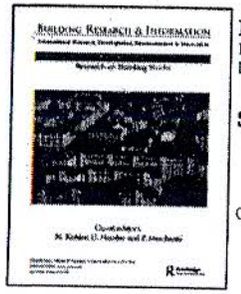

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Sustainable urban development and BEQUEST

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Editorial

Sustainable urban development and BEQUEST

What is sustainable urban development?

Sustainable architecture. Sustainable planning. Sustainable construction. Sustainable building. Sustainable drainage. Sustainable tourism. The 'S' word is almost everywhere, but what does it mean? It is now routinely misapplied in situations where 10 or even five years ago the words 'environmental', 'environmentally friendly' or 'ecological' might have been applied. The use of the adjective to describe many built environment and other activities where efforts are made to reduce the impact of human activities on the environment denies or ignores other important and essential dimensions of a more sustainable life. It overlooks the wider socio-economic and equity dimensions of the term devised and/or identified in the context of general human development at the UN Conference on Environment and Development, known as the Earth Summit, held in Rio de Janeiro, Brazil, in June 1992.

This landmark event was described by Von Weizsaker *et al.* (1997, p. 213) as the 'biggest gathering of heads of state and government in all human history'. The Rio conference represented an important watershed in terms of an international consensus on common environmental and human development problems and the principles upon which their resolution should be based. Some of the key principles agreed in Rio recognized, really for the first time in global political terms, that poverty was the enemy of environmental protection. Development that provided a better quality of life for the poor and disadvantaged was seen as an essential factor in reducing the uncontrolled exploitation of natural resources that results in environmental degradation. Global co-operation and action in this regard was identified as a vital ingredient in addressing these questions.

As we approach the Rio Plus 10 Conference, soon to be held in South Africa, thoughts turn to the extent of progress that has been made to ensure that future development is more sustainable. Resisting the temptation to indulge in a lengthy and detailed tirade, listing the many lost opportunities for more positive action, locally and globally, over the 10 years since Rio, it is important to recognize that the majority of (environmental, economic and social) evidence shows trends in the 'wrong' direction. Despite the increasing globalization of trade and economic expansion of the affluent world, the gap internationally between the 'haves' and 'have nots' continues to widen along with environmental degradation in the developing world. Binding international agreements on key issues, e.g. CO_2 abatement and climate change, continue to be elusive. The controversy that has surfaced over America's failure to ratify the Kyoto agreement has at least clearly identified the position of various vested interests as well as the gulf that still divides nations on this and similar issues. For example, Magda Helvoet, the Belgian Minister of the Environment, in her address closing the European Conference on Sustainable Development in Malmo, Sweden, 29 June 2001, described President George Bush, Jr's utterances on climate change and the Kyoto conference, made just after he was elected, as 'almost criminal'!

Cities, the largest artefacts made by man, and the home of an ever-increasing proportion of the world's population, have rightly been recognized as central to the issue of more sustainable development. They constitute the major centres of resource consumption, pollution and waste, whose environmental footprint is many times the physical area of occupation. In this context, those involved in the provision and maintenance of cities, in the planning and delivery of buildings, and other aspects of civil construction have begun to appreciate their pivotal role at the centre of the debate over the impact of urban development, the overall quality of life and the sustainability of communities.

In the developed world, a major driver of urbanization is the further industrialization of agriculture with fewer and fewer people needed to work the land and produce food. In Europe, it is anticipated that this and other pressures will result in 80% of the population being 'urban' by 2002. In the developing world, important drivers are the rapid population growth and the perception (or conviction?) in the minds of ordinary citizens that a better quality of life is to be had in cities. Brazil, for example, already has a 75% urban population. As cities are expressions of the collective values, economic and cultural prowess of their citizens, national and local politicians and their advisors face increasing pressure as many urban areas continue to suffer decline or a degraded quality of life. Negative environmental effects and local

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economic decline, social tension, fear of crime, pollution and increased traffic, etc., continue to fuel outward migration to the 'safer' or 'better' suburbs (and the associated urban sprawl). Unauthorized shanties and the entirely unsatisfactory and unhealthy living conditions that they create represent the lot of the poorest citizens and continue to mar the cities of the developing world. It is unacceptable that in many countries, particularly in Africa, safe drinking water is not available to a significant proportion of the population.

Despite the quite different problems facing cities in the developed and developing world, the concept of sustainability and sustainable urban development binds the affluent and those holding such aspirations in a common cause: one that seeks the reality of more sustainable ways in which to both live and work. What this will represent and how to get there is still a matter of intense debate. The reality of the last 10 years has, in fact, been very much about 'drilling down' to the details and practical matters of what can and ought to be done to address the Rio principles properly. This has, in turn, begun to increase our collective awareness of what sustainable development is about and just how difficult the challenge is proving to address adequately.

BEQUEST

This special issue of *Building Research & Information* reports on one of the many research initiatives that have been part of the 'drilling down' undertaken to identify more sustainable solutions to the problem of urban (re)development. The work of the BEQUEST (Building Environmental Quality Evaluation for Sustainability through Time) Network over 1998–2001, supported by the Research Directorate of the European Commission, is a good example of a new research phenomenon, described in 'Euro-speak' as a 'concerted action'. This is a funding device created by the Commission to increase research collaboration across the European Union (EU). Using this opportunity, the BEQUEST project set out with very ambitious aspirations, not only to pursue the project participants' collective interest in the investigation and understanding of sustainable urban development, but also to do this across all the relevant disciplines. From strategic planning on the one hand, to facilities management on the other hand, by reaching out to a wider interest group. An interest group that would attempt to build an understanding of sustainable urban development on the basis of a real international, multiprofessional, cross-sectorial consensus, albeit primarily European. Thus outcomes of the BEQUEST EU project are significant, not only in terms of new insights into the understanding and appreciation of the characteristics and factors that make for more sustainable interventions in cities, but also in how to evaluate them. Important to this is the co-operative methodology that has been used to develop a web-based decision support 'Toolkit' on sustainable urban development.

What contribution has BEQUEST made to our understanding? Bentivegna *et al.*'s (2002) introduction, subsequent perusal of the website and Toolkit vividly indicate the vast scope of the subject. The expression that we, the various professionals involved in urban development, have 'to think out-of-the-box', although hackneyed, is nevertheless entirely appropriate here, in terms of the wide range of subject-matter and breadth of collaboration needed. In this respect, the project was extremely ambitious for it has attempted to move forward on a wide multidisciplinary, multi-aspectual front accepting the risk of little or no progress. This was necessary in order to begin to understand fully the differences in approach, language, objectives and the means of evaluating the various actions by different professional actors, recently embarked upon in the name of sustainable urban development.

The vast nature of the problem, the importance of seeking more sustainable solutions and the problems that this presents in terms of collective action underlie and are addressed in different ways in all the papers here. In this context, BEQUEST's main contribution is to begin to establish a framework and language for collective action as a basis for a more informed discussion and for setting joint objectives capable of being 'owned' and understood in the fullest political, economic, social, legal and technical terms by all those taking part. In this emerging area of knowledge, the BEQUEST project provides a map that illustrates the topography of sustainable urban development, some of the landmarks established and a Toolkit, which helps to navigate the route through this contested terrain.

BEQUEST's contributions

What are the landmarks? Given the size and complexity of the subject, it is pleasing to report that the general response from users of the Toolkit is that the decision support system provides easily accessible well-structured information, as described in Hamilton *et al.* (2002). An outsider's view of BEQUEST, presented by Kohler (2002), supports this view. The reasons for this can be traced to the robustness of the underlying structuring system, known as the BEQUEST Framework (Bentivegna *et al.*, 2002), as well as the interactive methodological approach to developing consensus within the Network and with potential users. This aspect is explored by Cooper (2002), who suggests the project represents a modest, early example of 'the new production of knowledge', e.g. a development of multidisciplinary working for consensus-building through the use of information technology.

Kohler makes some very constructive criticisms of the Framework in terms of its underlying philosophy, as seen in the context of his own work and then goes on to identify some (even wider!) dimensions overlooked in BEQUEST. His points are variously recognized, shared or rejected by the range of individuals that make up the research team. However, the variety of reactions emphasizes that the Framework, and to a lesser extent the good practice guidance contained in the Toolkit, represents a consensus developed over three years

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across the wide range of disciplines and cultures involved in the network. The consensus of opinion may be viewed as a compromise that, as a lowest common denominator, could be interpreted as weak. However, the fact that the Framework adequately represents the subject for *all* the disciplines and cultures involved in the network and that each 'owns' the outcome is a great strength. The Framework, and the consensus it represents, is seen as an important landmark by the project team.

Another 'landmark' contribution is a more integrated approach to sustainability evaluation as explored by Deakin *et al.* (2002). The question that faces all urban decision-makers can be simply stated: how can we be more certain that any one urban development proposal will be more sustainable than others and contribute to improving the quality of life? In as far as BEQUEST proffers an answer, it is based on the premise that most professional actors are unaware of the breadth of the problem and of either the appraisal or evaluation of sustainable development or of the methods currently available to carry out such assessment. While others have attempted to draw up a compendium of assessment methods in the past, notably the International Energy Agency Annex 31, most have been aimed at appraising environmental impact rather than at evaluating the sustainability of urban development. Now for the first time, assessment methods can be selected in terms of their potential field(s) of application and in terms of developing a broader assessment of *urban sustainability*.

Of equal importance is that BEQUEST has begun to identify the unmapped areas of the topography. Deakin *et al.* (2002) show where current assessment methodologies can address sustainability questions and where methods are absent, or where existing techniques are found wanting, which is very important for future research and research policy. As most environmentalists are aware, a major area of weakness is in terms of the long-term externality costs associated with wider community interests. Other areas lacking assessment methodologies include those relating to quality of life, flexibility and adaptability indices, and methods that can assess the value of heritage and the building stock in general. In addition, the methodological means needed to address institutional issues, such as governance, morality and ethics, are shown to be lacking in the assessments currently undertaken.

In the long-term, it is fully integrated, multi-aspectual tools that can address all these complex issues simultaneously, as outlined by Kohler (2002), that are needed. However, as Bentivegna *et al.* (2002) identify, their routine application is probably ten years away. In the meantime, the BEQUEST Toolkit provides a very useful aid to decision-makers operating in this area. In fact, the large number of new methods and tools emerging from the EU and national research programmes is likely to mean an even greater requirement for the Toolkit. The EU Urban Cluster of projects funded through Framework 5 consists of 16 new projects. All will deliver new assessment methodologies with many aimed at governance issues and at urban landscape. Another cluster of similar size contains projects investigating sustainable transport issues. Clearly, all this provides ample justification for further development of the Toolkit in the short-to-medium-term, as a means of integrating these methods, making their field of use more explicit and their application more accessible to the widest range of potential professional users.

BEQUEST is not a panacea for all the ills resulting from a lack of sustainability in society in general, or for more effective action to 'save the planet'. As Bentivegna *et al.* (2002) point out, there are deep-seated sustainable development policy problems surrounding such short-termism, the lack of transparency and accountability in urban decision-making, loss of faith in governance and inadequate participation – that can be summed up as the need to 'democratize democracy' further. BEQUEST is a pointer here, for it has shown just how difficult developing consensus can be, but perhaps more importantly the project has also shown that despite the difficulties, it is possible (Cooper, 2002)! However, the main problem of lack of demand for more sustainable solutions is identified as a key barrier (Bentivegna *et al.*, 2002). While the technical means currently exist to address the problem, it is evident that we lack the collective will to ensure its general application as a means of moving towards a more sustainable way of life. Key to this is the identification and acceptance of indicators and of realistic targets for improvement. Given the breadth of issues, in terms of environmental, economic and social improvement, the need for realistic targets appears all the more important. In Europe, the CRISP (Construction and City Related Sustainability Indicators) project, funded by Framework 5, is to provide a database on the use and application of a wide range of sustainability indicators for construction and urban areas. The BEQUEST Framework has been used to help structure the indicator data in the system.

Nevertheless, recommendations drawn up on the international stage need to be reinterpreted for local conditions. Trying to persuade a community group, seeking to improve their living conditions in a Brazilian *favella* (shanty), to consider alternative energy sources or green sewage treatment although technically and economically appropriate may be unacceptable socially. They ask why they cannot be connected to the infrastructure like everyone in the affluent countries. For them, this is a key symbol of greater affluence. Therefore, the affluent countries must show the way. Most EU countries have set themselves reasonably stringent resource reduction targets. Bentivegna *et al.* (2002) specifically mention The Netherlands as a good example. The UK has included sustainability in its KPIs (Key Performance Indicators) for industry, including construction. If the USA cannot reconcile itself to agreeing the Kyoto targets, what is it prepared to do?

Moving forward

Governments can give a lead with educational programmes for the public and to develop professional capacity. To assist,

members of the BEQUEST project team are actively seeking funding for local development of the Toolkit, for its translation into other European languages and for the inclusion of locally specific information such as Agenda 21 recommendations, environmental protection regulations, social and economic policy instruments, fiscal incentives, etc. The emerging outcomes from the Framework 5 project PRESCO (Practical Recommendations for Sustainable Construction) could also be included. Even without these improvements, the BEQUEST Toolkit is already useful as an educational aid for planning and construction professionals. In this way, other regions, Africa, Southeast Asia and South America, could also consider repeating the BEQUEST process for themselves.

This special issue of *BRI* shows that the reality of trying to find an 'answer' to the problem of sustainable architecture, planning, civil engineering, building and surveying, has enormous and very complex implications for the *modus operandi* of urban (re)development. At one of the BEQUEST workshops, the architect of a major European sustainable building demonstration project had an important insight, a 'eureka' moment. He said,

> 'I have just realised that we have fixed this area of the city for most of the next century, and we have not really discussed its impact with the current residents and have no idea about the needs of the next generation!'

To attempt to address the question fully implies a sea change in the political and professional agenda of all the planning, property and construction professions. Simultaneously in each project, they have to come to terms with the increased scope and complexity, wider spatial scales of socio-economic and environmental impacts over much longer-term time considerations, coupled with a wider range and number of actors involved though increased cross-sectorial collaboration and integration.

BEQUEST is unique in that it bridges all scales of action from planning to component manufacture and it enables the various actors to see the full scope of the sustainable urban development problem. It helps by offering both a language and a framework for conducting project negotiations with all interested parties. However, at the stage of development reported in this special issue of *BRI*, BEQUEST only provides a beginning. As Cooper (2002) correctly points out, it is not enough for the research network to have agreed amongst themselves. For decision-making to be seen as legitimate, the BEQUEST framework and guidance needs further scrutiny and application by other stakeholders as a possible starting point for wider participation over more sustainable urban development. Please access the Toolkit and send your views and comments [http://www.surveying.salford.ac.uk/bqextra/].

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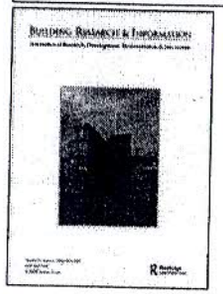

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A vision and methodology for integrated sustainable urban development: BEQUEST

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The concepts and visions of sustainable development that have emerged in the post-Brundtland era are explored in terms laying the foundations for a common vision of sustainable *urban* development (SUD). The described vision and methodology for SUD resulted from the activities of an international network called BEQUEST, funded by the European Commission. The project involved building consensus over the language and vision of SUD across a wide range of stakeholders in the urban environment and across a range of spatial and temporal scales, development activities and environmental and social issues. The resulting vision of SUD is that of a relative, adaptive process in which the current urban fabric is gradually adapted over time to suit more sustainable lifestyles. A framework for structuring information on SUD has been developed which provides a unique, integrated representation of the scope and extent of the subject that links together socio-economic and technical dimensions as well as planning, property, design and construction interests, in time and space. Impediments to implementation of the vision and method are explored, including lack of demand, lack of capacity, absence of agreed targets and indicators together with other policy problems undermining full sustainability assessment and evaluation of urban re/development proposals.

Keywords: assessment systems, built environment, cities, decision support system, good practice, planning, public policy, sustainable urban development, urban management

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Cet article analyse les concepts et les perspectives du développement viable qui ont vu le jour dans l'ère post Brundtland en des termes qui posent les fondations d'une vision commune du développement urbain viable (DUV). Les perspectives et la méthodologie en matière de DUV sont nées des activités d'un réseau international dénommé BEQUEST et financé par la Commission européenne. Ce projet prévoyait de dégager un consensus sur le langage et la vision du DUV au sein d'une vaste population d'intervenants dans l'environnement urbain en prenant en compte une diversité d'échelles spatio-temporelles, d'activités de développement et de problèmes d'environnement et de société. La vision du DUV qui en résulte est celle d'un procédé relatif et souple dans lequel le tissu urbain actuel s'adapte progressivement avec le temps à des styles de vie plus viables. Un cadre permettant d'organiser l'information sur le DUV a été développé ; il constitue une représentation unique et intégrée du domaine et de l'importance du sujet qui unit les dimensions socio-économiques et techniques ainsi que le planning, la propriété, la conception et les intérêts de la construction, dans l'espace et le temps. L'article poursuit en traitant des obstacles à la mise en œuvre de la vision et de la méthode, y compris les manques de demande et de capacité, l'absence d'indicateurs et d'objectifs convenus ainsi que d'autres problèmes de politique qui sapent la pleine évaluation de la viabilité et l'évaluation des propositions de développement et de redéveloppement urbain.

Mots clés : systèmes d'évaluation, environnement bâti, cités, système d'aide à la décision, bonne pratique, planning, politique publique, développement urbain viable, aménagement urbain

Introduction

This paper explains a vision of a more integrated approach to sustainable urban development (SUD) that has emerged from the recent activities of the BEQUEST (Building Environmental Quality Evaluation for Sustainability through Time) international network. This results from a three year (1998–2001) project funded by the Research and Technical Development Directorate of the European Commission (EC) through the Fourth Framework Programme. Lack of common understanding of sustainability between all the parties engaged in the planning, design, construction and use of the built environment has been identified as a key barrier to more SUD (Cooper, 1997; Curwell *et al.*, 1998). The broad aim of the BEQUEST Network project is to create a forum for pan-European research, training and practical action in the quality assessment of the urban environment in order to identify the basis for common understanding and implementation of SUD (BEQUEST, 1998).

The complex and intractable problem of what constitutes SUD, how to move towards it in existing cities and how the sustainability of re/development proposals can be assessed and evaluated has been explored though a series of 10 interactive workshops and an electronic network known as the BEQUEST EXTRANET. This has involved discussion between the project team (24 researchers from 14 partner organizations in six EU countries) and around 120 representatives of all actors and a wide number of disciplines representing both the demand and supply sides of the property and infrastructure industries. The network members are drawn mainly from European countries, but also include a significant proportion from a wide range of other nations across all continents. Web pages were established and maintained as a means of supporting the networking activities and the main outcomes and emerging policy issues raised in the workshops have been reported in information papers available on the web (BEQUEST, 1998-1,-2, 1999-1,-2, 2000, 2001-1,-2). Through this process BEQUEST has engaged in a more structured discussion of sustainability issues and assessment methodologies with a broader range of actors across a wider range of interests involved in the urban environment, than has been seen to date.

The iterative, interactive discussion process, described as a 'concerted action' – the EC's formal title for this type of research where knowledge and experience is pooled together, has provided the basis of the concepts and consensus that will be elaborated in this paper. In this context the BEQUEST 'vision' is primarily a conceptual or structuring device, known as the BEQUEST Framework, rather than a utopian vision of physical form. Consideration of physical models was not a key objective of BEQUEST, however a number of case study examples have been examined in order to explore elements of good practice in the procurement and assessment of SUD (BEQUEST, 1998-1,-2, 1999-1,-2, 2000). The outcomes in terms of good practice protocols, assessment methods and the decision support aid – the BEQUEST Toolkit, in which the Framework has been used to structure the procurement and assessment of SUD is described in companion papers (Deakin *et al.*, 2002; Hamilton *et al.*, 2002, see also BEQUEST 2000, 2001-2).

BEQUEST's conceptual foundations include the basis of sustainable development (SD), continuing concerns about the negative aspects of cities, i.e. the 'unsustainable' city, new ideas from 'green' economics and business, as well as some of the emerging ideas for sustainable cities. A number of these building blocks are briefly explored, before explaining the BEQUEST Framework in detail.

