp.1739-1750

Broadbent and Ward (eds.), 1969, *Design methods in Architecture*, Lund Humphries, London

Buchanan C., 1962, *Traffic in towns,* HMSO, London

Cadman H. and Payne G. (eds.), 1990, *The living city,* Routledge, London

Camagni R. (ed.), 1996, *Economia e pianificazione della città sostenibile*, Il Mulino, Milan

Clementi A. (ed.), 1996, *Infrastrutture e piani urbanistici*, Palombi, Rome

Clementi A., Dematteis G. and Palermo P.C. (eds.), 1996, *Le forme del territorio italiano*, Laterza, Rome

Cooper I., 1999, Learning lessons from the UK Sustainable Cities research programme, in Lombardi (ed.), Analisi e valutazione di programmi e progetti di sostenibilità urbana. Alcune esperienze, *Urbanistica* n.112 (in press)

Curwell S. and Cooper I., 1998, The implication of urban sustainability, in *Building Research & Information,* vol.26, n.1, pp.17-28

Curwell S. and Lombardi P.L., 1999, Riqualificazione urbana sostenibile, in Lombardi (ed.), Analisi e valutazione di programmi e progetti di sostenibilità urbana. Alcune esperienze, *Urbanistica* n.112 (in press)

Davoudi S., 1999, Sustainability: A new vision for the British planning system, in Lombardi (ed.), Analisi e valutazione di programmi e progetti di sostenibilità urbana. Alcune esperienze, *Urbanistica* n.112 (in press)

Dente B. (ed.), 1990, *Le politiche pubbliche in Italia*, Il Mulino, Bologna

Freeman H. and Sherwood C., 1970, *Social research and social policy*, Prentice-Hall

Friedmann J., 1987, *Planning in the public domain: from knowledge to action*, Princeton University Press

Fuller T. and Jones-Evans D., 1994, *Firm futures: Developing a methodology to anticipate change within the small firm sector in the UK*, British Academy of Management Conference, Lancaster University, September

Gabetti R. & Isola A. in association with Oliva F., 1998, *Report of the urban design "Memoria e Oblio"*, presented to the design competition for the Urban Regeneration of the Falck areas in the city of San Giovanni (Milano), 16th October, Milan

Gili A., 1992, *Nuovo bel design*, Electa, Milan

Gregory S.A. (ed.), 1966, *The Design method*, Butterworths, London

Hall P. and Hay D., 1980, *Growth Centres in the European Urban System*, Heineman Educational Books, London

Healey P., 1992, A planner's day: knowledge and action and iterative practice, *Journal of Planning Association*, vol.58, n. 1, pp.9-20

Healey P., 1995, The communicative turn in planning theory and its implications for spatial strategy formation, *Environmental and Planning B: Planning & Design*, vol.23, n.2, pp.217-234

Healey P., 1997, *Collaborative Planning*, MacMillan, London

Healey P., Khakee A., Motte A., Needham B. (eds.), 1997, *Making Strategic Spatial Plans: Innovation In Europe*, UCL Press, London

Knight R.V. and Gappert G. (eds), 1989, *Cities in a global society*, Urban Affairs Annual Review v.35, Sage Publications

Koster A., 1994, Urban marketing – A new approach for town planning and a chance for reactivation of sites in old-industrial regions, in Ave and Corsico (eds.), 1994, *Urban Marketing in Europe*, Torino Incontra Edizioni, Turin, pp. 662-667

Kotler P., 1986, *Marketing management. Analisi, pianificazione e controllo*, Einaudi, Turin

La Cecla F., 1997, *Il malinteso*, Laterza, Rome

Lawson B., 1990, *How designers think. The design process demystified*, Butterworth-Heinemann ltd., Cambridge

Lawson B., 1993, Parallel lines of thought, *Languages of design* vol.1, pp. 321-331

Lee J.A., 1985, *The environment, public health and human ecology: Consideration for economic development*, Johns Hopkins University Press, Baltimore