Sustainable development

The world-wide decay in environmental quality and the gradual depletion of natural resources has been a dominant theme for research and public policy in the latter part of the twentieth century and looks set to remain so for the first quarter of the next century so that the European Union (and a number of member states) have placed sustainable development at the heart of policy making (Buisquin, 2000). The global interest in, and current concepts of, SD can be traced back to the 1980 World Conservation Strategy published by the International Union for Conservation of Nature and Natural Resource (IUCN). In the section entitled 'towards sustainable development' the main agents of habitat destruction are identified as poverty, population pressure, social

inequity and the terms of trade which work against the interests of the poorer countries. This contributed to the concept of sustainable development (Hatcher, 1996), although the real watershed in interest emerged from the Brundtland Commission on Environment and Development (WCED, 1987). When the Commission tried to define sustainable development they were unable to agree on anything but this rather vague definition:

> Sustainable development is development that meets the needs of present generations without compromising the ability of future generations to meet their needs and aspirations.

This remains the 'benchmark' definition, but is often considered inadequate, and numerous other definitions exist, some good, others positively misleading. Nevertheless 'Brundtland' represented the emerging international consensus around the concept and the conflict between the demand for human development and protection of environmental systems into the future. The concept was further expanded at the Earth Summit, Rio 1992 (UNCED, 1992) in the Agenda 21 'Policy plan for environment and sustainable development in the 21st Century'. In all, 27 principles were agreed in the final declaration. All are important but 10 of the more relevant in the context of urban re/development are shown in Table 1.

The Agenda 21 principles have been criticized in terms of the human-centered nature of the recommendations, however they should be judged together with the other agreements made in Rio, i.e. the Climate Change Framework Convention and the Biodiversity Convention. The 27 principles interweave political, economic, legal, social and environmental dimensions. Thus a valid criticism is the complex way in which they are framed, which undermines common understanding and appreciation. However, from the concepts underpinning the Brundtland definition, the Rio Agenda 21 Principles as well as that of a range of other views represented in the literature (Mitchell *et al.*, 1995), there is widespread consensus on four underlying sustainable development principles, although not necessarily on their relative importance or interpretation. These principles can be referred to as those of environment, equity, participation and futurity.

Physical conditions for sustainable development

The environment principle recognizes the undeniable fact that people are entirely dependent upon the natural world, and that without the resources and ecosystems services it provides, life and development are impossible. Therefore, in order to maintain the viability of ecological systems in perpetuity, development must not degrade or deplete them to such an extent that they are unable to function effectively. The futurity principle, recognizes that the development aspirations of future generations must not be impaired by actions that are taken today, and for this reason futurity is also known as inter-generational equity, or simply ensuring 'fair shares' for us and our descendants. Futurity demands that the value of all assets that are passed on to future generations, including natural resources, cultural heritage and human knowledge should not decline, and is supported by the following guidelines:

- Renewable resources must not be consumed faster than the rate at which they are renewed
- Non-renewable resources must not be consumed at a rate faster than that which they can be substituted for by a renewable resource
- Waste substances must not be discharged to the environment faster than it can assimilate them without impairment of ecosystem function.

Fairness for all

The equity principle, (also known as social or intra-generational equity) requires that the most vulnerable people in society have a satisfactory quality of life, particularly with respect to access to resources and development opportunities, and freedom from threat. The equity principle arises through:

- Enlightened self interest, which argues that if social deprivation is reduced, less pressure is placed on critical natural systems upon which everyone depends
- The view that social deprivation is morally undesirable.

SD requires transparent and inclusive decision making

From the above it is clear that there remains considerable scope for debate over the meaning of sustainable development, the objective goals associated with the concept, and not least how best to achieve the desired goals in any given situation. There are heated arguments, for example, over the importance attached to species that have no obvious resource value, over what constitutes a fair allocation of resources amongst people, and over the nature of growth and development – the former associated with economic expansion, achieved through continued resource consumption, and the latter concerned with the quality of development, judged by its effectiveness at satisfying the higher 'quality of life' aspirations, whilst at the same time maintaining the integrity of supporting ecosystems. Such debates mean that the final principle, 'participation of concerned stakeholders in decisions that affect them', is critical. The significance of participation is further elevated when it is considered that sustainable development is not about achieving a desired balance between competing needs at any one time, but about achieving this balance continuously over a long time frame, in a world where natural and human systems are dynamic and uncertain.

Table 1 'Agenda 21' Principles of sustainable development – of particular relevance to urban re/development*

Principle 1: Human beings are the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.
Principle 3: The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.
Principle 4: In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.
Principle 5: All States and all people shall cooperate in the essential task of eradicating poverty as an indispensable requirement for sustainable development, in order to decrease the disparities in standards of living and better meet the needs of the majority of the people of the world.
Principle 7: States shall cooperate in a spirit of global partnership to conserve, protect and restore the health and integrity of the Earth's ecosystem. The developed countries acknowledge the responsibilities that they bear in the international pursuit of sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command.
Principle 8: To achieve sustainable development and a higher quality of life for all people, States should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate demographic policies.
Principle 10: Environmental issues are best handled with the participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy shall be provided.
Principle 15: In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.
Principle 16: National authorities should endeavour to promote the internalisation of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment.
Principle 17: Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have significant adverse impact on the environment and are subject to a decision of a competent national authority.

* It is accepted that as urban development is now all-pervading all 27 principles are relevant, but the 10 above have the clearest implications for urban re/development.

Other concepts and models

BEQUEST began with these four principles in a 'four sided' model, known as PICABUE (see Figure 1) (ERC, 1996). It was used in the early stages of the project to help explore common understanding and terminology for SD in the network (Cooper, 2002) and to test other models and concepts with a view to developing consensus over a conceptual model of SUD. The review embraced a wide range of SD concepts from government, non-governmental organizations (NGOs), industry and research including the OECD Pressure Sate Response Indicator Model (OECD, 1994), Pentagon Model (Nijkamp, 1998), Quantifiable City (May *et al.*, 1997), etc. (see Figure 2). Other ideas explored include Natural Step and the service economy. The four 'systems conditions' of Natural Step (Figure 3) provide a good SD business philosophy which is finding increasing application in a wide range of industrial sectors including construction and development organizations. This and the service economy concept (Figure 4) seek more cyclical industrial and economic processes, rather than the current linear process of production, consumption and waste. In the service economy design, manufacturing and maintenance strategies are aimed at extending the service life of materials and components considerably (Giarini and Stahel, 1996). Although, on the whole, buildings are long lived artifacts, the service economy concept could be applied to extend the service life of those parts of buildings that are regularly replaced or changed due to wear and tear and through declining technical performance or appearance. Building services and fittings form good examples.

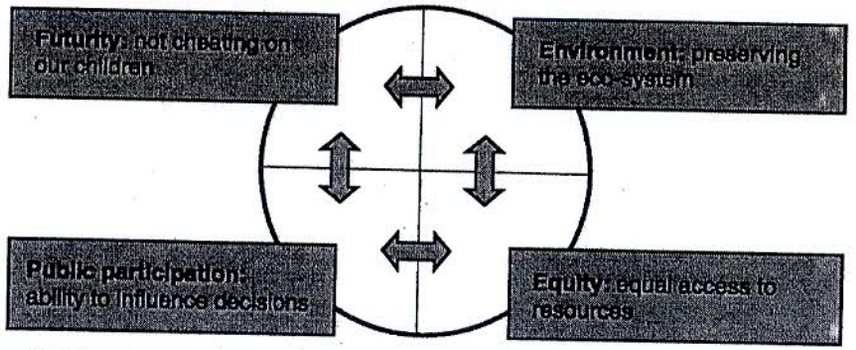


Figure 1 PICABUE model of sustainable development

It is clear that none of these models, of themselves, provide an adequate 'picture' of 'sustainable *urban* development', but important additional common factors have emerged from the analysis:

- SD is a relative rather than an absolute concept
- SD is a process not a product or fixed destination
- SD is concerned with very long time frames
- SD is an ethical construct
- progress towards SD *must integrate* economic, environmental and social factors.

These points represent additional principles, which together with PICABUE, form a consensus view of SD upon which the BEQUEST vision of SUD is based.

Cities and SUD

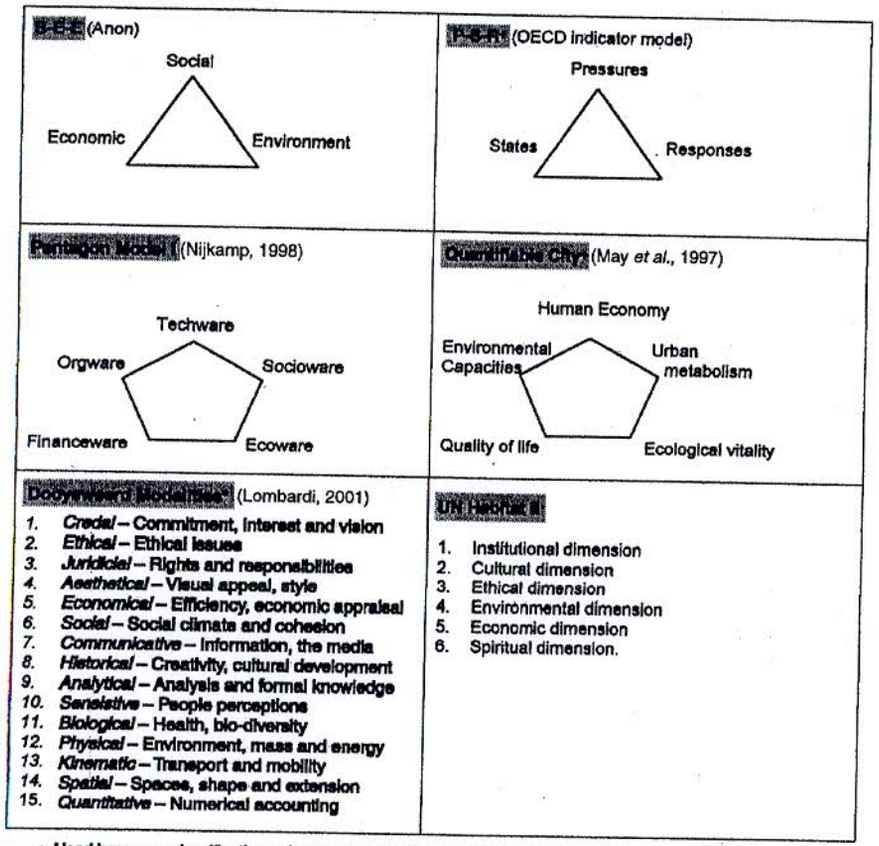
Cities, home to more than half the world's population and nearly 80% of citizens of the EU (Buisquin, 2000), are at the forefront of the battle to implement sustainable development. Cities can be seen simultaneously as a static receptacle of cultural heritage and as a dynamic mechanism, a machine with all the mobility, accommodation and other functions for supporting modern lifestyle needs. Clearly both visions are relevant and BEQUEST has attempted to embrace both views. As the economic and cultural powerhouses of nations, cities provide an abundance of benefits that are essential to meeting our development aspirations. However, they are the most significant consumer of ecosystem resources and services, for example it is estimated that in the developed countries around 6–10 tonnes of building materials are used per person per day and 75% of energy is consumed in the use of the built environment (BRE, 1996). This exerts impacts from the local to the truly global scale, and yet most city dwellers feel little connection to the natural environment they rely so heavily upon. Unsurprisingly, despite some improvement in some areas in recent years many of the environmental signals remain negative (EEA, 2000). Thus more SUD is crucial to improving the lives of urban populations, and the remainder of the planet, both people and ecosystems, impacted upon by their activities.

Urban environmental quality

The major challenge is the need to ensure economic, social and ecological sustainability now and into the medium and long term future. Economies of scale have eroded, and continue to erode, the quality of the urban living environment and the social stability of cities, so that well-tuned efforts have to be made to reconcile environmental demands with economic and social goals (Orishimi, 1982). In fact the negative view of the 'unsustainable city' is summarized by Ekins and Cooper (1993) as follows:

- A physical environment which has degraded and become polluted, with an overloaded or degenerating and inefficient infrastructure, which is unacceptably detrimental to human well-being
- An economy that has ceased to be able to support the population's expectations for either 'wealth creation' or 'quality of life'
- A social environment that has become dysfunctional, resulting in increased stress and fear of crime, alienation, high crime rates, and subsequent outward migration.

This represents a widespread consensus of what is 'wrong' with many existing inner-city areas, particularly in the post-industrial cities of affluent countries. Coincidentally emerging models of SUD such as the UN Habitat Programme (UNCHS, 1996) or the Dooyeewerdian modalities as



Pentagon Model (Nijkamp, 1998)

Quantifiable City (May *et al.*, 1997)

Dooyeweerd Modalities* (Lombardi, 2001)

1. *Credal* – Commitment, interest and vision
2. *Ethical* – Ethical issues
3. *Juridical* – Rights and responsibilities
4. *Aesthetical* – Visual appeal, style
5. *Economical* – Efficiency, economic appraisal
6. *Social* – Social climate and cohesion
7. *Communicative* – Information, the media
8. *Historical* – Creativity, cultural development
9. *Analytical* – Analysis and formal knowledge
10. *Sensistive* – People perceptions
11. *Biological* – Health, bio-diversity
12. *Physical* – Environment, mass and energy
13. *Kinematic* – Transport and mobility
14. *Spatial* – Spaces, shape and extension
15. *Quantitative* – Numerical accounting

UN HabPlat+

1. Institutional dimension
2. Cultural dimension
3. Ethical dimension
4. Environmental dimension
5. Economic dimension
6. Spiritual dimension.

* Used here as a classification only, not a philosophy as originally conceived by Dooyeweerd (1958)
\+ Each category subdivided one or more times to give increasingly more specific 'people-environment' factors

Figure 2 Some examples of people-environment factor classifications or models

interpreted for Urban Development by Lombardi (1998) identify (see Figure 2), in addition to all the parameters already discussed, the importance of the cultural and spiritual background in terms of the built heritage and overall well-being of citizens. These point up important difficult-to-quantify 'extra' dimensions of the quality of life of citizens. On another level the built environment and its cultural heritage is clearly an important 'good' that has measurable economic value in terms of tourism.

Thus the quality of the urban environment has become a key factor in the inter-competitiveness of urban areas within a city and between cities in achieving the income generation or other inward investment required to ensure the creative redevelopment necessary to a dynamic urban economic life (Finco and Nijkamp, 2001). Failure to develop an effective balanced SUD policy will tend to reinforce urban sprawl and risks spreading inner-city 'unsustainability' problems to a much larger area. The success of such policies depends on three determinants:

- Physical: the urban structure and morphology, i.e. population density, urban form, transportation and utility networks, urban heritage, etc.

the NATURAL STEP

The Four System Conditions

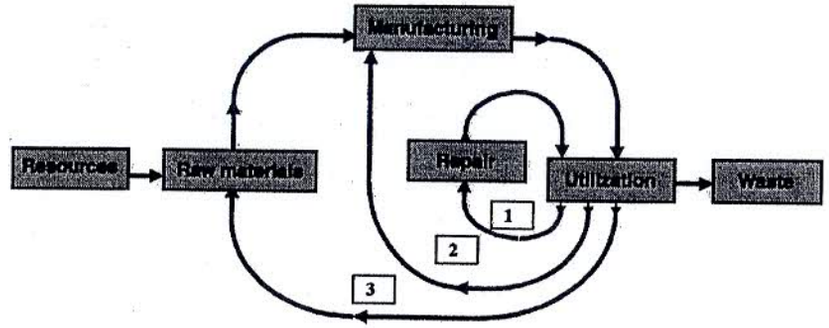
In the sustainable society, nature is not subject to systematically increasing . . .

1. . . . concentrations of substances extracted from the Earth's crust
2. . . . concentrations of substances produced by society
3. . . . degradation by physical means

and, in that society . . .

4. . . . human needs are met worldwide.

Figure 3 The Natural Step system conditions



Loop 1 Reuse and repair cycle
Loop 2 Reconditioning, technical and fashion upgrading cycle
Loop 3 Recycling of materials

Figure 4 The service economy

- Behavioural: attitudes and behaviour of citizens, their life-style choices, mobility patterns, environmental awareness, etc.

- Governance: institutional factors concerned with the management and organization of the urban systems, public – private modes of co-operation, forms of participation, etc.

Targets and indicators

The question of whether a given urban development meets the dual aims of liveability and sustainability is therefore co-determined by the targets set by policy-makers, which have to reconcile conflicting demands and interests of various members of the community, and to some extent by the assessment systems and methodologies that are used evaluate progress. In the past 20 years many

environmental assessment methods have been developed but these do not necessarily adapt for the much wider set of criteria represented by SUD (Deakin *et al.*, 2001, 2002).

In terms of minimizing environmental impact there is a lack of clarity and agreement about what overall sustainability targets should be set and upon the indicators of progress. In terms of resource reduction Holland has set a good national example with the objective of Factor 20 by 2050. (The argument for this target is based on environmental and international equity grounds.) A number of experimental building projects in the EU have achieved reductions in energy and/or resource consumption of this level when compared with normal practice (BEQUEST 1998, 1999; EGBF 2001), but the mainstream is a long way from such performance levels. This supports the view (e.g. Von Weizsacker *et al.*, 1997, Fudge 2000) that the technology exists to ameliorate the vast majority of current environmental problems in, or created by, urban centres provided *all* the best available technological practice could be generally instigated *now*. Clearly an immediate step change to Factor 20 reductions would bring with it a number of undesirable short-term commercial consequences for the construction industry. The introduction of year on year, aggregated improvements, such as those suggested by the Wuppertal Institute's *Modelling a Socially and Environmentally Sustainable Europe* (Wuppertal, 1998), appears a more viable route forward. The implications of attempting to achieve such high levels of performance improvement for the EU construction sector has yet to become an area of serious (research strategy) debate, let alone practical action.

There are a very wide and varied set of quantifiable criteria, or systems of indicators developed internationally and by local authorities through the local Agenda 21 process. However it appears to be extremely difficult to operationalize such indicator systems and so there is no single unambiguous measure to help planners, urban designers and other urban policy-makers with the 'change management' problem (Finco and Nijkamp, 2001). In this confused situation BEQUEST has adopted and developed the classification used in the UN Working List of Indicators (UNCSD, 1996), i.e. environment, economics, social and institutional, rather than others that might have been selected such as that of the OECD. However it should be noted that establishing a consensus view across all members of the research team in this area proved to be very difficult (Cooper, 2002), therefore selection of the four sided environment, economics, social and institutional structure represents a compromise that provides a link with an established, recognized international system of indicators that is related to Agenda 21. It is important to appreciate that a concerted action entails the pooling of knowledge and the development of a common approach and understanding. This is extremely difficult to achieve across the wide range of disciplines and cultural contexts that are embraced by the EU and SD. In this context the importance of the consensus that the BEQUEST framework represents is a significant achievement.

The above principles have a clear and distinct and strategic meaning for urban development and the built environment. They relate to land use, architecture, monument conservation, transport and infrastructure, housing, commercial buildings and public facilities. The spatial reality is that current urban centres consist of a complex amalgam of existing buildings, transport and infrastructure systems developed over a long time period. Ninety percent of the structures which will be in use 30 years time have already been built (CEC, 2000). Thus SUD is the process of adapting the existing built environment over time in a way that supports more sustainable patterns of living and working. Therefore in terms of priority, addressing the political, economic and social barriers to implementing the emerging cleaner, resource efficient technologies is as important, if not more important, in catalyzing change and improving the sustainability of cities. At the same time, it ought to be recognized that the realization of targets of urban sustainability may extend beyond the borders of the city (the 'ecological footprint'), implying that sustainable urban planning and development requires a more balanced portfolio of policy measures than is currently the case.

Negative aspects of current policy and practice in urban redevelopment

The urban case studies explored by BEQUEST were selected because they offered some exemplary characteristics. However, on the whole, they have shown an absence of any detailed and integrated investigation of SUD. Long-term consideration of environmental, economic and social effects is not common and thus inter-generational equity, although recognized by most actors as an important principle, is not an effective part of active decision making at present (BEQUEST 1999-2).

It appears that the pressures to correct the problem areas of cities and the inter-competitiveness issues mentioned earlier lead to what BEQUEST has described as the 'regeneration imperative', i.e. the economic, social and political pressures to seek quick fixes to the perceived problems such as industrial decline, environmental degradation or social malaise. This is compounded by the short time frames controlling allocation and use of various sources of financial aid available from EU, national, regional and local agencies to help with urban problems. Many commercial and political investment decisions are moulded by the availability of such regeneration and re/development incentives. These factors link together to drive the normal pragmatic approach to setting objectives, spatial boundaries and time dimensions in planning of re/development projects. Thus the need for immediate action to improve an area suffering serious decay and/or decline overrides participation and futurity needed for consideration of the longer-term impacts of the development (BEQUEST, 1999; Curwell and Lombardi, 1999).

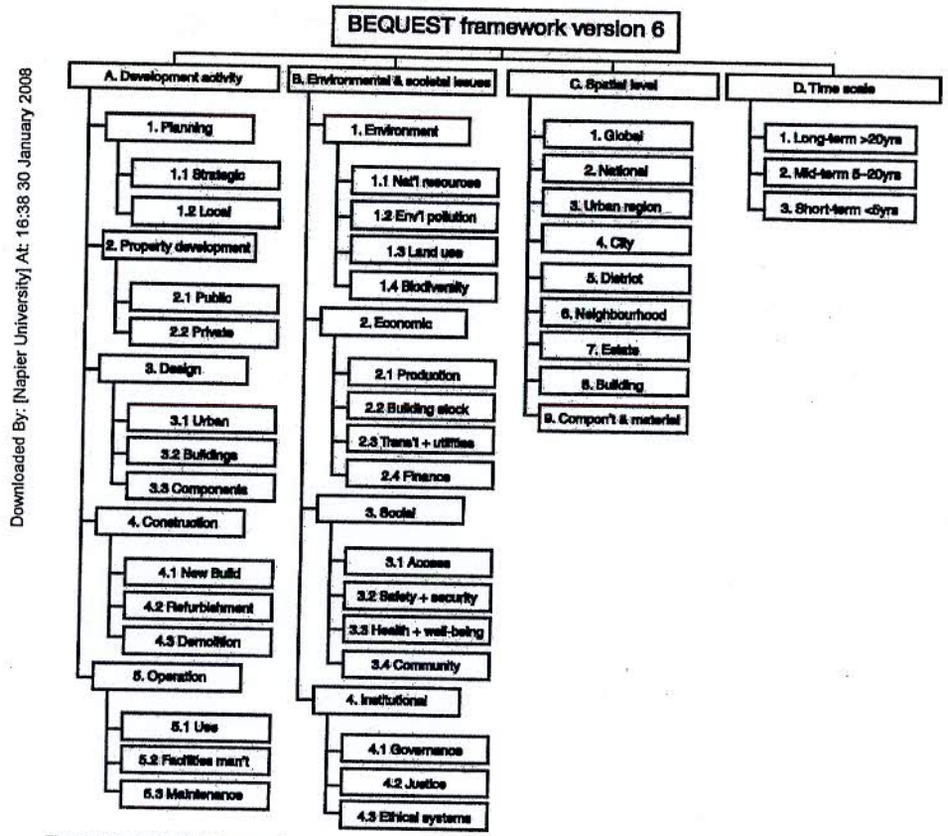


Figure 5 The BEQUEST framework

This favours a deterministic policy priority of (immediate?) physical change, which is expected to lead to economic and social improvements, ahead of measures promoting longer-term investment in people, through improvements in educational and skills capacity. In addition, the boundaries of political and economic jurisdictions form more important considerations than the potential 'footprint' of various environmental or social effects (e.g. over a river watershed, or in an adjoining community). In turn, this also results in the assessment, and the majority of the tools that are used for the assessment, being restricted to short term consideration of impacts within the specific 'site' or 'planning' boundaries set by the politico-economic drivers. The negative impact of these constraints on the longer term sustainability of urban interventions and development appears to be a seriously un(der)addressed issue in current 'leading edge', 'good practice' in the EU with important implications for policy at all levels.

BEQUEST Framework for SUD

Returning to the key question posed above – how is it possible to know that the urban interventions made today will lead to, or assist in supporting, more sustainable communities in the future? It is clear that the answer is very location specific; it depends on the local environmental, economic and social constraints relevant in any particular urban area. Therefore BEQUEST does not attempt to answer the question directly, but seeks to provide easy access to relevant and structured generic information (BEQUEST 2001-2; Hamilton *et al.*, 2002). The Framework relates four main dimensions of urban development: the development activity,

environmental and social issues, spatial level; and timescale (see Figure 5).

Development activity

As identified earlier, SUD is a process. As such, good practice guidance on SUD and on the use and procurement of assessment methods need to be integrated with the urban development process from strategic planning on one hand to utilization of the resulting built environment at the other. The main activities and their sub-activities, i.e. planning (strategic and local), property development (public and private interests), design (urban, building and components), construction (new build, refurbishment and demolition), and operation (use, facilities management and maintenance) each represent separate processes in themselves where more SUD thinking, good practice and assessment has to be applied.

Environmental and social issues

Various human activities create effects that are more or less sustainable. These activities are created by, or are consequences of, sources of environmental, economic and social stress. Environmental stresses include depletion of natural resources, pollution, excessive land use with consequent loss of biodiversity. Economic stress is often a cause and effect of loss of production, decaying building stock, and/or of inadequate finance or incentives. Transport and utilities are important industrial sectors that affect and are affected by other economic sectors. Social stress may include lack of access to facilities, inadequate safety and security, poor health or general loss of well-being which is often associated with poor sense of community. Good governance is necessary to create equality of access to resources along with social participation and judicial means of redress are all part of the institutional framework necessary to support SD. All these aspects, and the spiritual dimensions of life, are ethical constructs.

Spatial levels

Urban development can take place at various spatial levels from the scale of the whole city down to that of the individual building and its material components. Equally, the environmental effects or other socio-economic implications can be felt from local to global levels. A planning proposal can lead on to various new industrial and commercial consequences for the environment, economy and society from the level of the whole city down to the neighbourhood scale. The provision of new buildings can effect the extraction of raw materials and the manufacture of components, which in turn can create emissions that can have effects on the environment from the local to global scale and so on.

Timescale

The importance of long-term thinking to SUD has been emphasized above. The timescale used by BEQUEST, i.e. short-term 0–5 years, medium-term 5–20 years and long-term more than 20 years, represents the normal scale used in economic and strategic planning.

Conclusion

The BEQUEST Framework is predicated on the key conclusion identified earlier – that SUD is a relative, adaptive process. In this context, the BEQUEST Toolkit (and its underlying information 'Framework') is intended to help make 'better' decisions along the way. In order to achieve the objective of development proposals that are more sustainable, it is necessary to 'benchmark' the current situation, to identify a range of possible best practice policy and physical development options and to select the optimum for the situation under consideration. In all cases there is a clear need for assessment and evaluation techniques that enable objective sustainability assessment and provide sound information both for decision-makers and the wide range of other stakeholders. Through the logic of the Framework, BEQUEST provides a unique integrated representation of the scope and extent of SUD that links socio-economic and technical dimensions as well as planning, property, design and construction interests, in time and space which:

- Provides a 'model' of SUD that adequately represents, but simplifies, the breadth and complexities of the problem as already explored
- Forms the basis for common understanding between a wide range of stakeholders
- Enables the classification of assessment and evaluation methods (Deakin *et al.*, 2001, 2002) that assists in understanding their relevance to various decision-makers and urban re/development problem situations as well as a means of identifying current gaps in sustainability assessment
- Forms a means of structuring current good practice guidance so that it is relevant to various decision-makers and urban re/development problem situations.

The full potential of the BEQUEST Framework (and toolkit) is still being investigated. In addition to influencing the approach of the research partners in their own portfolios of research in the field the Framework is already being used as a structuring device by other research groups, notably the European Green Building Forum (EGBF, 2001) and in a project known as CRISP exploring the range of Construction and City Related Sustainability Indicators (CRISP, 2001). The potential to bridge various 'gaps' in understanding of SUD between a wide range of interests and stakeholders has been recognized. These include the gaps between:

- Environmental assessment and fuller sustainability assessment of the built environment
- Assessment methods used at the building scale and those at the urban planning scale
- Demand and supply side interests.

And across three main professional interest groups, i.e. those involved in:

- Planning and property development
- Provision and management of the infrastructure
- Design, construction and management of buildings.

Finally, are urban re/development professionals able to fulfill the high expectations that SUD puts on them? This is a challenging question. A wide range of examples of good and not so good SUD policy and practice exist, a number of which have been explored in the BEQUEST project. It is clear that lack of awareness by many professional actors of the broad range of techniques (i.e. in terms of technological change, good practice and evaluation tools) that will allow them to achieve their objectives is contributing to the absence of detailed and integrated investigation of sustainable development effects beyond simple economic and environmental protection criteria. Clearly the BEQUEST approach can assist in the educational and capacity building that is necessary to establish a broader and fuller SUD perspective.

Another important contradiction is apparent between the 'doomsday' predictions of some environmentalists, that is, the short time period available to correct many current, serious environmental problems (e.g. 20 years or less) and the long time frames necessary for both the social and political changes that will ensure adequate change towards much more sustainable life-styles as well as the physical improvement of cities (e.g. 50 years or more). On its own, BEQUEST cannot overcome a number of wider social and political impediments that will tend to slow or constrain implementation of more integrated approaches to SUD, including:

- The overall lack of demand in some countries for more sustainable solutions
- Inadequate participation and empowerment in urban re/development decision making and loss of citizen's faith in governance in general
- Lack of clarity and agreement about what sustainability targets should be set and upon the indicators of progress towards a more sustainable built environment.

Final success (or failure) in any particular re/development situation will be dependent on two essentials. Firstly, a closer dialogue between all stakeholders from the point of view that sustainability is an essential requirement for human settlements in future. BEQUEST offers a more defined and constructive language for SUD with which to frame these wider problems and within which much more constructive discussion can take place. Secondly, greater integration across various urban decision-making and professional disciplines. The BEQUEST vision for SUD supplies a framework for this integration.

In this context, urban policy-makers, planners, property developers, designers (architects and engineers) and constructors need to see themselves as change-managers seeking innovative solutions to adapt and regenerate the built environment so that it can support more sustainable regenerated city life. The strategies that should be employed should not be based on a fixed target or blueprint, but on an integrated and flexible approach that adjusts to local conditions and the local community requirements.

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SUSTAINABLE URBAN DEVELOPMENT: THE FRAMEWORK AND DIRECTORY OF ASSESSMENT METHODS

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Sustainable development is an issue that has attracted a considerable amount of academic interest since the publication of the Brundtland Report. With Agenda 21, it is an issue which has also found its way into the policy and action programmes of the European Commission. For Europe and its member states, the issue has become one of sustainable urban development and this paper reports on the interim findings of a concerted action programme undertaken to foreground the urban question, develop a framework for the analysis of sustainable development and compile a directory of methods to assess the sustainability of urban development. It classifies the assessment methods in question and goes on to map their applications across the sustainable development issues represented in the framework for analysis. Having done this, the paper goes on to set out how the said methods are being used to build the environmental capacity that is needed for the city of tomorrow to carry its cultural heritage and develop forms of human settlement which are sustainable.

Keywords: Sustainable development; urban planning; environmental assessment methods; carrying capacity.

Introduction

This paper documents the interim findings of the BEQUEST (building environmental quality evaluation for sustainability) network and the project's investigation of sustainable urban development. The network has its origins in an international conference "*The Environmental Impact of Buildings and Cities*", held in Florence in 1995 (Brandon *et al.*, 1997). More recently, the network has been funded by the Research Directorate of the EU Framework 4 Programme. The project sets out to develop a common language and approach to sustainable urban development (SUD) and aims to produce a framework, directory of assessment methods and set of procurement protocols for such purposes. The framework, assessment methods and procurement protocols, are currently in the process of being linked together in the form of a tool-kit. It is anticipated this instrument will be of particular use for those advising on the sustainability of urban development and taking decisions about the city of tomorrow and its cultural heritage.

The EU Environment and Climate Programme

Although BEQUEST is a Framework 4 project, it addresses Action 4: City of Tomorrow and Cultural Heritage of the EU Environment and Climate Programme in Framework 5. The aims and objectives of BEQUEST relate to Sec. 4.1 of the City of Tomorrow and Cultural Heritage. It is also relevant to Sec. 4.3 and the paragraphs referring to sustainable development, resource conservation and environmental protection in particular. In terms of the EU's document: "Sustainable Urban Development: A Framework for Action" (CEU, 1998), the project also raises awareness of SUD, by exploring ways of utilising communication and information technology to exchange experiences in framing the relevant issues and assessing the effect resource conservation and environmental protection has upon the city of tomorrow and its cultural heritage.

The BEQUEST concerted action

The BEQUEST concerted action project aims to lay the foundations for a common understanding of sustainable urban development through a multi-disciplinary network of contributions from the scientific and professional communities. The research method adopted provides a structured process of interaction between the wide range of interests involved in the process of urban development (i.e. the planning, provision, use and maintenance of the built environment as a form of human settlement). Mature deliberation, debate and evolution are key elements

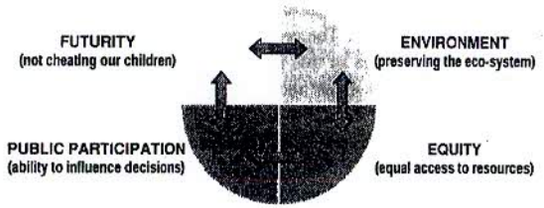
of the project and develop through an iterative learning cycle of workshops, reflection and concerted action. The project partners, known as the Intranet, act as the mentors and facilitators of this process. Extranet members participate in the project though the workshops and by means of follow-up comments on information papers. Using communication systems, including a web page, the workshops provide the project partners and extranet members with the information technology needed for the networked community to debate SUD and enter into a dialogue about resource conservation and environmental protection. Together the intranet and extranet represent the type of community needed to **B**uild Environmental capacity, **QU**alify whether the city of tomorrow is able to carry its cultural heritage and **E**valuate if the forms of human settlement resulting from this process of urban development are su**ST**ainable. There are 14 partners in the BEQUEST EU project and over 130 extranet members in the networked community. To date, 4 international workshops have been held (Manchester, Milton Keynes, Amsterdam, Turin, Helsinki, Florence, Vienna, Lisbon and Salford) and further details of this work, together with the associated information papers can be found at http://www.surveying.salford.ac.uk/bq/extra. The web-site also provides an outline of the project, the partners and extranet members. What follows reports on the interim findings of work carried out on two of the project objectives: the framework for a common understanding of sustainable development and directory of assessment methods.

A Framework for a Common Understanding

As any standard textbook on environmental issues points out, what sustainable development means is difficult to define. The first commonly accepted meaning of the term was that offered by the Brundtland Report, which defines it as:

> "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987: 43).

Subsequently the UN "Earth Summit", held in Rio in 1992, developed a wider concept known as Agenda 21 and represented in shorthand form as Fig. 1 (Mitchell *et al.*, 1995, as developed by Cooper, 1997). This focuses on a four-sided definition of sustainable development. Here attention is drawn to the concern about the quality of the environment, the equity of resource consumption, as well as the participation of the public in decisions taken about the future of the urban development process. It is this four-fold (environment, equity, participation and futurity) representation of sustainable development that the BEQUEST project



Source: Adapted from Cooper (1997).

Fig. 1. The fourfold definition of sustainable development.

has adopted. Following the discussion of "human settlement" appearing in the Brundtland Report, Agenda 21 and the UN Habitat Conference in 1996, the project has sought to draw upon these definitions as a means of moving the EU towards a framework for a common understanding of sustainable development. In Europe, human settlement is pre-dominantly urban in form (2/3 of EU citizens live in towns or cities) and as a consequence, questions about sustainable development relate to matters concerning the future of this particular development process. In particular they are matters that relate to questions about the development of urban futures, cities of tomorrow and their cultural heritage. They are questions about how to build the capacity needed to not only conserve resources and protect the environment, but qualify and evaluate whether such action is equitable and dealt with in an manner which fosters public participation in decisions taken about the future of urban development.

Fore-grounding the urban question

The project has sought to identify the common issues underlying this growing interest in sustainable development and structure them in such a way as to provide a framework for analysis (Nijkamp, 1991; Mitchell *et al.*, 1995; Haughton & Hunter, 1994; Miltin & Satterhwaite, 1996; Pugh, 1996; Mazza & Rydin, 1997). This has been done by first adopting the Mitchell *et al.* (1995) definition of sustainable development, "mapping out" the "fuzzy buzzwords" (Palmer *et al.*, 1997) associated with the concept and by then modifying it to include the issues underlying the urban process. Mitchell *et al.*'s (1995) model of sustainable development provides the opportunity to "map out" the multitude of meanings — "the buzzwords" — and agree on what they all have in common. This has led to the project developing a common language to communicate what

is meant by SUD and agree the vocabulary to be used in addressing the subject. The agreed vocabulary takes the form of a "glossary", setting out the terminology to be employed in addressing the issues in question. This in turn provides the terms of reference needed to "frame" the relevant issues (structure them in space and time) and direct decision makers towards the technology currently available to assess the sustainability of urban development. This modification has required the following:

- Fore-grounding the question of urban development (Nijkamp, 1991) and representing the process of urbanisation as a life cycle of inter-related activities
- Agreeing the sustainable development issues (Miltin & Satterhwaite, 1996) underlying the urban process
- Identifying the environmental, economic and social structure, spatial level and time scales of sustainable urban development (Pugh, 1996).

In fore-grounding the urban question, the project has sub-divided the development process by division of labour in the scientific and professional communities. The division of labour in question is that of urban development: planning, design, construction and operation (use, demolition and recycling). Representing the process of urbanisation as a life-cycle of inter-related activities, the sustainable development issues that surface concern the environmental, economic and social structure, spatial level and time scales of SUD. The spatial level of analysis identifies the territorial impact of urban development. This illustrates that the impact can be at the city, district, neighbourhood, estate, building, component and material level. The consideration of time-scales also shows that the said impact can be short, medium and long-term in nature.

Towards a directory of environmental assessment methods

While the aforesaid provides a framework for analysis, it does not address the question of how decision makers can reverse the current trend of resource depletion, conserve resources and protect the environment? That is build the environmental capacity needed to ensure the city of tomorrow is able to carry its cultural heritage and develop forms of human settlement which are sustainable. To achieve this, it is necessary to: qualify whether the capacity exists for the city of tomorrow to carry its cultural heritage and to evaluate if the forms of human settlement which surface from this process of urban development are sustainable.

In addressing these questions, the network has agreed the sustainable development issues underlying the process of urbanisation. These have been defined in terms of the environmental, economic, social and institutional issues

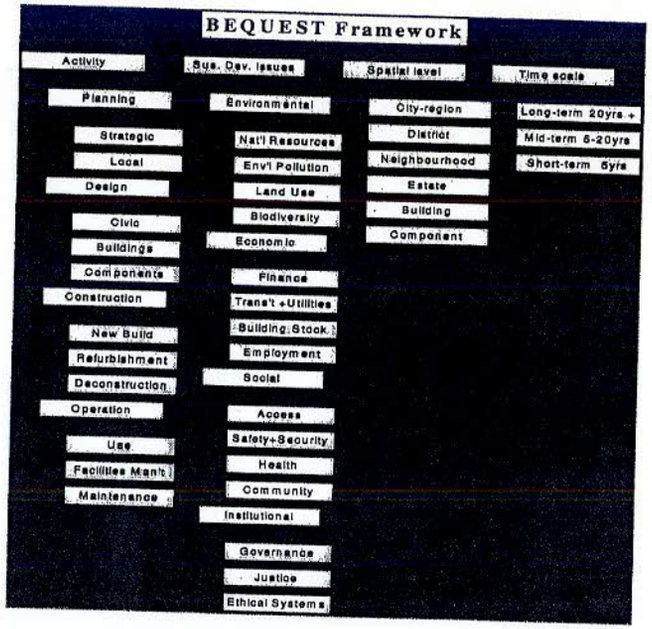


Fig. 2. The BEQUEST framework.

underlying the urban development process. Here, environmental issues take on the form of considerations about how the process of urbanisation consumes natural resources, whether it produces emissions that pollute the atmosphere and the effect development has upon the bio-diversity of habitats. Economic considerations relate to questions about the financing of the infrastructures, transport and utilities required for the built environment to accommodate the urban development process and employment of resources associated with this. The social issues concern matters about access to such services, the safety and security of cities, human health and well-being cultural heritage provides (see Fig. 2). The institutional issues refer to the governance, justice and ethics of settlement patterns subject to urban development.

The reason why sustainable development issues, their spatial levels and time scales raise questions about environmental assessment is of particular significance.

This is because many of the assessment methods currently in existence are pre-Brundtland and in their present forms do not adequately address the questions of resource conservation, environmental protection, or sustainable development (Pearce & Markauya, 1989; Pearce & Turner, 1990; Norgaard & Howarth, 1991). Many of the assessment methods currently in existence can be traced back to cost benefit analysis and the critique of the discounting principle this technique of analysis is based upon (Rydin, 1992; Deakin, 1996; 1997; 1999). Their development can also be linked to the emergence of hedonic and non-market techniques of analysis as alternative forms of assessment. Techniques of analysis such as the contingent value and travel cost methods of environmental assessment (Miltin & Satterhwaite, 1996; Brooks *et al.*, 1997; Powell *et al.*, 1997). Since the Brundtland report, environmental assessment has been placed under investigation by the green movement and critical distinctions have been drawn between eco and anthropocentric techniques of analysis (Pearce & Warford, 1993). Since the Rio Earth Summit, attention has also turned to the concept of "ecological footprint" and use of this assessment method to qualify whether the environmental capacity exists for the city of tomorrow to carry its cultural heritage (Rees, 1992; Kozlowski & Hill, 1993; Breheny, 1992a, 1992b; 1995; Breheny & Rookwood, 1993; Breheny *et al.*, 1993; Selman, 1996). In turn, attention has subsequently focussed on evaluating if the forms of human settlement surfacing from this process of urban development are sustainable (Brandon *et al.*, 1997).