Lutz W. (ed.), 1994, *Population, development, Environment: understanding their interactions in Mauritius*, Springer-Verlag, Berlin

MacLoughlin J.B., 1969, *Urban and Regional Planning: A Systems Approach*, Faber and Faber, London

Mandelbaum S.J., Mazza L. and Burchell R.W. (eds.), 1996, *Explorations in Planning Theory*, Urban Policy Research Centre, Rudgers State Univ., New Brunswick, New Jersey

Merret S., 1995, Planning in the age of sustainability. *Scandinavia Housing & Planning Research*, vol.12, pp.5-16

Meyer W.B. and Turner B.L. (eds.), 1990, *Changes in Land Use and Land Cover*, Cambridge University Press, Cambridge

Neary S.J., Symes M.S. and Brown F.E. (eds.), 1994, *The Urban Experience. A people-environment perspective,* Proceedings of the 13th Conference of the Int. Assoc. for People-Ennvironment Studies, Manchester, 13th – 15th July, E&F SPON, Chapman & Hall, London

Norton B.G., 1992, Sustainability, Human Welfare and Ecosystem Health, *Ecological Economics*, vol.14, n.2, pp.113-127

Odum M.T. and Odum E.C., 1980, *Energy Basis for Man on Nature*, McGraw Hill Inc., New York

Ostrom E., 1990, *Governing the Commons*, Cambridge University Press, Cambridge

Owen S., 1992, Energy, Environmental Sustainability and Land-use Planning, in Breheny (ed.), 1992, *Sustainable Development and Urban Form,* Pion London, pp.79-105

Palmer J., Cooper I. and van der Vost R., 1997, Mapping out fuzzy buzzwords - who sits where on sustainability and sustainable development, *Sustainable Development*, vol. 5, n. 2, pp.87-93

Parry M.L., 1990, *Climate Change and World Agriculture*, Earthscan, London

Pimentel D., 1996, Human Demography and the Environmental Resources, in Nath et al. (eds.), *Sustainable development,* VUBpress, Brussels, pp.111-136

Planning and Compensation Act 1991

RIBA, 1965, *Architectural Practice and Management Handbook*, RIBA Publications, London

Russell P. and Grammenos F., 1995, A Building for all reasons. A vision of a balanced Mixed use Building, in Cole et al. (eds.), *Linking & prioritising environmental criteria*, Toronto, Canada, 15th – 16th November, pp.145-154

Russo D.M. and McLaughlin E.W., 1992, "2000 - a food industry forecast", *Agribusiness*, vol. 8, n.6, pp.493-506

Rydin Y, 1992, Environmental Impacts and the Property Market, in Breheny (ed.), 1992, *Sustainable Development and Urban Form*, Pion London, pp.217-241

Santos A.S. and Hinks J., 1996, *International benchmarking of construction operations,* Technical Report, Department of Surveying, University of Salford, December

Selman P., 1995, Local sustainability, *Town Planning Research*, vol. 66, n.3, pp.287-302

Selman P., 1996, *Local Sustainability*, Paul Chapman, London

Simin D., 1999, Sustainability: A new vision for the British planning system, in Lombardi (ed.), Analisi e valutazione di programmi e progetti di sostenibilità urbana. Alcune esperienze, *Urbanistica,* n.112 (in press)

Sinopoli N., 1997, *La tecnologia invisibile. Il processo di produzione dell architettura e le sue regie,* Angeli, Milan

Symes M., 1997, Space management in European compact city, in Brandon et al. (eds.), *Evaluation of the Built Environment for Sustainability*, E&FN SPON, Chapman & Hall, pp.363-370

Town and Country Planning Act 1971

van den Berg L., 1982, *A Study of Growth and Decline*, Pergamon Press, Oxford

Winch G. and Campagnac E., 1995, The organisation of building projects: an Anglo/French comparison, in *Construction Management and Economics*, vol.13, pp.3-14

Wong C., 1994, Quality of urban living: an infrastructural dimension, in Neary et al. (eds.), *The Urban Experience*, E&F SPON, London, pp.257-269