Recent surveys of environmental assessment

Recent surveys of environmental assessment examine how the methods are currently being used. The examinations in question provide:

- Reviews of how assessment methods are being drawn upon to promote sustainable development through resource conservation and environmental protection policies (Therivel, 1992; Glasson *et al.*, 1994; Jowsey & Kellnet, 1996; Lichfield, 1996)
- Evaluations of the impact major infrastructure and building installation projects have upon resource conservation, environmental protection and the sustainable development of cities (Guy & Marvin, 1997; Marvin & Guy, 1997; Brandon *et al.*, 1997)
- Meta-analysis of the potential that assessment methods have to conserve resources, build environmental capacity and ensure the city of tomorrow is able to carry its cultural heritage in forms of human settlement which are sustainable (Bergh *et al.*, 1997; Nijkamp & Pepping, 1998).

Such surveys illustrate the gaps that exist between the inter-related activities of the urban life-cycle the assessment methods cover and the sustainable development issues which the techniques of analysis address (Cooper, 1997). An example of this can be found in the different assessment techniques used in the EIA of larger urban development projects (i.e. infrastructure design proposals) and those drawn upon to assess individual building installations (Cooper & Curwell, 1998). The surveys also reveal that scientific opinion about the potential of environmental assessment is currently divided. Firstly, there are those who are of the opinion environmental assessment methods can be used to promote sustainable development (Brandon *et al.*, 1997; Bergh, 1997; Nijkamp & Pepping, 1998). Secondly, there are others who are of the opinion the all-pervasive marketisation, privatisation of the environment and resultant risk and uncertainty surrounding the nature of public goods, means the methods currently available are no longer appropriate. As a consequence, they tend to question whether we have the appropriate methods for the assessment of SUD (Guy & Marvin, 1997). This division of opinion is important for two reasons. Firstly, because it illustrates the scientific community is divided about the value of assessment methods. Secondly, the division of opinion tends to undermine the certainty the professional community needs in order to be confident about the worth of such assessments (Pugh, 1996; Cooper, 1997; 1999).

The position adopted by the network

The position the network has taken on the matter tends to align with the first opinion. This is because the network is of the view that the environmental assessment methods can be used to promote SUD and the uncertainty and risk which surrounds the process of privatisation represents a particular, but not insurmountable challenge for the scientific community. The network is of the opinion that the source of such division lies in the absence of appropriate frameworks and the less than systematic approach that has previously been taken towards the inter-related activities of the urban life-cycle, sustainable development issues, spatial levels and time scales drawn attention to (Curwell *et al.*, 1998; Cooper & Curwell, 1998).

The assessment methodology the project adopts is based upon an understanding that the growing international and increasingly global nature of the relationship between the environment and economy is uncertain, resulting in as yet incalculable degrees of risk associated with EC policy and any actions which member states take on resource conservation. This, in turn, means that standard methods of environmental valuation are of limited help in building the capacity needed to qualify whether the city of tomorrow is able to carry its cultural heritage and if

the forms of human settlement which develop from this process of urban development are sustainable. This is because such assessments increasingly require the use of non-standard valuation (hedonic and contingency type) methods (Powell *et al.*, 1997).

Perhaps more critically, though, the network is of the opinion that methods of this kind are of limited use in assessing sustainable development and it is necessary to transcend such valuations as part of a co-evolutionary approach to environmental assessment. This is an approach that uses a holistic framework for the analysis of sustainable development and represents the environmental, economic and social as complementary (Facheaux *et al.*, 1996; O'Conner, 1998; Facheaux & O'Conner, 1998). Complementary is the sense that resource conservation reduces depletion rates, protects the environment and builds the capacity which the city of tomorrow has to carry its cultural heritage. The environmental capacity — it should be added — the city of tomorrow needs to carry its cultural heritage in economic and social structures that in turn develop forms of human settlement which are sustainable. Forms of human settlement that are sustainable in terms of the quality of life they in turn institute. It should perhaps also be noted that this concern with the quality of life is significant because it transcends the issues which are of current concern to environmental valuation (property rights, landscape, recreation and leisure), shifts attention to valuing the environment in terms of ecosystem integrity (resource consumption, pollution, land use and bio-diversity) and the scientific basis of such assessments.

Transcending environmental valuation

What such assessments do is turn attention towards the ecology of resource consumption. The advantage of this lies in the opportunity that assessments of this kind provide to develop methods which apply the so-called "hard" certainties of bio-physical science to the more uncertain, risky social relations. The relations that are "softer" and which are by nature more difficult to predict (Facheaux & O'Conner, 1998). This is done by emphasising the co-evolutionary nature of the bio-physical and social in a framework for analysis that integrates the environmental, economic and social and which in turn provides the methodology for assessing the sustainability of development. What this does is focus attention on the hard and soft issues of sustainable development (Fusco *et al.*, 1997; Capello *et al.*, 1999). The issues that in this instance are integrated in the form of the environmental appraisals and impact analyses which provide statements about the sustainability of development. Environmental appraisals and impact analyses that transcend existing valuation techniques and which in turn develop as forms of sustainability assessments.

Transforming environmental assessment

What is significant about such methods is the tendency they illustrate to not only transcend existing valuation techniques, but transform environmental assessment *per se*. This is because as forms of sustainability assessments, such methods (i.e. environmental appraisals and impact analyses) not only transcend existing valuation techniques, but go a long way to transform environmental assessment methodology. What such methods do is to transform into a post-Brundtland directory of environmental assessment methods.

The post-Brundtland directory

In response to this, members of the network have sought to survey the methods currently in existence and provide a post-Brundtland directory of environmental assessment. The methods surveyed are classified in terms of name; description; data required; status (well established, or experimental); activity (planning, design, construction and operation); environmental and social issues (environmental, economic, social and institutional); scale of assessment (spatial level and time scale); references.

So far, the survey has identified that 64 such methods are available to conserve resources and build environmental capacity. It has also identified the said methods have been applied to the planning, design, construction and operational activities of the urban life-cycle and used to analyse the sustainability issues this raises at the various levels and scales of assessment.

The directory can be accessed at the web-site address previously referred to. The web-site provides a copy of each standard classification and in a number of cases offers hyper-text links to the case studies they have been drawn from. This provides the opportunity for the reader to explore the implications of applying the method in further detail and satisfying themselves as to whether the technique is appropriate for the assessment under consideration. The list of methods are drawn from a survey of the scientific literature and unpublished reports written by professional members of the community. In certain cases, they represent assessment methods the partner and extranet members of the network have been engaged in developing or have a detailed knowledge of. A full list of the environmental assessment methods can be found in Appendix 1.

The Assessment Methods

The assessment methods fall into two classes: "environmental valuations" and those developing into particular "forms of sustainability assessments". The survey

has found that post-Brundtland, environmental valuations tend to focus on assessments of eco-system integrity. It has also been found that those methods developing into particular forms of sustainability assessments, tend to focus on building the environmental capacity needed to not only qualify the integrity of eco-systems, but evaluate the equity, participation and futurity of the economic, social and institutional structures underlying the city of tomorrow, its cultural heritage and forms of human settlement.

Examples of the "environmental valuation" class of methods include: cost-benefit analysis, hedonic analysis and multi-criteria analysis. The "forms of sustainability assessments" have been sub-classified as "environmental appraisal" (simple base-line qualifications) and "environmental impact assessments" (complex and advanced evaluations). They include: the compatibility matrix, eco-profiling and environmental auditing methods (environmental appraisal). The environmental impact assessments (EIAs) include: project, strategic, economic, social and community evaluations (complex), BEES, BREEAM, Eco-points and the Green Building Code. They also include, the MASTER framework, the Pentagon model, the quantitative city model, SPARTACUS, the sustainable city model, sustainable community, sustainable region and the transit-orientated settlement model, as advanced forms of environmental assessment. Examples of these two classifications are set out in Table 1.

In terms of the environmental valuations and forms of sustainability assessments, the methods tend to further sub-divide into the following types:

- Methods supporting the post-Brundtland commitment to sustainable development in terms of the policies adopted by the EU and its member states (Bentivegna, 1997; Davoudi, 1997; Therivel, 1998).
- Those centring on the assessments of projects providing the infrastructures (energy, water and drainage, transport, tele-communication technologies, leisure and tourism) required to build the environmental capacity needed for the city of tomorrow to carry its cultural heritage (Banister & Burton, 1993; Nijkamp & Pepping, 1994; Graham & Marvin, 1996; Nijkamp *et al.*, 1997; Guy & Marvin, 1997a,b; Jones *et al.*, 1996; Allwinkle & Speed, 1997).
- Those assessment methods that focus on the procurement of construction and installation of operations for the purposes of developing forms of human settlement which are sustainable (Prior, 1993; Vale & Vale, 1993; Cole, 1997; Curwell *et al.*, 1999; Deakin, 1999).

Building environmental capacity

The survey of the assessment methods currently being used to conserve resources and build environmental capacity, is drawn from those assessment methods listed

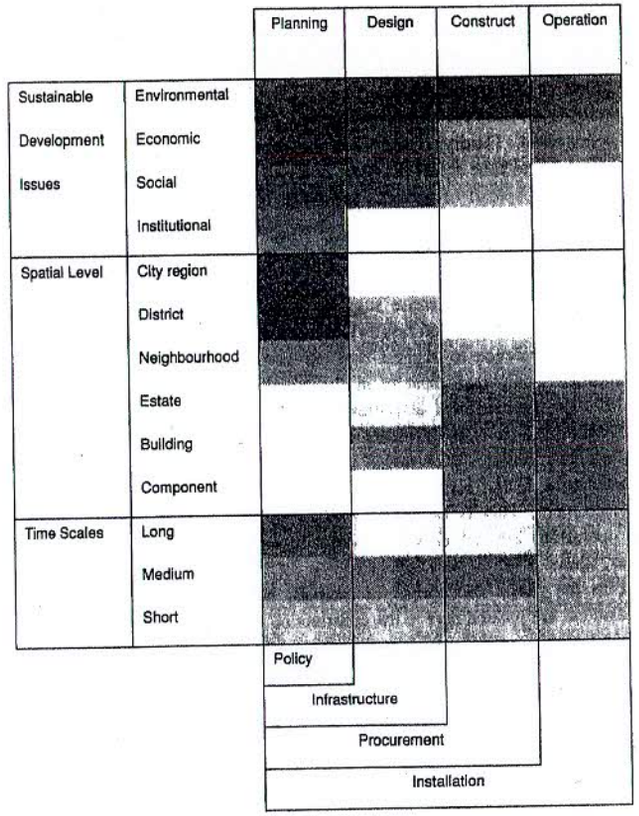
Table 1. Environmental assessment methods.

Environment Valuations	Forms of Sustainability Assessment	
	Environmental Appraisal	EIA
Contingent valuation	Compatibility matrix	Project
Cost benefit analysis	Eco-profiling	Strategic
Hedonic analysis	Ecological footprint	• economic
Multi-criteria analysis	Environmental auditing	• social
Travel cost theory	Flag method	Community evaluation
	Spider analysis	BEES
		BREEAM
		Eco-points
		Green Building Code
		MASTER framework
		Meta-analysis (Pentagon method)
		NAR model
		Quantitative city model
		Regime analysis
		SPARTACUS
		Sustainable city model
		Sustain. communities
		Sustainable regions
		Transit-oriented settlement

Source: See Appendix 1.

in Appendix 1. It represents the classification of each method by inter-related activities of the urban life-cycle. The sustainable development issues, spatial level and time scale that both classes of assessment methods (environment valuations and forms of sustainability assessments) are applied to with the object of building environmental capacity.

Figure 3 maps the methods by the inter-related activities (planning, design, construction and operation) of the urban life-cycle, sustainable development issues, spatial level and time scale of assessment. It illustrates the strength of representation spread across the range of activities making up the aforesaid. In this aggregated form, the survey provides evidence to suggest a wide range of methods exist to assess the environmental capacity of all the activities (planning, design,



Note: The shading is indicative of the "intensity scores", or "frequency" by which the assessment methods address the sustainable urban development issues in question. The shadings score the frequency by which the assessment methods address the issues in terms of high, medium, low and no representation. □ = 0%, □ = 0–25%, ▨ = 25–50%, ▨ = 50–75%, ■ = 75–100%, ■ = 100% represent the issues at the specified spatial level and time scales.

Source: Mapping of Appendix 1.

Fig. 3. Assessment methods.

construction and operational activities) making up the urban life-cycle, sustainable development issues, spatial level and time scales.

The purpose of mapping the assessment methods by such co-ordinates is four-fold. First, it illustrates the range and spread of methods currently available. Secondly, it provides the means by which to identify how the assessment methods are being used. Thirdly, it identifies the strength of representation by SUD, spatial level and time scale. Fourthly, it draws attention to the gaps that exist in the range and spread of methods needed to assess the sustainability of urban development. It also provides the opportunity to direct further research aimed at developing the methodology (science, theory and practice) of environmental assessment.

What the mapping exercise suggests is that the scientific and professional communities are drawing on assessment methods to build environmental capacity. It provides evidence to suggest that the assessment methods are being used to build environmental capacity in the policy planning, infrastructure design, construction procurement activities and those associated with the operation of installations. It also illustrates that it is the urban life-cycle, sustainable development issues, spatial levels and time scales of the planning policy and infrastructure design activities, which are the most strongly represented forms of assessment. This is because the other forms of assessment (construction and operation) are not as well covered in terms of sustainable development issues, spatial level, or time scale (see Fig. 3). This suggests that the gaps, which exist in the range and spread of methods needed to provide an integrated assessment, are located here in the construction and operation stages of the urban life-cycle, their particular sustainable development issues, spatial levels and time scales.

It should be noted that Fig. 3 does not map how the assessment methods represent the ecological integrity, equity, participation and futurity of SUD. To be explicit about this, further analysis is needed to extend the mapping exercise beyond the matrix set out in Fig. 3 and to introduce a more comprehensive grid referencing system. One that can map, not only the urban development process in terms of its life-cycle, sustainability, spatial levels and temporal scale, but cross-reference them with the ecological integrity, equity, participation and futurity components of the assessment methods in a form of "frontier analysis".

What follows will limit its observations to the mapping exercise of Fig. 3 and set out what it tells us about the attempts being made to build environmental capacity. This will include references to how environmental assessment methods are currently being used.

The Qualifications and Evaluations

It is proposed that Fig. 3 provides evidence to suggest:

1. A number of methods exist to assess the post-Brundtland commitment towards sustainable development and these include:
   - CBA, contingent valuation, travel cost, hedonic and multi-criteria analysis, to assess the environmental value of urban development proposals.
   - Simple base-line methods drawn upon to assess the integrity of eco-systems and ensure the economic, social and institutional issues underlying the process of urbanisation are consistent with policy commitments towards sustainable development. Examples of such methods appear under the title of "environmental appraisal" and include the compatibility matrix, eco-profiling and environmental auditing techniques.
   - The use of more complex methods to assess whether infrastructure projects (servicing energy, water and drainage, transport, tele-communication technologies, leisure and tourism services), build the environmental capacity that is needed for the city of tomorrow to carry its cultural heritage in forms of human settlement which are economically efficient in the way they accommodate growth, encourage competitiveness and the social cohesion of institutions. Examples of such methods appear under the heading of "EIA" and include project, strategic, economic, social and community evaluations.
   - The development of complex methods that assess the environmental capacity of operational installations and evaluate whether the forms of human settlement which they produce are sustainable in these terms. These evaluations include BREEAM, Eco-points, the Green Building Code, the net annual return (NAR) model of EIA.
   - The emergence of advanced methods which assess (at the level of policy and infrastructure projects) the ecological integrity and equity of alternative urban development paths. The alternative urban development paths it is possible for the public to participate in selecting. Participate in selecting as those "futures" best able to build the environmental capacity that is needed for the city of tomorrow to carry its cultural heritage in forms of human settlement which are sustainable. These methods include the MASTER framework, the Pentagon model, the quantitative city model, SPARTACUS, the sustainable city, sustainable region, sustainable communities and transit-orientated settlement models.
2. The methods are used in a specific or more general capacity. That is as a means to assess the environmental capacity of a specific stage in the urban development process, i.e. qualifying if the planning policy associated with the

city of tomorrow has the capacity to carry its cultural heritage, or for the more general purpose of evaluating if the design and construction activities connected with the operation of installations produce forms of human settlement which are sustainable (Birtles, 1997; Cooper, 1997; 1999). Here, it is noticeable that environmental appraisals (in their simple, base-line forms) are used to quality whether the city of tomorrow has the capacity to carry its cultural heritage. It is also evident that it is the EIAs (as more complex and advanced assessments) which are used to evaluate if the forms of human settlement produced by the urban development process are sustainable. This indicates that the environmental appraisals are undertaken to meet the statutory requirements of development planning and are used to qualify whether the city of tomorrow has the capacity to carry its cultural heritage. This also suggests that the EIAs are being used to evaluate if the infrastructure designs and construction procurement activities of the operational stages produce forms of human settlement which are sustainable.

3. The use of the methods illustrates the growing inter-disciplinary nature of the assessment exercise, providing evidence of assessment methods being used to assess the following:

- The policy planning and infrastructure design of the urban development process.
- The infrastructure design, construction procurement and operational activities making up the city of tomorrow, its cultural heritage and forms of human settlement.

Irrespective of whether the methods in question are applied to policy planning, infrastructure design, construction procurement, or the installation of operations, the object of the "environment valuation" class is to assess the capacity (in this instance ecological integrity) of the sustainable development issues under consideration. With the application of this class, it is also noticeable that any economic analysis is confined to the planning and design stage of policy and infrastructure provision and does not extend into activities associated with either the construction, or operational stages. This is also the case for any social issues that surface from the application of such assessment methods. Perhaps most noticeable is the relative absence of any institutional analysis at this level of assessment.

With the "forms of sustainability assessment" the situation is somewhat different. This is because with this class of method there is evidence to suggest the assessments take environmental capacity to include the equity, public participation and futurity of the sustainable development issues underlying the economic and social structures in question. It is also noticeable that in

developing into this kind of assessment, it is common to see methods from the other classification (environmental valuations) embedded in and providing the environmental and economic foundation for the range of appraisals and impact assessments (forms of sustainability assessments) undertaken. This is common irrespective of whether the environmental appraisal and EIA is of the simple, complex, or even advanced type. Examples of this occur with the use of CBA in environmental appraisal and impact assessment (Glasson *et al.*, 1994; Lichfield, 1996; Therivel, 1998). It is also evident in the use of the multiple-regression component of the hedonic technique forming the meta-analysis of sustainability assessment (Berg *et al.*, 1997; Nijkamp, 1998). Another example of this can be found in the transformation of multi-criteria assessments into regime analysis and use of this to resolve environmental conflicts over the economic and social structure of sustainable development (Bizarro & Nijkamp, 1997). Although, there is clear evidence to show the methods experience noticeable difficulties in dealing with the complexity of institutional structures and the range of stakeholder interests, this introduces into any such assessment (Lombardi, 2001).

It is also common to see this transcendence of environmental valuation mediated through other assessment methods. Methods that take on the function of mechanisms which support the transformation of environmental assessment as part of the search for sustainable development. This is evident in the use of the analytical hierarchy process to transform CBA in both environmental appraisal (the flag method) and impact assessments undertaken as part of a regime analysis. It is also seen in the use of life-cycle analysis to transform CBA into the NAR model of EIA. The model of environmental impact also adopted for the assessment of sustainable communities.

Another distinction that can be drawn from this transformation of environmental assessment relates to the way in which the hard and soft issues of sustainable development form part of the methodology. With certain forms of sustainability assessments, for example, BEES and the quantifiable city model, the bio-physical forms the focus of attention. With BEES the sustainable development issues under assessment are those of energy consumption, material flows, waste and pollution. This is also the case for the quantifiable city model. While valuable for focusing attention on the environment (in this sense ecological integrity), it should perhaps be noted that such methods do not integrate either the economic or social structures of the urban development process to the same degree as other forms of sustainability assessment. Methods that manage to balance the bio-physical and social and provide a more integrated environmental, economic and social assessment (of ecological integrity, equity, participation and futurity) include BREEAM, the MASTER Framework,

SPARTACUS, the sustainable community, city, region and transit-orientated settlement models.

4. The methods are being applied at different spatial levels of analysis and evidence exists to suggest these are as follows:
   - Methods to assess the policy and planning of sustainable development are applied at the city-regional, district and neighbourhood levels of analysis
   - These levels of analysis are also typical of the methods adopted to assess the policy planning and design of major infrastructure projects
   - In terms of methods assessing the design, construction and operation of various installations, the levels of analysis adopted to evaluate whether the city of tomorrow has the capacity to carry its cultural heritage, tend to be those of the estate, building, component and material.
5. The time scale implied in the assessment of policy commitment and both the planning and design of major infrastructure projects at the city-regional, district and neighbourhood scale, is medium to long-term. However, often the political pressures for rapid reversal of areas in environmental stress, economic decline and social depravation, means that the opposite is the case. So, as with the design, construction and operation of the various building installations, short-term considerations can be applied (Curwell & Lombardi, 1999).
6. The simple base line and more complex methods tend to restrict the spatial level of assessment to the city-region, district, neighbourhood, estate, building and component level of analysis, while the advanced methods assess the cumulative national, growing international and global impact of the urban development process over the long, medium and short-term. In taking this form, the advanced assessment methods recognise the need for a pan-European understanding of the urban development process. This, in turn, recognises the need to develop assessment methods that are urban in nature. That is urban in the sense they provide the technologies and communicative structures required by member states to conserve resources and build the environmental capacity needed for the city of tomorrow to carry its cultural heritage. Furthermore, do so in a form of human settlement that are sustainable at diverse (i.e. macro, meso and microscopic) levels and scales of analysis (Brandon & Lombardi, 2001).
7. While this suggests a great deal of headway has been made post-Brundtland to progress the theory, science and practice of assessment, it should be recognised that it is only the simple base line methods which are currently well established. This is because the more advanced assessment methods are still experimental.

8. It should also be recognised the following tend to restrict the degree of progress made in advancing the theory and practice of environmental assessment:
   - The tendency for the policy planning and infrastructure design stages to overshadow the assessment needs of construction procurement and the operational stages of the urban development process (Cooper, 1997; 1999; 2000; Deakin, 2000; 2001)
   - The paucity of environmental, economic and social (sustainable development) indicators, it is possible to draw upon as a means of benchmarking the effect policy planning, infrastructure design, construction procurement and the operation of various building installations has upon environmental capacity (Mitchell, 1996; 2000)
   - The fact that this, in turn, makes it difficult — in methodological terms — to assess the aggregate effect the aforesaid have upon attempts to not only build environmental capacity, but use this as a means to qualify and evaluate the sustainability of urban development. Qualify whether and evaluate if, that is, the said development leads to the city of tomorrow having a cultural heritage and form of human settlement which is sustainable (Brandon & Lombardi, 2000; Cooper, 2000; Lombardi, 2000).

The aforesaid are restrictive because they tend to highlight the rather limited nature of the data-sets currently available to assess the sustainability of the urban development and inform us about the effect attempts to build environmental capacity have upon the city of tomorrow, its cultural heritage and forms of human settlement.

Conclusions

This paper has outlined the areas of the Environment and Climate Programme (Economic and Social Aspects of Human Settlement) the BEQUEST project addresses, examined the framework it sets out for a common understanding of sustainable development and assessment methods currently made use of by planners, architects, engineers and surveyors to build environmental capacity. It has gone on to set out the issues the project addresses in transcending environmental valuations, transforming assessment methodology and moving towards a post-Brundtland directory of environmental assessment methods. This in turn has led to a classification of the environmental assessment methods contained in the directory.

The paper has established that the methods in question fall into two classes: "environmental valuations" and those which develop into "forms of sustainability assessments". It has shown the environment valuations tend to focus on assessments

of eco-system integrity. It has also illustrated that those methods augmenting into particular forms of sustainability assessment, tend to focus on building the environmental capacity which is needed to not only ensure the integrity of eco-systems, but the equity, participation and futurity (sustainability) of the economic, social and institutional structures underlying the urban development process. The examination has highlighted some of the problems currently associated with the application of the environmental assessment methods. This has drawn attention to a number of weaknesses in how the methods qualify whether the city of tomorrow has the capacity to carry its cultural heritage and evaluate if the forms of human settlement which surface from this process of urban development are sustainable. This, in turn, has drawn particular attention to the need for further research aimed at:

- Extending the analysis beyond the matrix-based mapping set out in this paper and introducing a more comprehensive grid referencing system. One that can map, not only the urban development process in terms of its life-cycle, sustainability, spatial levels and temporal scale, but cross-reference them with the ecological integrity, equity, participation and futurity components of the assessment in a form of "frontier analysis"
- Addressing the difficulties current assessment methods have in dealing with the complexity of institutional structures and associated stakeholder interests
- Overcoming the tendency for the policy planning and infrastructure design stages of the urban development process to overshadow the assessment needs of other activities and result in a situation whereby comparatively speaking, relatively little is known about either the procurement of construction, or installation of operations
- Augmenting the sustainable development indicators it is possible to draw upon as a means of measuring the effect planning policy, infrastructure design, construction procurement and activities associated with the operation of building installations has upon environmental capacity
- Developing the means to assess the aggregate effect of the aforesaid upon attempts to build environmental capacity and in turn qualify not only whether the city of tomorrow is able to carry its cultural heritage, but evaluate if the forms of human settlement which surface from this process of urban development are sustainable.

Finally, it is recognised that the methods able to fully transform environmental assessment are still in the research phase and the practical tools which are needed for an integrated economic and social assessment of SUD are some years away. In the meantime, the web-based technology being developed by BEQUEST

provides the communication and information systems required to undertake "state-of-the-art" assessments. The decision support system being assembled provides the toolkit needed to undertake such assessments. This includes the assessment methods contained in the post-Brundtland directory and protocols to follow in using them as a means of qualifying whether the city of tomorrow has the capacity that is needed to carry its cultural heritage and evaluate if the forms of human settlement which surface from this process of urban development are sustainable.

Appendix 1. List of Environmental Assessment Methods

List of Assessment Methods (19 September 2000)
Analysis of interconnected decision areas (Aida)
Analytic hierarchy process (AHP)
ATHENA
BEPAC
BRE environmental assessment method (BREEAM)
BRE environmental management toolkits
Building energy environment (BEE 1.0)
Building environmental assessment and rating system (BEARS)
Building for economic and environmental sustainability (BEES 2:0)
Cluster evaluation
Community impact evaluation
Concordance analysis
Contingent valuation method
Cost benefit analysis
Eco-effect
Eco-indicator '95
Eco-instal
Economic impact assessment
Ecological footprint
Eco-points
Ecopro
Eco-profile
EcoProP
Eco-quantum

List of Assessment Methods (19 September 2000)
ENVEST
Environmental impact analysis
Environmental impact assessment
Environmental profiles (The BRE methodology for environmental profiles of construction materials, components and building materials)
EQUER
ESCALE
Financial evaluation of sustainable communities
Flag model
Green building challenge
Green guide to specification: An environmental profiling system for building materials and components
Hedonic analysis
Hochbaukonstruktionen nach ökologischen Gesichtspunkten (SIA D0123)
INSURED
Leadership in energy and environmental design green building rating system (LEEDTM)
Life-cycle analysis (LCA)
Mass intensity per service unit (MIPS)
MASTER framework
Meta-regression analysis
Multi-criteria analysis
Net annual return model
Optimierung der Gesamtanforderungen (Kosten/Energie/Umwelt) ein Instrument für die Integrale Planung (OGIP)
PAPOOSE
PIMWAQ
Project impact assessment
Regime analysis
Quantitative city model
Planning balance sheet analysis
Risk assessment method(s)
SANDAT
Semantic differential
Social impact assessment
SPARTACUS
Strategic environmental assessment (SEA)

List of Assessment Methods (19 September 2000)
SUDECIR
SYSTIM
Sustainable communities
Sustainable cities
Sustainable regions
Transit-orientated settlement
Travel cost theory

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The assessment of sustainable urban development

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This paper describes the outcomes of a survey of assessment methods for sustainable urban development (SUD) undertaken by an international network called BEQUEST. It addresses aspects of good practice in terms of SUD, explores the range of methods available and explains the classification used in the directory of methods included in the BEQUEST Toolkit available on the web. An exercise undertaken to map the range of assessment methods to the various sustainability issues and development activities is described. The strengths and weakness and other deficiencies in current forms of sustainability assessment are explored. The key gaps in sustainability assessment are identified for further research and the importance of greater integration in assessment and evaluation, across professional and subject boundaries is emphasized.

Keywords: classification of assessment methods, evaluation, good practice protocol, sustainability assessment, sustainable urban development, urban development, urban planning

Cet article analyse les résultats d'une étude portant sur les méthodes d'évaluation du développement urbain viable (DUV) entreprise par un réseau international dénommé BEQUEST. Il traite de certains aspects des bonnes pratiques en termes de DUV, explore l'éventail des méthodes disponibles et explique le classement utilisé dans le répertoire des méthodes qui est inclus dans le Dossier BEQUEST disponible sur Internet. Il décrit également un exercice de cartographie du choix des méthodes existantes en fonction de divers problèmes de viabilité et des activités de développement. Les points forts, les points faibles et autres déficiences des formes actuelles de l'évaluation de la viabilité y sont étudiés. L'article poursuit en recensant les principales lacunes dans l'évaluation de la viabilité dans la perspective de futures recherches et en insistant sur l'importance d'une meilleure intégration de l'évaluation entre les professions et les sujets.

Mots clés : classement des méthodes d'évaluation, évaluation, protocole de bonnes pratiques, développement urbain viable, évaluation de la viabilité, développement urbain, aménagement urbain.

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Introduction

Increasing urbanization, together with all the associated social and environmental problems this has created, is widely recognized as a predominant factor, if not the most important factor, underlying the growing interest in sustainable development. The BEQUEST European Union (EU) Network has demonstrated the difficulties in developing a common understanding of the problem of sustainable urban development (SUD), due to its all-encompassing, multi-disciplinary, political, economic, social and technical nature (BEQUEST, 1998, 1999, 2000). In this context, SUD is increasingly being seen as a relative rather than absolute concept, i.e. as a process without clear or fixed outcomes (Bentivegna *et al.*, 2002).

Over the last decade, the responsibilities placed on local authorities through Agenda 21 (LA21) have resulted in various strategies seeking to move local communities towards greater 'sustainability'. In turn, this is beginning to impact upon urban planning and development control, in terms of a range of new requirements, which it is thought will contribute to improving the overall 'sustainability' of the community and in terms of carrying the cultural heritage into the city of tomorrow. Examples include:

- Planning measures aimed at increasing urban density or mixed use provision in the belief that this will reduce transport demand and in turn reduce pollution
- Environmental measures such as requirements for building energy efficiency above that of national regulation, or requirements to use a percentage of energy from renewable sources
- Economic measures such as a requirement to contribute funds to improve the public transport facilities aimed at improving access for disadvantaged groups
- Social measures such as a requirement to source labour locally.

Alongside these developments a wide range of alternative assessment methods have emerged which evaluate the environmental impact of construction materials and buildings. Since the introduction of the European Commission Directives (European Council Directive, 1985; European Communities, 1997) Environmental Impact Assessment (EIA) has been required for larger urban development and infrastructure projects. However, as individual assessment methods address a specific environmental, economic or social impact, it has long been recognized that these methods are inadequate when faced with the broader problem of SUD, Agenda 21 and emerging EU requirements (Glasson *et al.*, 1994; Cooper, 1997; Weston, 1997; Cooper and Curwell, 1998; Cooper, 1999). The development of new methods that address the broad complexity of the problem continues to be a major research priority, as illustrated by the EU's Fifth Framework Programme and many national research strategies. The inadequacies of current assessment methods and evaluation techniques in addressing sustainable development, raises three important questions:

- What assessment methods exist and what contribution can they make to the overall sustainability of urban development?
- How does one decide which assessment methods to use in any given urban development, and at what stage in the process?
- How professional actors can use assessment methods to effectively improve the 'sustainability' of urban development and particular projects?

The challenge that SUD and these questions raise for the scientific and professional community is considerable. There are very different approaches to assessment in urban planning, property development, building design and facilities management (Cooper, 1997; Curwell and Cooper, 1998; BEQUEST, 1999-1, 1999-2). Each has its own terminology, assessment methodologies and evaluation techniques, priorities and standards. In addition to the absence of a common language with which to frame the problem and to describe the assessment, all professional groups have to address a much broader political, social, economic legal and technical agenda. They also have to consider the implications of the development over a much wider spatial and temporal range, than has previously been the case (Bentivegna *et al.*, 2002).

The BEQUEST EU concerted action (1998–2001) was aimed at bringing together current knowledge to gain new insights into the problem of SUD and therefore has addressed the issues that surround the questions posed above. It has explored a range of current practice in SUD and in environmental and sustainability assessment. The project methodology is described in more detail in Curwell *et al.* (1998), Bentivegna *et al.*, (2002) and some of the aspects of consensus building required for such purposes are explored in Cooper (2002). BEQUEST has attempted to identify the range of assessment methods and to classify them so that all users can understand each methods potential field of application and its limitations. The outcomes of this exercise have been included in a web-based toolkit. This facilitates quick access to good practice advice and guides users of the decision support system (Toolkit) towards methods (BEQUEST, 2001). The structure, use and application of the Toolkit is described in a companion paper (Hamilton *et al.*, 2002). In providing a description of the good practice recommendations, master list and directory of assessment methods created by BEQUEST, this paper attempts to show how the outcomes of the project provide answers to the questions SUD raises. The results of an exercise to map the range and spread of SUD issues which assessment methods currently address is also presented. The paper goes on to set out recent progress made in assessing the sustainability of urban development, as well the conclusions that can be drawn on the matter.

Good practice in SUD – the BEQUEST protocol

The good practice guidance on SUD that has been compiled is included in the BEQUEST protocol. This is drawn from three sources:

- The work of the various research teams and consultants in the project (14 groups from 6 EU member states)
- The research teams' and consultants' knowledge of the literature and current developments
- Ten interactive workshops held during the project attended by the BEQUEST Extranet.

The Extranet is a network of individuals, agencies and institutions who represent all the actors involved in urban re/development (BEQUEST, 1998). This collective knowledge has been brought together in three components:

- Actions: that should be considered for urban re/development ranging across different scales, from strategic planning at one end of the spectrum to the operation of individual buildings at the other
- Procedures: to follow in order to satisfy the EU directive (EC, 2000)
- Case studies: examples of urban development where sustainability has been foregrounded and/or where assessment of some or all of the sustainability issues has been attempted.

Actions in pursuit of SUD

BEQUEST has sub-divided the urban development process on the basis of the division of labour within the scientific and professional communities (Nijkamp, 1991). That is: planning (strategic and local); property development (public and private); design (urban, building and components); construction (new build, refurbishment and demolition) and operation (use, facilities management and maintenance). Checklists of good practice have been compiled for a number of these activities where there is good evidence or a professional consensus can be established for the type of actions recommended. The checklists are subdivided into those actions that should be considered to address environmental, economic, social and institutional issues. The purpose of the checklists is twofold. For the uninitiated they provide a basic introduction to good practice actions and for the experienced they are a useful aide-memoir, to the issues for which some form of assessment or evaluation may be necessary.

Procedures to follow in pursuit of SUD

The procedures relate to the stages included in the forthcoming EU Directive on the 'assessment of the effects of certain plans and programmes on the environment' (EC, 2000). The focus of this is to ensure proper consideration of the relevant environmental and sustainable development issues/effects before development takes place. This has implications for how the assessment is procured, i.e., who undertakes it, how they should proceed and the methods they should use. BEQUEST has summarized the requirements of the main stages (a–h):

a Preliminary procedures ('screening' the urban development activities)

b Identification of the key sustainable development issues (scoping)

c Clarifying what activities, environmental, economic and social issues are to be addressed (clarification)

d Carrying out consultations with affected parties (consulting)

e Selection of the methods needed to procure environmental appraisals of plans, EIAs of urban development programmes and projects

f Adoption of the methods needed to assess if the plans, programmes and projects, provide the capacity which the city of tomorrow needs to carry its cultural heritage and produce forms of human settlement that are sustainable

g Reporting on the sustainability of urban development in terms of ecological integrity, equity, participation in development processes and in futurity considerations of the city, its cultural heritage and forms of human settlement

h Monitoring the sustainability of the said urban development process.

A summary of each section is included in the Toolkit, which facilitates easy access to the requirements. Sections e–h specifically address the selection and adoption of the methods it is possible to procure to ensure a full assessment of urban development proposals. For example, assisting a local authority and its urban design team to identify the type of assessments they should seek to undertake to support the evaluation of a major urban redevelopment project so that it addresses local sustainability objectives. Thus the selection, adoption and proper application of a range of assessment methods is seen as the key component in determining a more sustainable outcome to any development proposal.

Case studies of more SUD

Case studies form a well-established tool for the dissemination of knowledge and good practice. In the early stages of the project the BEQUEST team used case studies of various

cities and development projects as a working tool. This was done to identify the scope and range of a number of methods that have been applied to address sustainability issues beyond that of simple, single issue assessments such as energy calculators. The case studies explored in the BEQUEST workshops also identified a number of problems and inadequacies in current practice that need to be addressed in the future – see Bentivegna *et al.* (2002). Although such case studies were not a 'deliverable' of the EU project, the studies developed by BEQUEST have been made available in a standard format in the Toolkit. This also includes hypertext links to a range of other case studies available on the web, which, altogether, provides a useful resource on many aspects of current SUD practice. However, this aspect of BEQUEST is not explored further in this paper.

The directory of assessment methods for SUD

In order to develop the directory, the BEQUEST team conducted a survey of assessment methods to review a number of well known evaluations. Initially the survey was conducted internally, i.e. methods were identified from the knowledge base of the various research teams and consultants involved in the project, from their review of the literature and from interaction with other research projects and groups working in the field. This resulted in a master list, which was adapted and edited as a result of consultations with the Extranet members during the interactive workshops and communications that took place over the Internet. The survey approach adopted was a necessary consequence of the nature of the project, a concerted action programme (see Bentivegna *et al.*, 2002 for a further description of 'concerted action'). The directory that has developed and the list of methods represents the combined knowledge of the participants and therefore has the advantage of 'benchmarking' the degree of consensus which exists over the assessment of SUD. This approach may be criticized in terms of the rigour of the investigation when compared with that expected of normal research and technical development (RTD) projects.

The background to the survey and classification of assessment methods

The underlying principles of assessment can be traced back to the development of cost benefit analysis and the critique of the discounting principle, which this technique of analysis is based upon (Pearce and Markauya, 1989; Pearce and Turner, 1990; Norgaard and Howarth, 1991; Rydin, 1992; Deakin, 1996, 1997, 1999). Evidence also exists to suggest the development of the methods is linked to the emergence of the hedonic and non-market techniques of analysis representing alternative forms of assessment. Such techniques of analysis include the contingent value and travel cost methods of assessment (Miltin and Satterhwaite, 1996; Brooks *et al.*, 1997; Powell *et al.*, 1997).

Since the Brundtland Report (WECD, 1987), it is evident that the science of assessment has been placed under investigation by the 'green' movement. The key methodological distinctions that have been drawn from this examination relate to the eco-centric and anthropocentric nature of the assessment methods (Rees, 1992; Pearce and Warford, 1993). Within this analysis, the former is seen to incorporate the ecological systems that make up the environment, while the latter refers to the anthropology of human settlement, cultural heritage and the city's economic and social structures. (Kozlowski and Hill, 1993; Breheny, 1992a,b; Breheny and Rookwood, 1993; Breheny *et al.*, 1993; Breheny, 1995; Selman, 1996).

In view of the key methodological distinctions which can be drawn from such examinations and the diverse range of assessments that currently exist, BEQUEST sought to provide a standard classification of methods that are available for assessing SUD. The classification adopted represents the process of urbanization as a life cycle of interrelated activities. The sustainable development issues concern the environmental, economic and social structure, spatial level and time frames (Mega, 1996; Miltin and Satterhwaite, 1996; Pugh, 1996; Mazza and Rydin, 1997), applied to the planning, property development, design, construction and operational activities of the urban development process. The development of the four-sided classification system set out in the BEQUEST Framework for SUD, i.e. development activities, environmental and societal issues, spatial level and time-scale, is outlined in Bentivegna *et al.* (2002). The survey collected data on the methods using a standard format, which includes the following:

- Name of method
- Brief description
- Data required in order to use it
- Status (well established, or experimental)
- Development activity area(s) where the method can be applied (planning, property development, design, construction and operation)
- Environmental and societal issues (environmental, economic, social and institutional) that the method addresses
- Scale of assessment addressed (spatial level and time frame)
- References to further information on the method and/or its application.

Methods were classified using this standard format directly by members of the research team for those methods well known to them. Others methods were completed by their promoters or by expert members of the Extranet.

Results of the survey 1 – master list and the directory of methods

Initially the survey identified over 100 assessment methods. The aim was to 'collect' methods that provided complex assessments, i.e. intended to address sustainable development issues explicitly and to exclude single-issue methods, for example, an energy calculator. Nevertheless the number identified was much greater than anticipated by some of the research team. This included those members of the research team drawn from the building scale (architects, building researchers), who had experience of some preliminary work on the environmental assessment of buildings through other agencies, such as the working group of the *Conseil International du Batiment* (CIB). One reason for the higher number of methods than anticipated was that in planning and economics a wide range of 'generic' methods such as cost benefit analysis, can and are being used to address SUD issues.

Following a series of iterative investigative reviews by the research team, the number was finally reduced to 64. Some very similar assessment methods were identified, originally appearing twice under different 'brand' names or descriptions. Others were found to be defunct, i.e. they were not in active use. For others, full information from the promoters was not forthcoming. This might be a result of misunderstanding caused by language difficulties or misinterpretation of the requirements to take part in the BEQUEST survey.

The master list of assessment methods is shown in Appendix 1. Of these methods, 25, which are broadly representative of the full list, have been reviewed in detail and fully classified as described above and included in the BEQUEST Toolkit. The standardized format used in the directory enables potential users to identify key criteria for selection. The Toolkit provides a searchable list of the assessment methods classified and in certain instances offers hypertext links to the case-studies they have been drawn from. This provides easy access and enables the user to quickly examine the range of assessment methods, to identify one or more methods to address the sustainable development issues under consideration and to satisfy themselves whether a particular technique is appropriate for the evaluation in question.

For the reasons already outlined, it has not been possible to provide a detailed survey nor to undertake a detailed classification of all the methods identified in the Master List. This proved to be beyond the resources of the concerted action programme BEQUEST has been engaged upon. As the directory of assessment methods is not fully comprehensive, the Toolkit offers hypertext links to other organizations addressing the assessment of environmental impact and sustainability of urban development, notably the website of the International Energy Agency (Annex 31 group). Overall, the Toolkit together with the links to other organizations, provides a comprehensive review of the methods available in Europe, North American and Canada. This includes case study evaluations of their application in assessing the sustainability of urban development (Deakin *et al.*, 2001 provide further details of the survey of assessment methods). Written description cannot adequately explain the functionality of the Toolkit in terms of the ease of identifying appropriate methods – readers are advised to test the system for themselves, freely available at: http://www.surveying.salford.ac.uk/bqextra/

Results of the survey 2 – observations on the use and application of methods

BEQUEST's Toolkit brings together methods from a number of discipline-specific locations: for example environmental science, economics and sociology and identifies the urban development activities, sustainability issues, spatial levels and time frames they assess. The survey also reveals the agents within the built environment that carry out such assessments and the methods they use. This illustrates and reinforces the observations of others that assessment methods are being used to:

- Promote sustainable development through resource conservation and environmental protection policies (Therivel, 1992; Glasson *et al.*, 1994; Jowsey and Kellnet, 1996; Lichfield, 1996; Faucheaux *et al.* 1997; Faucheaux and O'Conner, 1998)
- Provide evaluations of the effect that plans, development programmes and projects have upon resource conservation, environmental protection and the sustainable development of cities (Guy and Marvin, 1997; Marvin and Guy, 1997; Brandon, *et al.*, 1997)
- Present meta-analysis of the capacity which the city of tomorrow has to carry its cultural heritage and produce forms of human settlement that are more sustainable (Bergh *et al.*, 1997; Nijkamp and Pepping, 1998).

The survey also begins to reveal the gaps that currently exist between the interrelated activities of the urban development process that the assessment methods cover and the sustainability issues addressed by evaluation techniques (Cooper, 1997). An example of this can be seen with the different techniques used in the assessment of property development programmes, i.e. infrastructure design proposals, against those drawn upon to assess construction projects and the operation of installations (Curwell and Cooper, 1998). This is explored more fully in the next section.

Additional observations emergent from the review and classification of methods

In addition to the four sided classification of methods used in the Toolkit, a number of additional observations can be drawn from the various types of assessment that are currently undertaken, which relate to the rigour and depth of the evaluation undertaken. Two general types of assessment have been identified by the classification: those

using methods to obtain 'environmental valuations' and those undertaken to provide statements on the 'environmental, economic and social' sustainability of urban development. With the former, the focus of attention is on assessing the environmental sustainability of urban development. With the latter, the object of the assessment is more far-reaching. This approach provides a more integrated (environmental, economic and social) assessment of SUD. With the environmental valuations a high level of expertise is needed to carry out such assessments and it is the scientific community that normally undertakes such exercises. With the environmental, economic and social assessments, the type of expertise is both scientific and technical, drawing upon professional input from planners, architects, engineers and surveyors as agents of the built environment. The results of the classification suggest that the environmental valuations provide assessments which focus on ecosystem integrity, on assessing the environmental impact plans, programmes and projects have on natural resources, land use, pollution, the bio-diversity of habitats and the effect this in turn has on the ability of the ecosystem to carry a given loading. It also provides evidence to suggest that the integrated (environmental, economic and social) assessments tend to focus attention on the technology which is needed to mitigate the adverse effect such impacts have on the sustainability of urban development. That is, the technology which is needed to mitigate the adverse effect which such environmental impacts have on the sustainability of the building stock, transportation, safety, security, health and well-being (economic and social structures) underlying the urban development process.

The 'environmental valuation' class includes cost-benefit analysis, hedonic analysis and multi-criteria analysis. The integrated (environmental, economic and social) class includes 'simple base-line qualifications' and 'complex and advanced evaluations'. The simple base-line qualifications include the production of a compatibility matrix, the use of eco-profiling measures and environmental auditing methods (simple-base line appraisals). The complex and advanced methods include project, strategic, economic, social and community evaluations, BEES, BREEAM, Eco-points and the Green Building Code (complex evaluations). They also include, the MASTER Framework, the Pentagon model, the Quantifiable City model, SPARTACUS, the Sustainable City model, sustainable region, sustainable community and Transit-orientated settlement models, as advanced forms of evaluations. Examples of these two classifications are shown in Table 1.

The classification has also identified that the methods can be used to support evaluations in the following areas:

1 The commitment to sustainable urban development in terms of the planning policies adopted by the EU and its member states (Bentivegna, 1997; Davoudi, 1997; Threivel, 1998)

2 The assessment of the property development programmes, providing the infrastructure (energy, water and drainage, transport, telecommunication technologies, leisure and tourism) designs and construction projects (Banister and Burton, 1993; Nijkamp and Pepping, 1998; Graham and Marvin, 1996; Jones *et al.*, 1997; William *et al.*, 1996; Nijkamp *et al.*, 1997; Guy and Marvin, 1997; Allwinkle and Speed, 1997)

3 The design and construction of projects and installation of operations for the purposes of assessing whether the city of tomorrow has the capacity needed to carry its cultural heritage and produce forms of human settlement which are sustainable (Prior, 1993; Vale and Vale, 1993; Cole, 1997; Curwell *et al.*, 1999; Deakin, 1999).

Table 1 Assessment methods

Environmental valuations	Environmental, economic and social assessments	
	Simple	Complex and advanced
Contingent valuation	Compatibility matrix	Project
Cost benefit analysis	Eco-profiling	Strategic – economic – social
Hedonic analysis	Ecological footprint	Community evaluation
Multi-criteria analysis	Environmental auditing	BEES
Travel cost theory	Flag method	BREEAM
	Spider analysis	Eco-points
		Green Building Code
		ASSIPAC
		MASTER Framework
		Meta-analysis (Pentagon method)
		NAR model
		Quantitative City model
		Regime analysis
		SPARTACUS
		Sustainable City model
		Sustainable communities
		Sustainable regions
		Transit-oriented settlement

Source: see Appendix 1

These distinct areas of assessment and their fields of application have, in turn, been used to inform the mapping exercise undertaken for purposes of providing a more detailed examination of the assessment methods.

Mapping the application of assessment methods

Although the BEQUEST Toolkit enables users to identify which assessment methods can be used to help address particular SUD issues, it does not identify either the range or spread of issues they currently address. In short, it does not identify where the assessment methods are strongly represented, or where there is no, or very limited coverage of the issues. Much of the work needed to accomplish this is still ongoing, but this section of the paper reports a preliminary mapping exercise (see Figure 1) undertaken to show the main areas of application, along with a range and spread of assessments. The applications of the methods in the master list have been mapped using the BEQUEST Framework classification. This provides four additional levels of understanding over that available from the Toolkit. Firstly, it provides a graphical illustration of the range and spread of methods currently available. Secondly, it identifies where and how the assessment methods are being used. Thirdly, it identifies the strength of representation by sustainable development issue, spatial level and time frame. Fourthly, it draws attention to the gaps that exist in the range and spread of methods. This is very important as it shows where new methods need to be developed to provide a fully integrated (environmental, economic and social) assessment of SUD. This is important to research policy in terms of the direction of further research aimed at developing the range, scope and methodology of such assessments.

What this analysis suggests is that the range of methods available to the scientific and professional communities

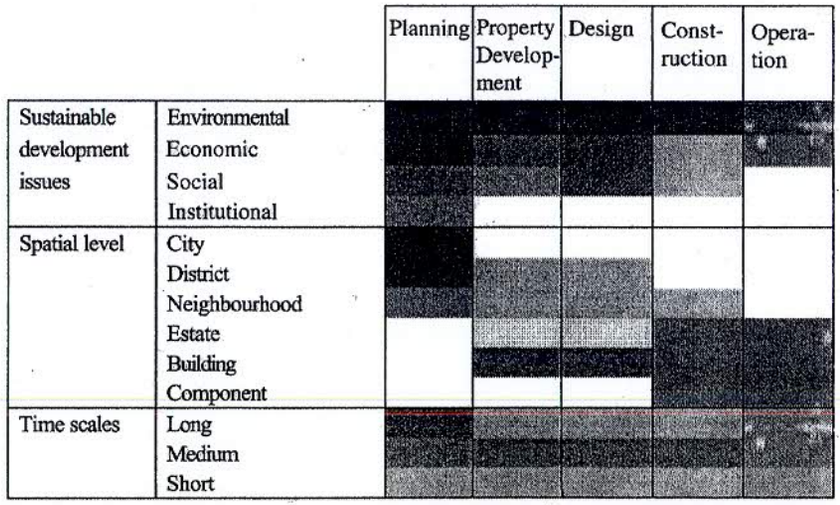

Figure 1 Mapping of the assessment methods

This figure provides the results of the mapping exercise carried out on 25 assessment methods. The shading shown is indicative of the 'intensity scores', or 'frequency' by which the assessment methods address the sustainable urban development issues, spatial levels and time scales of assessment. The degree of shading (from darkest to lightest) scores the frequency by which the assessment methods address the issues in terms of high (75–100%), medium (50–75%), low (25–50%) and no (0%) representation.

Source: mapping of methods from Appendix 1

is broadly adequate to assess the sustainability of urban development and to procure adequate sustainability evaluations as required in the EU Directive (stages e and f mentioned above). It provides evidence to suggest that a range of methods are being used to assess whether the city of tomorrow has the policy planning, property development programmes, infrastructure designs, construction projects and operations needed to carry its cultural heritage. The analysis also illustrates that it is the sustainable development issues, spatial levels and time frames of the planning policy (field 1), property development programmes and infrastructure design activities (field 2), which are the most frequently assessed. Field 3 (construction and operation) is not as well covered in terms of sustainable development issues, spatial level, or time frame (see Figure 1). This suggests that the gaps which exist in the range and spread of methods needed to provide an integrated assessment of SUD are located in the construction of projects and operation of buildings and other installations.

It should be noted that Figure 1 does not map how the assessment methods represent the ecological integrity, equity, participation and futurity issues underlying the sustainability of the urban development process. To be explicit about this a further analysis will need to be carried out, which will need to extend beyond the matrix-based mapping set out in Figure 1 and introduce a more comprehensive grid referencing system. This would extend forward from the sustainability issues, spatial levels and time frames as shown to cross-reference them with the ecological integrity, equity, participation and futurity components of the assessment methods in a form of a 'frontier analysis'.

Discussion of the findings from the BEQUEST review and the mapping of methods

From the BEQUEST review and the mapping of the applications, the wide range of methods that exist for the assessment of SUD can be divided into five main classes in terms of the complexity and completeness of the overall evaluation they provide:

1 *Environmental valuations:*
in the form of cost benefit analysis, contingent valuation, travel cost, hedonic and multi-criteria analysis, to assess the environmental sustainability (in this instance, ecological integrity) of urban development.

2 *Simple baseline or benchmarking methods:*
To assess the environmental, economic and social issues underlying the policy commitment to SUD. Examples of such methods include the use of compatibility, eco-profiling and ecological foot-printing exercises. They also include the use of environmental auditing techniques such as the flag method and spider analysis exercises.

3 *More complex methods:*
To assess whether the planning, property development, design and construction of infrastructure projects (servicing energy, water and drainage, transport, telecommunication technologies, leisure and tourism), provides the city of tomorrow with the capacity (in this instance ecological integrity and equity) that is needed to carry its cultural heritage. Examples of such methods include project, strategic, economic, social and community evaluations.

4 *Advanced methods:*
that assess the contribution of construction to SUD, i.e. how particular construction projects and installations, for example, energy systems, waste management provisions, repair and maintenance technologies operate and what effect they have upon the environmental sustainability of urban development. This includes an assessment whether they have levels of energy consumption and emissions that have an adverse effect, or an impact that is more environmentally friendly. This is in the sense that the construction and operation of such installations augments, rather than diminishes, the capacity (ecological integrity, and equity) that the city of tomorrow has to carry its cultural heritage. These evaluations include BREEAM, Eco-points, the Green Building Challenge and the NAR (net annual return) model.

5 *Very advanced integrated assessments and/or models:*
that assess (at the level of policy planning) the ecological integrity and equity of the alternative developments that it is possible for the public to participate in. These enable alternative development paths that it is possible for the public to participate in and select as those designs, constructions and operations that augment, rather than diminish the capacity (in this instance; ecological integrity, equity, participation and futurity), which the city of tomorrow has to carry its cultural heritage. These methods include ASSIPAC, the MASTER Framework, the Pentagon model, the Quantitative City model, SPARTACUS, the Sustainable City, sustainable region, sustainable community and transit-orientated settlement models.

However, in terms of answering whether the methods meet the requirements of the EU directive, the two broad classes set out in Table 1 (i.e. 'environmental valuations' and 'environmental, economic and social evaluations') will be used to simplify the remaining discussion below. Irrespective of whether the environmental valuations are applied to policy planning, property development programmes, infrastructure design, construction projects, or installation operations (fields 1–3 above), the object of the 'environmental valuations' is to assess the ecological integrity of the sustainable development issues (natural resources, land use, pollution and bio-diversity) under consideration. With this class of assessment, it is also noticeable that any economic analysis is confined to the planning, property development and design stage of the policy, programme and infrastructure provision (field 1 and 2) and does not extend into the construction of projects, or installation of operations (field 3). This is also the case for any social issues that surface from the application of such assessment methods.

With 'environmental, economic and social assessments' the situation is different. This is because these methods address development activities (planning through to operation) and evaluate the ecological integrity, equity, participation and futurity of the sustainability issues (including those surrounding the construction and installation of operations) in both economic and social terms. These assessments take SUD to include environmental sustainability, in terms of eco-system integrity *and* the equity, participation and futurity of the building stock, transport, safety, security, health and well-being (economic and social structures) underlying the urban development process. This is a key point – because here the assessment of SUD begins to become *integrated* in the sense that the methods address environmental sustainability *in terms of* the economic and social structures that underlie the urban development process. Thus, these methods assess the capacity for the city to carry forward its cultural heritage into 'tomorrow' by developing the building stock, transport, safety, security, health and well-being (economic and social structures) that are required for forms of human settlement, which would be recognized as more sustainable in such terms.

However, it is evident that most of the methods fail to address the institutional issues underlying the assessment of SUD. It is clear that in their current form, the methods find it difficult to address issues relating to governance, morality and ethics of the urban development process. The reasons for this are not currently known and require further investigation. It may be because most attention has been focused on environmental, economic and social issues and this has resulted in relative under-development of the institutional considerations. So it appears that if the assessment methods are to provide an appropriate basis for such evaluations, the governance, morality and ethics of the urban process also need to be integrated into the assessments.

Both of the broad categories of assessments relate to particular spatial configurations and time-horizons. With the environmental evaluations the spatial domain considered is that of the city and its districts. With the environmental, economic and social assessments, it is evident that the simple base line and various complex evaluations tend to be more explicit about the spatial configuration of SUD. This extends to the city, district, neighbourhood, estate, building and component levels of analysis. It is also noticeable that it is the advanced methods that assess the regional, cumulative national, growing international and global sustainability of urban development over the long, medium and short term. This suggests the advanced assessment methods appreciate the need for a pan-European understanding of the urban development process. This in turn recognizes the need to develop assessment methods that are urban in the sense in which they transcend the city and evaluate the regional, cumulative national, growing international and global issues that SUD faces.

Progress in sustainability assessment – post-Brundtland transformation

Since the concept of sustainable development has come to the fore, it is evident that the 'green' forms of environmental valuation have commonly provided the foundation for the other class of evaluations carried out: in this instance, the 'environmental, economic and social assessments'. This is common irrespective of whether the assessment is of the simple, complex, or advanced type, a good example is cost benefit analysis (CBA) (Glasson *et al.*, 1994; Lichfield, 1996; Therival, 1998; Deakin, 1997, 1999). It is also evident in the use of the multiple-regression component of the hedonic technique forming the meta-analysis of policy planning, property development and infrastructure design (Bergh *et al.*, 1997; Nijkamp, 1998). Another example of this is the transformation of multi-criteria assessments into regime analysis and use of this evaluation technique to support actions taken over the development of property and design of infrastructures (Bizarro and Nijkamp, 1997).

There is also some evidence to suggest this 'post-Brundtland' transformation of environmental evaluation is mediated through other methods, particularly those that provide a more integrated assessment of SUD. Examples include the use of the analytical hierarchy process to transform CBA in both environmental appraisal (the flag method) and the impact assessments undertaken as part of a regime analysis. It is also seen in the use of life cycle analysis to transform CBA into the NAR (net annual return) model. The method is also adopted for the assessment of sustainable communities. Another observation that can be drawn from this type transformation relates to the way in which the 'hard' (technical, environmental) and 'soft' (social, institutional) issues of sustainable development form part of the assessment methodology. With BEES (Building for Environmental and Economic Sustainability) and the Quantifiable City model, the biophysical aspects of the eco-system are the main issues. Here the sustainable development issues under assessment are those of energy consumption, material flows, waste and pollution. This is also the case for the Quantifiable City model. While useful in focusing attention on eco-system integrity, it should be noted that such methods do not integrate either the economic or social issues to the same degree other assessments have managed; for example: BREEAM (Building Research Establishment Environmental Assessment Method), the MASTER Framework, SPARTACUS, sustainable community, city, region and transit-orientated settlement models.

Finally a 'trans-disciplinary' approach is another issue that has been recognized most forcefully 'post-Brundtland' as the key to a fully integrated assessment of SUD and this has

become a cornerstone of the BEQUEST project (BEQUEST 1998). Trans-disciplinary issues can be found in three of the advanced assessment methods: the Quantifiable City, Sustainable community and transit-orientated settlement model. The trans-disciplinary issues are those of urban metabolism (Quantifiable City model), urban sprawl, economic growth, competitiveness and social cohesion (the sustainable communities model), and the mobility questions, which are in turn raised about urban development (transit-orientated settlement model).

From this analysis and discussion a great deal of progress in the theory, science and practice of assessment can be recognized. The survey and review of methods, classification and mapping of the assessments, provide a great deal of evidence to counter the recent criticisms of EIA as a project-based exercise (Wood, 1998), provided methods and their evaluative are routinely applied in development projects. This also shows how methods are currently being used to assess the sustainability of urban development plans, programmes and projects, thereby going some way to meet the objectives which the most recent EC Directive sets out on the matter (EC, 2000).

However despite all these developments certain factors tend to undermine the progress that has been made in the theory, method and practice of assessment. These include:

- The tendency for the policy planning, programmes of property development and infrastructure design considerations, to overshadow the assessment needs of the construction and installation stages (Cooper, 1997, 1999, 2000; Deakin, 2000, 2001)
- The relative absence of any institutional assessment
- The paucity of environmental, economic and social (sustainable urban development) indicators it is possible to draw upon as a means of benchmarking the effect planning policies, property development programmes, infrastructure designs, construction projects and installations have upon the sustainability of urban development (Mitchell *et al.*, 1995; Mitchell, 1996; 2000)
- The fact that this in turn makes it difficult – in methodological terms – to assess the aggregate effect of policy planning, property development programmes, infrastructure designs, construction projects and the installation of operations, on attempts to augment the capacity the city of tomorrow has to carry its cultural heritage and produce forms of human settlement which are sustainable (Cooper, 2000; Lombardi, 2000; Brandon and Lombardi, 2001).

The aforesaid tend to highlight the rather limited nature of the data-sets currently available to provide a fully integrated assessment of SUD. They are limited not only in terms of assessing whether the city of tomorrow has the capacity that is needed to carry its cultural heritage, but if it is also able to produce forms of human settlement which are more sustainable.

Conclusions

This paper has examined the outcomes of the BEQUEST project in terms of identifying the range of methods that exist to assess the sustainability of urban development and what contribution each assessment method can make to such an evaluation. Whilst it is not possible to fully appreciate the nature of the decision support system incorporated in the Toolkit available for identification and selection of methods without actually accessing it electronically, the basis of the categorization upon which selection can be made has been explained.

Building on the BEQUEST review of assessment methods and its categorization of assessment methods, this paper has suggested how it is possible to develop the science and technology of assessment and how further research can help with this. It has proposed that the environmental valuations, which have been carried out in the past, tend to focus on assessing environmental sustainability solely in terms of ecosystem integrity and by implication are inadequate in the new paradigm of SUD. This paper has identified that the 'environmental, economic and social assessments' use methods to assess the sustainability of urban development in a more integrated manner. They take SUD to include environmental sustainability in terms of eco-system integrity, equity, public participation and futurity of the economic and social structures that not only underlie the urban development process, but the capacity which the city of tomorrow has to carry its cultural heritage. This is because where 'environmental, economic and social assessments' become integrated, the greater chance there is of the economic and social structures underlying the urban development process being more sustainable.

This goes some way to counter the recent criticism of EIA by demonstrating how existing methods provide the opportunity to assess the sustainability of urban development plans, programmes and projects by emphasizing the trans-disciplinary nature of the problem. The inadequacies of certain classes of assessment methods have been highlighted and the need to overcome such difficulties through the development of more complex, multi-criteria techniques has been acknowledged.

The protocol and directory of assessment methods included in the BEQUEST Toolkit is not yet able to provide a fully integrated assessment of SUD. However, by providing access to the broad range of methods currently available, it allows the various professional actors to appreciate the wide range of evaluations required to assess the sustainability of urban development that is necessary for SUD and to make more integrated evaluations than that undertaken in the past. The need for fully integrated assessment methods remains a research and development objective, but the realization is probably still 10 years away. In the meantime the BEQUEST Toolkit (see Hamilton *et al.*, 2002 in this issue) provides one of the most integrated approaches to the SUD problem currently available.

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Appendix 1: master list of assessment methods (September 2000)

Analysis of Interconnected Decision Areas (AIDA)
Analytic Hierarchy Process (AHP)
ASSIPAC (Assessing the Sustainability of Societal Initiatives and Proposed Agendas for Change)
ATHENA
BEPAC
BRE Environmental Assessment Method (BREEAM)
BRE Environmental Management Toolkits
Building Energy Environment (BEE 1.0)
Building Environmental Assessment and Rating System (BEARS)
Building for Economic and Environmental Sustainability (BEES 2:0)
Cluster Evaluation
Community Impact Evaluation
Concordance Analysis
Contingent Valuation Method
Cost Benefit Analysis
Eco-Effect
Eco-Indicator '95
Eco-Instal
Economic Impact Assessment
Ecological Footprint
Eco-points
Ecopro
Eco-Profile
EcoProP
Eco-Quantum
ENVEST
Environmental Impact Analysis
Environmental Impact Assessment
Environmental Profiles (The BRE Methodology for Environmental Profiles of Construction Materials, Components and Building Materials)
EQUER
ESCALE
Financial Evaluation of Sustainable Communities
Flag Model
Green Building Code
Hedonic analysis
Green Guide to Specification (An Environmental Profiling System for Building Materials and Components)
Hochbaukonstruktionen nach ökologischen Gesichtspunkten (SIA D0123)
INSURED
Leadership in Energy and Environmental Design Green Building Rating System (LEEDTM)
Life Cycle Analysis (LCA)

Mass Intensity Per Service Unit (MIPS)
MASTER Framework
Meta Regression Analysis
Multi-Criteria Analysis
Net Annual Return (NAR) Model
Optimierung der Gesamtanforderungen (Kosten/Energie/Umwelt) ein Instrument für die Integrale Planung (OGIP)
PAPOOSE
PIMWAQ
Project Impact Assessment
Regime Analysis
Quantitative City Model
Planning Balance Sheet Analysis
Risk Assessment Method(s)
SANDAT
Semantic Differential
Social Impact Assessment
Sustainable Cities
Sustainable Regions
Transit-orientated Settlement
Travel Cost Theory

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li, P. Properzi, P. Ricci, P. Romaniello, F. Sbetti, O.
lini, S. Stanghellini, M. Talia, S. Viviani, Comune
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liulia: L. Comandini; Liguria: R. Bobbio; Emilia-
na: S. Vecchietti; Toscana: S. Viviani; Marche:
llini; Umbria: D. Zurli; Lazio: L. Contardi;
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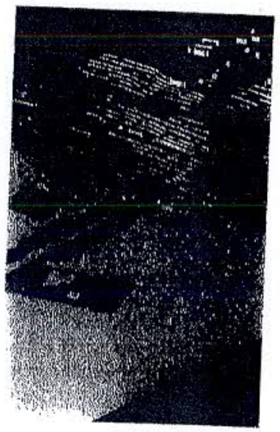

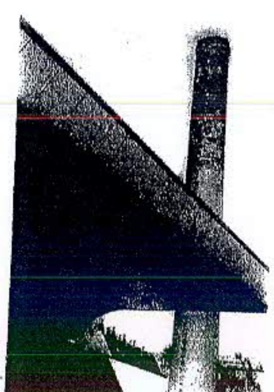

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rmodynamics. The laws of rmodynamics apply to all own phenomena, and include conservation of energy (energy not be created or destroyed, the distribution of energy by m changes); and that the ection of processes is always in order to disorder (increasing tropy).

reshold Limit. The value of posure to a pollutant above ich damage occurs, and below ich damage will probably not cur. For some pollutants there is safe exposure limit.

ol. A product, concrete or stract, used in applying a ethod. Instrument of logic for isisting analysis.

olkit. BEQUEST: Set of logical ols which together provide werful analytical assistance sually electronic).

wn. An urban area smaller than city but larger than a village.

ransparency. Citizens should articipate in decision-making and ave access to information and udicial and administrative roceedings.

Transport. Means (usually mechanised) of conveyance or carriage within and between urban areas.

Urban. Of, pertaining to or constituting a city or town; occurring in or characteristic of a city or town.

Urban Design. Process or product of creating a model for the construction of an urban area or a regeneration.

Urban Development. Progress in constructing or extending the city or town. The buildings and infrastructure.

Urban District. Part of a town or city that supports some commercial activity.

Urban Regeneration. Breathing new life into (part of) the town or city.

User Pays Principle. A principle according to which the user of a facility or public resource pays the market price for the service or good, plus a price for the associated externality costs.

Utilities, Utility. Public utilities; the energy, water and waste disposal systems of a community.

Valid. A well-founded, applicable and defensible argument, assertion, objection, etc.; having some force, pertinency, or value.

Value Sensitive. Characteristic of an individual or system of analysis takes proper consideration of things that cannot be given a numerical value or cost.

Value System. Understanding of worth or importance (often of things that cannot be given a numerical value or cost).

Wealth. Abundance. Assets of an individual or society as a whole.

Wealth Creation. Acts of industry and commerce that accumulates assets.

Urban sustainability assessment: a preliminary appraisal of current techniques

Mark Deakin, Gordon Mitchell, Patrizia Lombardi

Bequest is a pan-European network of physical, economic and social scientists and practitioners concerned with sustainable urban development (http://www.surveying.salford.ac.uk/extra). The network has latterly been supported by the EU Research Directorate under the 4th Framework Programme and includes fourteen groups in six EU countries forming the core of the network, with additional 'Extranet' members providing material, guidance and feedback to the core team. The aim of the network is to contribute to the assessment, practice and realisation of sustainable urban development (SUD) through the development of: a directory of assessment methodologies and a common protocol for procuring a sustainable built environment (Rosasco 2001); a directory of external advisors on assessment practice and protocol actions supported by identification of best practice examples of sustainable urban development (Mambelli *et al.* 2001). These elements, and the 'common urban sustainability language' developed within the network, are brought together in the Bequest toolkit, an electronic information system that attempts to present and structure, using a common framework, Bequest material so as to support urban decision making for sustainability (Lombardi, Curwell 2001).

This paper discusses the development of the directory of assessment methodologies that have been, or could be used in the process of evaluating urban development and making decisions that contribute to sustainability. Preliminary findings on the type and range of available methods and their suitability for sustainability assessment are discussed, and some directions for future urban sustainability assessment presented.

Development of an assessment methods directory

The Bequest toolkit provides access to the current directory of assessment methodologies identified by the network as relevant to urban development and sustainability assessment (Rosasco 2001). The methods were identified from the practical experience of network-members and through literature review. Note that sustainability indicators and to a lesser extent computer based urban-environmental models are beyond the current scope of the Bequest project, and whilst relevant to its objectives, have not been addressed in detail. To date, 64 assessment methods have been identified which may be applicable to urban or sustainability assessment. A simple description of 25 of these methods is given in the prototype Bequest toolkit, comprising: the method name; its origins and methodological basis; data requirements; its status from well established to experimental; the activity domain (e.g. building design) it addresses; the social, environmental, economic and institutional issues it addresses; and the temporal and spatial scales it applies to. Further references and links to method advisors are presented where available.

For the purpose of this paper, no attempt has been made to group methods according to any conventional classification, monetary *vs.* non-monetary, or social, environmental and economic for example, as it was thought that such divisions might act to reinforce existing prejudices and preferences over particular methods or assessment approach, and hence prevent an examination of the relative merits of the methods with respect to sustainability objectives. However, from the list it is evident that there has been considerable method development activity in recent years, and that methods could, albeit very crudely, be divided into "pre and post Brundtland report" (WCED 1987) approaches.

The pre-Brundtland approach tends to identify impacts (using checklists or matrices for example) and evaluate development using techniques such as logical frameworks, fiscal analyses, cost-effectiveness analysis and multi-criteria assessments. Cost-benefit analysis was also widely used to evaluate outcomes from these techniques, with environmental (non-market good) evaluations increasingly made using revealed or expressed preference techniques including contingent valuation, hedonic pricing and the travel cost method (see e.g. Pearce, Markandya 1989). Since Brundtland, and the Agenda 21 (UNCED 1992) call for the integration of environment and development in decision making, the science of assessment has been placed under greater scrutiny by environmentalists and critical distinctions have been drawn between ecocentric and anthropocentric techniques of analysis (Rees 1992; Pearce, [illegible] 1993). In particular the role of the natural environment, as the fundamental support system for economic and social development is increasingly recognised.

This recognition has led to the development of many methods [illegible] focus on energy and material [illegible] addressing both resource use and waste arising, across a wide [illegible] of urban activities. Examples include ATHENA, a tool for [illegible] cycle impact assessment of [illegible] components, BREEAM and [illegible] which address material flows [illegible] impacts associated with [illegible] buildings, and the ecological footprint and environmental [illegible] methods which can express consumption patterns of [illegible] regions or countries relative [illegible] clearly defined environmental sustainability thresholds.

A framework for assess[illegible] method appraisal

Recent surveys have exa[illegible] today's assessment method[illegible] currently being used. The[illegible] that: sustainable develo[illegible] being promoted through [illegible] focussed on resource [illegible] and environmental prot[illegible] (Therivel 1992; Glasson [illegible] Jowsey, Kellet 1996; Lic[illegible] Faucheaux *et al.* 1997 [illegible] O'Conner 1998) while [illegible] applications are focus[illegible] limited set of activiti[illegible] development program[illegible] infrastructure projects [illegible] buildings (Guy, Marvin [illegible] Marvin, Guy 1997; B[illegible] 1997).

These surveys, toge[illegible] meta-analyses (Ber[illegible] Nijkamp, Pepping [illegible] identify optimal [illegible] an aggregate analy[illegible] assessments achiev[illegible] alternative method[illegible] that there are urb[illegible] activities and sus[illegible] development issu[illegible] poorly addressed [illegible] assessment metho[illegible] The surveys also [illegible] opinion about the [illegible] environmental ass[illegible] [illegible]urrently divided between those who believe it can promote sustainable development (Brandon *et al.* 1997; Bergh 1997; Nijkamp, Pepping 1998), and those who feel existing approaches, exemplified by revealed preference techniques, are unable to evaluate non-market goods and services and hence are inappropriate to sustainability assessment (Guy, Marvin 1997). This division of opinion is important for two reasons. Firstly, it illustrates the scientific community is divided about the [illegible]lity and value of assessment methods, and second, it under[illegible] the certainty that the professional community needs to [illegible] confident about the validity and [illegible]ness of these methods (Pugh [illegible] Cooper 1997, 1999).

[illegible] Bequest network believes that [illegible]mental assessment methods [illegible] used to promote sustainable development, and that while [illegible]ities and risk associated [illegible]rketisation' of the [illegible]ent present particular [illegible] they should not prove [illegible]table. [illegible]cause of the problem is [illegible] of a systematic [illegible]aken towards assessment [illegible] activities in the urban [illegible] cycle, and with [illegible]rence to significant [illegible] issues (Curwell *et al.* [illegible] Curwell 1998). This [illegible] of the Bequest net-[illegible]support from the [illegible] Zdan 1997; [illegible] Devuyst *et al.* 1999). [illegible]work developed an [illegible]scales framework [illegible]mon point of [illegible]test material [illegible] assessment [illegible] This framework is [illegible] argued for by [illegible]hich seeks to [illegible] truly integrated [illegible] [illegible]ments, but is a [illegible] the need to [illegible] the diverse [illegible] the Bequest [illegible]put, including [illegible] sustainability [illegible] [illegible] also one [illegible] common [illegible] [illegible]eveloped [illegible] and [illegible] partners [illegible] [illegible] attempt [illegible] level [illegible] practically dealt with, and hence does not promote better decision making. Rather, the aim of the framework is to provide a holistic structure, upon which integrated assessments and analyses can be based, where integration implies that the most significant components are addressed.

The framework is a conceptual map that represents the key domains (activities, sustainability issues, scales) relevant to sustainable urban development. It has four axes: Urban development activities: planning, property development, design, construction and operation, as use and maintenance. These address buildings, spaces between buildings and the transport and utility infrastructure that connects them; Environmental and societal issues that influence or are influenced by development. The principle subdivisions, environmental, societal, economic and institutional are those used by the UN Committee on Sustainable Development (UNCSD 1996) in classifying sustainable development indicators, hence were thought to be a widely acceptable basis for classifying urban issues; The spatial scale of development activity or impact, from buildings component to global; and the time period over which impacts might be experienced and/or assessed. Further details of the framework are presented by (Lombardi, Curwell 2001). The Bequest framework is of great significance because it represents a consensus amongst all the main professional actors, and has already been used to structure thinking in the CRISP EU FP5 project on sustainability indicators (CRISP 2001), and is being considered by the European Green Building Forum (EGBF 2001).

A preliminary assessment of urban sustainability assessment methods

In order to understand the coverage by assessment methods of sustainability criteria, and to also to recognise any 'gaps' in the portfolio of currently available sustainability assessment methods, the methods described in the Bequest toolkit were 'mapped' onto the Bequest framework. From this simple mapping exercise and the Bequest review of assessment methods upon which it is based, several issues relevant to the current status of urban sustainability assessment can be identified.

It is apparent that assessment methods are available to cover many of the elements in the Bequest framework, suggesting that methods are available for sustainability assessment of most urban activities. The review reveals however, that many of the methods are recent developments, demonstrating that whilst this is an active research and development area, many methods remain experimental and have yet to be widely adopted in practice. The 'pre-post Brundtland' division in method approach remains strong, with pre-Brundtland methods having a predominantly environmental focus (e.g. economic evaluation of environmental goods and services), whilst post-Brundtland, the focus of method development has shifted towards life cycle assessment (LCA) of urban activities in which there are attempts to address broader sustainability issues such as environmental limits, social equity concerns and the need for stakeholder participation. A further division can be seen in this latter group, with methods focussed on either assessment of policies, plans and programmes, or on evaluation of infrastructure projects. Collectively these latter methods cover most of the urban life cycle, although there is relatively little overlap between the LCA sub-divisions.

The environmental and largely pre-Brundtland methods do not appear to have the capacity to address the range of activities and scales represented by the framework, and are mostly limited to applications at the policy planning, programme development and urban design stages. In contrast the LCA methods appear to be addressing a much broader range of urban activities and scales. However, both display significant limitations with respect to the range of sustainability issues they can address (e.g. LCA methods do not perform well with respect to social and institutional, and to a lesser extent economic criteria), or to sustainability principles of threshold limits and equity criteria which are covered in a piecemeal fashion.

Overall, the policy planning, programme development and urban design phases are best covered, whilst construction and operation (use and maintenance) are poorly covered (see Cooper 1997; Cooper, Curwell 1998 for further details). This suggests that method developments are needed in the construction and operation stages of the urban life cycle.

However, this conclusion should be tempered by a consideration of the need for a comprehensive coverage

the Bequest framework by
essment methods.
demand for holism, but the
practicalities of comprehensive-
is when dealing with sustainable
an development, implies that
essment methods may not be
uired to address all activity-
ue-scale elements, just those
ught to be most significant.
is suggests that method
velopments should then, focus on
proving the quality of
essment methods in domains
at are already addressed, in
dition to developing methods for
eas considered significant, but
t currently served by assessment
chniques.
ross the range of urban activities,
e environmental dimension of the
stainable development issues has
eatest coverage. Here issues such
resource consumption, pollution
d impacts on bio-diversity are
nsidered, using methods including
mple base-line techniques (e.g.
o-profiling, flag method, spider
ethod), environmental valuation
sing cost-benefit analysis and
vealed/expressed preference
chniques, building scale and
rban form methods (BREEAM,
co-points, Green Building
hallenge, net annual return model)
nd methods to evaluate infra-
ructure and particularly planning
olicy.
he latter are addressed by EIA,
ommunity and social impact
nalysis, and the proposed EU
irective on SEA (EC 2000) and
clude methods such as ASSIPAC,
he MASTER Framework, the
'entagon model, SPARTACUS, the
)uantifiable City model, sustainable
egion, sustainable community and
ransit-orientated settlement
nodels. Several of the latter are
omplex computer based urban
nodels integrating extant models
f individual urban processes, often
within a GIS, with other decision
making techniques (e.g. Delphi,
MCDA) to evaluate alternative
development options within a
sustainability framework. They are
distinct from conventional urban
models in that they are oriented
towards issues of environmental
and societal sustainability, rather
than having a sole objective of
furthering the understanding of
urban land use, demographic or
transportation processes.
The economic and social
sustainable development elements
address, respectively,
considerations relating to the
financing of the infrastructure,
transport and utilities required for
the desired urban development, and
access to services, peoples safety
and security, health and well-being.
With the application of the pre-
Brundtland 'environment in general
methods', it is noticeable that both
economic and social analyses are
confined to the planning, property
development and design stages
(thus addressing assessment of
policy, programme and infra-
structure provision), and do not
address construction of projects, or
installation of operations.
Conversely the 'post Brundtland
LCA' methods attempt to address
social and economic issues in
addition to their environmental
focus, although this treatment is
piecemeal. It is apparent that these
LCA type methods often address
social or economic issues using
approaches from the former group.
Examples can be found in the
sustainable city models described
above, in the mix of formal LCA
and CBA (e.g. Glasson *et al.* 1994;
Lichfield 1996; Therival 1998),
in meta-analysis of policy
planning and infrastructure design
(Berg *et al.* 1997), and in the
transformation of multi-criteria
assessments into regime analysis
so as to resolve environmental
problems arising from alternative
economic and social structure of
sustainable development (Bizarro,
Nijkamp 1997).
Perhaps the most obvious 'gap'
evident from the mapping frame-
work is the relative absence of
methods addressing institutional
issues such as governance, justice
and ethics with respect to
development (e.g. settlement
patterns). Unfortunately, there is
evidence to indicate that methods
experience extreme difficulties in
dealing with the complexity of
institutional structures and the
range of stakeholder interests this
introduces into assessment. Thus
methods to assess the capability of
institutional structures to promote
sustainable development remain
poorly developed, despite the
evident need for them (Lombardi
2001).
The assessment methods do cover
most relevant spatial and temporal
scales. There are gaps in the spatial
scale, but these occur away from
the city-planning to component-
construction axis as might naturally
be expected. However, whist the
impracticalities of comprehensive
coverage implies that reasonable
coverage has been achieved, this
does not imply that the coverage is
satisfactory. Potential gaps include
methods to assess estate planning,
and particularly operational/
servicing aspects above the estate
level (e.g. sustainability of waste
disposal practices at a district or
city scale). Methods are available to
assess urban activities across short,
medium and long (>20 years) time
periods. However, often the
political pressures for urban
regeneration means that decisions
are taken which reflect evaluation
conducted over the short term
(<5 years) with little or no
consideration of the long term and
particularly inter-generational
effects. Thus as with the design,
construction and operation of
building installations, short-term
considerations often apply to
planning too, dominating the
appraisal in question (see e.g.
Curwell, Lombardi 1999).

Conclusions

Agenda 21 (UNCED 1992) called for
the integration of environment and
development in decision making,
and since then impact assessment,
in the broadest sense, has advanced
considerably. Within the EU, EIA
has been introduced as a statutory
instrument (directive 85/337/EEC
and amendment 97/11/EC), and the
critique of EIA as solely a project
specific assessment approach (e.g.
Glasson *et al.* 1994) has led to its
extension to plans and programmes
under the proposed EU Strategic
Environmental Assessment directive
(EU 2000). This shift in emphasis is
significant as it requires the
development of procedures for the
procurement and assessment of
plans, programmes and projects
able to satisfy the policy
commitment to sustainable
development (O'Conner 1998;
Devuyst 1999; Harrop, Nixon 1999;
Selman 2000). A further key gain
has been the evolution of methods
that attempt to assess the impact of
development in terms of material
and energy flows, across most
stages of the urban life cycle.
These present opportunities to
assess developments with respect
to ecological limits, although in
practice few are able to achieve this
at present. While this suggests
much progress has been made post-
Brundtland to improve the theory
of assessment, it is recognised that
the practice of assessment lags well
behind, with new methods
remaining largely experimental
with relatively few applications in
practice. Meanwhile many of the
methods currently in widespread
use fail to make assessments that
adequately address the issues
underlying the sustainable urban
development process (Cooper 1997;
Cooper, Curwell 1998; Cooper 1999).
Our preliminary appraisal points to
the need for assessment method
developments in several areas.
Firstly, there is a need to identify
those aspects of the urban
activities-issues-scale framework
which are poorly addressed by
available assessment techniques.
This analysis is limited, in that we
have not examined all 2970
elements in the framework
(11 activities x 15 sustainable
development issues x 6 spatial
scales x 3 temporal scales), and
have only mapped methods to the
major headings (note however,
the preference for an analysis of
significant elements rather than a
comprehensive one). Nevertheless,
method 'gaps' are evident at this
higher level, with respect to
assessment of construction and
operation activities, which are
poorly addressed relative to
planning and design activities;
estate planning and operational
activities above the estate level;
long term and particularly
inter-generational effects; and
significantly the social and
institutional aspects of sustainable
development.
Method developments are required
in all these areas, but perhaps that
required to address the difficulty
current methods have in dealing
with the complexity of institutional
structures and associated stake-
holder interests presents the
greatest challenge. Secondly, there
is a need for assessment methods to
address much more explicitly the
fundamental principles of the
sustainable development concept,
recognising ecological
sustainability limits (carrying
capacities, resource renewal and
substitution rates, pollutant
assimilative capacities) and the
necessity to address social equity
concerns. For example, whilst
many of the recently developed
methods quantify physical flows,
and may attempt to integrate and
place a value or weighting on these
flows to allow comparison with
other objective functions, there is
little evidence of assessment
methods addressing the physical
limits of the natural environment
that are fundamental to sustainable
development. Methods which do
attempt to do this, such as
ecological footprinting and
environmental space, are largely
operational at the city or more
usually national scale, where they
have illustrated, for example, the
need for radical reductions in
resource use (e.g. 'Factor 40', see
Von Weizsaker *et al.* 1997) if
ecological sustainability is to be
achieved. Thus developments are
required so that methods are either
able to: address such limits for
assessments conducted at the sub-
city spatial scale and across the
range of urban life cycle activities;
and/or which can provide data for
use in methods where such limits
are recognised at more aggregate
levels. One means of achieving this
would be to benchmark assessment
method results against
sustainability indicators (Macoun *et
al.* 2001). However, despite
considerable effort in sustainability
indicator development, many
remain poorly constructed and fail
to explicitly address ecosystem
limits and equity concerns (Mitchell
1996, 2000), hence careful selection
of benchmark indicators is required
if assessments are to truly address
sustainable development objectives.
Thirdly, efforts to address new
problem domains, improving and
extending assessment capabilities,
through the cross-fertilisation of
approaches are to be encouraged.
There is much evidence to show
that such developments are under-
way as the examples discussed
earlier demonstrate. However,
developments also need to occur
with integration of assessment
methods with other assessment
techniques alluded to earlier as
being beyond the scope of the
Bequest assessment method
directory. In particular, there
remains considerable scope for
integration of assessment methods
with sustainability indicators, and
with urban sustainability models.
Both attempt to address the urban
system holistically. The former
present essential sustainability
benchmarks while the latter
present the opportunity to seek
preferred policy or development
alternatives for complex urban
systems which are otherwise
difficult to assess. Models can
continue to provide predictions of
objective measures which can be
subject to appraisal using
assessment methods. However, a
particularly interesting
development is the application of
models in a backcasting mode,
where rather than assessing the
effect that pre-determined actions
have (forecasting), a benchmark or
goal is set and the actions required
to achieve that objective can then
be determined (Holmberg, Robert
2000).
Fourthly, there is a need to ensure
that the emerging sustainability
assessment techniques are applied
and audited. Methods must move
quickly beyond the experimental
phase and be applied in practice,
so that those which better address
sustainability concerns replace
conventional techniques which do
not. This may require the
application of multiple methods
(conventional and experimental)
in parallel to accelerate the
learning process, and identify
how both theory and practice can
be improved. Critically, such
applications will require greater use
of auditing and post assessment
monitoring to determine how well
methods perform.
Finally, research is required into
means of assessing the aggregate
effect of policy and urban
developments on urban
sustainability. This could take the
form of assessment method
integration as described above, or
development of unifying frame-
works and analytical procedures as
argued for by Hardi and Zdan,
(1997) and Devuyst (1999).
However, in practice the
effectiveness of both approaches
will rely upon the development of
adaptive management structures
within decision making institutions,
so that they are able understand,
respond to, and foster improvement
of the sustainability assessment
procedures. Sustainability present
the challenge of addressing the
urban system holistically. This is a
critical challenge, but it is
impractical to expect to address
such a complex system
comprehensively, hence holism
must be addressed through an
integrated approach, defined as one
in which the most significant
elements and linkages in the
system are addressed. Assessment
of such an integrated system can
only be achieved through the co-
evolution of the 'technical' aspects
of assessment, and the 'soft'
institutional systems which direct
and respond to them.
In the longer term, perhaps ten
years or more, more complex
multi-aspect models, assessment
methods and institutional
procedures will develop to address
the broad scope and complexity
of the SUD question.
In the meantime, the electronic
Bequest toolkit, and its directory of
assessment methods represents a
key resource to decision-makers in
this problem area. It provides a
means to collate information on the
large number of new methods and
tools emerging from E.U. and
national research programmes, and
can be used to support research
into urban sustainability
assessment, assisting the selection
and application of assessment
techniques so as to address
sustainable urban development
issues in a pragmatic integrated
fashion.

Guidelines for
of the Bequ

Paolo Ron

The Bequest
information
research group
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the Sustainable
The toolkit is
modules: '
'Protocol', '
integrated by
toolkit is
page of the
surveying
clicking on
the index
different
options
After the first page,
the homepage of the
two different
visualized:
– a index menu, located
middle of the
provides the
for a correct
the potential
– a main menu, emphasized by a
blue bar located on the top of the
screen, reports the four
of the system ('Assessment methods',
'Protocol', 'Advisor' and 'Glossary')
and the decision matrix 'Frame-
work'. The menu is constantly
visible on the screen.
Within this menu, the 'Text Map'
option provides information on the
use of the system and the modules;
by clicking on the text map it is
possible to directly enter the main
informative and search options
available.
The menus satisfy two different
approaches: the first, an information
system, it helps the users to use the
system for the first time and to
understand the approach adopted
by the Bequest to deal with the
problem of Sustainable urban
development; the second, as
operative system, it helps the more
expert users to navigate into the
system and to use the available
tools.
The informative options of the
central menu are started up by
means of the special text-links and
enable the system to visualize:
– the aim of the toolkit and the
description of the Modules which
are included (menu: What the
Toolkit Does);
– graphic representation of the
toolkit (menu: Software System
Map) and the modules; the user can
directly enter to the different
modules and the available options
by clicking the relative pictures.
– synthetic information how to

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Developing Sustainable Communities in Edinburgh's South East Wedge: The Settlement Model and Design Solution

MARK DEAKIN

ABSTRACT *Sustainable communities are seen as offering the opportunity to manage growth in plan-led and environmentally friendly patterns of settlement. The settlement model put forward and design solution for the development of sustainable communities in the South East Wedge of Edinburgh is examined. It is suggested that while the growth management strategy is clearly plan led, the degree to which the settlement model can be said to be environmentally friendly is questionable. Furthermore, it is suggested this is because the settlement model put forward for the development of sustainable communities in Edinburgh is unable to show whether the design solution advanced is ecologically sound; whether, in particular, the solution is ecologically sound and, because of this, efficient, not only in greening economic development, but also in making it financially viable for plan-led experiments of this kind to produce environmentally friendly patterns of settlement.*

Introduction

The on-going review of structure plans in the United Kingdom has highlighted the attractiveness of new settlements as an alternative to cramming, peripheral expansion and urban sprawl. What follows examines the argument for new settlements appearing in the Written Statement on Lothian's 1994 Structure Plan. It goes on to establish how the experiments going on in Edinburgh's South East Wedge are transforming the new settlement phenomenon into the search for a plan-led, environmentally friendly and sustainable pattern of settlement. It draws attention to the Interim Development Framework put in place to support the plan-led, environmentally friendly experiment and settlement model adopted for such purposes. After making a number of observations on the development of sustainable communities in Edinburgh's South East Wedge, the paper draws some conclusions on the nature of the experiment.

Previous papers on the subject have looked at the model and design solution put forward for the plan-led development in question (Deakin, 2000, 2002). This paper examines the 'environmental-friendly' nature of the settlement pattern the plan puts forward for the development of sustainable communities. It draws attention to the strategic issues the plan has sought to address during the first 5 years of development (1995–2000) and highlights the questions these raise

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about the environmentally friendly nature of the settlement pattern the model advances as a design solution. This in done in the interests of exposing the limitations of such 'state-of-the art' models and drawing attention to the outstanding matters their design solutions still need to address in developing sustainable communities.

The Written Statement

The 1994 Written Statement on the Lothian Structure Plan Review states: "the development of Edinburgh can no longer be accommodated within the existing boundaries of the City" (Lothian Regional Council, 1994, p. 14). The "cramming of development in brown field sites is no longer an option for Edinburgh"; neither is development by peripheral expansion around the edge of the city's green belt seen as a viable option. This is because there are "simply not enough brown field sites to develop in Edinburgh and peripheral expansion around the edge of the City would put too much pressure on the greenbelt and result in urban sprawl" (p. 14). The solution, the statement suggests, rests with the development of new settlements an in particular with the "development of new settlements on a 1,600 hectare site at the periphery of Edinburgh and in an area of the City's greenbelt known as the South East Wedge" (p. 15).

As an exercise in the management of growth, the statement suggests that plan-led experiments of this kind can protect the environment and the proposal to "develop new settlements in the South East Wedge of Edinburgh, provides the City with just such an opportunity" (p. 15). The reasons put forward to explain why the development provides such an opportunity are as follows:

- representing less than 10% of the green belt, the site has the capacity to accommodate 35% of Edinburgh's land-use requirements, 60% of the city's population growth, 15% of additional households and 30% of future employment opportunities;
- the site is able to carry such a level of growth due to spare capacity in both the utility and transportation networks and because it is already well serviced with out-of-town shopping centres, retail and warehouse parks, leisure and entertainment facilities;
- in releasing pressure for speculative development around the edge of the city and protecting the green belt, the site provides the opportunity for Edinburgh to make sure the use of land, utilities, transportation networks and both retail and leisure services is environmentally friendly and fosters a more sustainable pattern of settlement.

The New Settlement Phenomenon

It is noticeable that the proposal to develop new settlements in Edinburgh's South East Wedge goes a long way to avoid the difficulties experienced by many of its predecessors (Ward, 1992). As Ward (1992) establishes, with the privatization of the New Towns Commission, private consortiums have sought to develop new settlements. It is a development that Glasson *et al.* (1994) also examine. Their research shows that during the review of structure plans carried out between 1988 and 1993, 46 new settlement proposals had been submitted to local authorities, and in taking the form of urban villages only two developments were successful in receiving outline planning consent. As Ratcliff and Stubbs' observations also serve to point out (Ratcliff & Stubbs, 1996), while the tight fiscal regime local governments operated under during this period made the development of such settlements an attractive proposition, they were seen as being too speculative, not supported by the planning system and of limited environmental value.

By comparison, it is noticeable that the proposal to develop sustainable communities in the South East Wedge of Edinburgh is not only supported by a written statement, but is an experiment which also has the advantage of being plan-led and environmentally friendly. While going a long way to distinguish the development of new settlements in Edinburgh from previous experiments of this type, it is not these qualities that mark it out from its predecessors. As a more advanced experiment in the modelling of alternatives to peripheral expansion and urban sprawl, the qualities that distinguish this design proposal from its predecessors lie elsewhere. They are seen to lie with the advantages that urban extensions of this kind have to be not only plan led and environmentally friendly, but also able to produce a pattern of settlement which is sustainable.

The Settlement Model and Design Solution

The settlement model the document puts forward as a design solution appears under the heading of 'sustainable communities'. Under this heading attention is drawn to the principles of sustainable development and the qualities that the document argues such settlements should be based on. Modelling the development of sustainable communities, the document proposes that Edinburgh's experiment should be based on the following:

- a distinctive urban culture;
- a spatially compact form;
- a strong landscape framework in a countryside setting;
- a set of neighbourhoods;
- a high density of population;
- a balance of land use, economic and social structures;
- an energy-conscious public transportation network;
- high levels of infrastructure and shared service provision;
- a pattern of settlement that is able to integrate existing communities with those emerging from the development;
- a financial structure that is viable in the short-, medium- and long-term horizons.

These design features reflect the findings of Breheny (1992a,b; 1995), Breheny & Rookwood (1993) and Breheny *et al.* (1993) in studies of settlements models in the UK. The settlement model also draws attention to the experiences of sustainable developments from a number of UK cities—the experiences of Cambridge, Portsmouth and Swindon, reported on by Selman (1996) and Brown (1998) in particular. Hall and Ward's examination of such models also draws particular attention to the particularly tight fiscal regime regulating expenditure on the infrastructures forming the mainstay of the design solutions (Hall & Ward, 1998). Similar examinations are provided by Roberts *et al.* (1999) and the Urban Task Force (1999).

What these examinations all have in common is their tendency to represent the models and design solutions they in turn advance as prototypes for the development of sustainable communities. In Edinburgh the plan-led experiment focuses on the development of sustainable communities in the city's South East Wedge and defines the qualities of the settlement model and design solution it advances in terms of the following six key features.

Distinctive Urban Culture

Within the settlement model the proposal to design a distinctive urban culture is of general concern. This is defined as an alternative to the suburban lifestyle, with its particular brand of resource-intensive consumerism, linked to demands for expansion into the periphery through the speculative development of greenfield sites—the speculative development of greenfield sites that results in the coalescence of settlements around the edge of the city and which in turn leads to the break-up of communities.

Spatially Compact Form, Strong Landscape Framework and Countryside Setting

The settlement model proposes that such an unfortunate outcome can be avoided by restricting development around the edge of the city and concentrating it in a spatially compact form. The design solution allows for the development to build out from existing peripheral housing estates and a former mining village. Set in a strong landscape framework, the model goes on to propose that the countryside setting should make use of natural features, woodlands and country parks, to separate the existing and new settlements from one another. The model also proposes an urban regeneration programme and limited town-centre expansion for the former mining village, so as to retain its identity and position in the settlement pattern.

Neighbourhoods, High Population Densities and Balanced Land Uses

Elsewhere, it is proposed that up to 20 000 people should be accommodated within three new settlements. The model also proposes these should be designed as neighbourhoods of approximately 5000 residents. The model allows for the neighbourhoods to have a high population density (forecast to be between 50 and 200 persons per hectare) and a balanced set of land uses, comprising residential, commercial (light industrial, business, warehouse and distribution and retail) and community services (transportation, recreational, education and health). The design also allows for each neighbourhood to have a balanced (low-, middle- and upper-income) economic and social structure, set in a diverse mix of tenure, i.e. in a mix of owner-occupied, private and social rented accommodation, which is available at affordable rates of occupation.

Living and Working Environment

In the interests of providing a 'high-quality working and living environment', the model allows for the development to have an energy-conscious transportation system. It suggests the transportation system should incorporate a number of measures; for example: a public transport corridor, bus priority proposal, park and ride system and traffic calming scheme. It also suggests that some of the neighbourhoods should be car free and that residents should be within easy walking distance of public transport facilities.

Infrastructure Requirements

The infrastructure requirements are considerable. They include land consolidation works, sites and service provision, transportation, recreation, education and health provision. In view of this, the model proposes that the transportation, recreation, education and health services should be shared between the peripheral housing estate, former mining village and neighbourhoods forming the settlement pattern it puts forward for the development of sustainable communities. This is because the neighbourhoods emerging from the development will not be able to provide the employment, recreational, education, health or retail services needed to support the high-quality working and living environment the model suggests is needed for the development of sustainable communities. It is this sharing of the infrastructure and service provision that is seen to represent the key factor integrating the peripheral housing estate, former mining village and neighbourhoods into a settlement pattern which is sustainable. This is because the regenerated peripheral housing estate, expanded former mining village and neighbourhoods need to have access to, share and co-operate in providing the infrastructures and services required, but do so in a way which allows the high-quality living and working environments which result to resist the pressure for any subsequent infill development.

Financial Viability

The financial viability issue tackles particular difficulties associated with the geology of the site and the high level of both infrastructure and service provision needed for the settlement pattern to develop. Given the abnormal preparation costs, high infrastructure and service content, the framework sets out what the development will yield in the form of land receipts. The cash flows making up these land receipts are analysed over the short-, medium- and long-term horizons and discounted at the opportunity cost of capital. The income takes the form of receipts from the sale of sites making up the mixed set of land uses (residential, light industrial and retail). The income represents the development value of the sites with planning permission. The costs include the purchase of land at existing use value (i.e. without the development proposal) and capital expenditure on the infrastructures required to service the sites. The existing use value is taken to represent the sum of agricultural and 'hope value'. The capital expenditure represents the cost of site preparation and providing the recreation, education, health and public transportation networks. The discounted cash-flow analysis supporting the appraisal illustrates that the project should yield an 11% internal rate of return (i.e. surplus of income over cost of development). The details of this discounted cash-flow analysis are documented in the Interim Development Framework (IDF) (see Chesterton Consulting, 1996).

As a development appraisal, the exercise follows the guidelines set out in the Department of the Environment (DoE) publication *Policy Appraisal and the Environment* (DoE, 1991). It also makes use of the DoE's document *Making Markets Work for the Environment* (DoE, 1993b) and a publication from the Local Government Management Board (LGMB) on *Greening Economic Development*

(LGMB, 1994). Drawing upon these sources, a number of economic instruments (for example, cash-flow analysis, discounting procedures and cost–benefit analysis techniques) are made use of in order to establish whether the quality of the working and living environments making up the development produce enough planning gain for the land market to fund the infrastructure services upon which the settlement pattern is based and the sustainable communities are seen to rest.

The Environmentally Friendly Nature

The immediate difficulties faced in trying to establish the development's environmentally friendly nature rest with the effective absence of the data needed for such an assessment. This is because of the following:

- despite drawing upon the DoE's Planning Research Programme (DoE, 1993a,b, 1994) and using National Planning Policy Guideline (NPPG) 1 (Scottish Office, 1994) to guide the on-going review of the structure plan, strategic environmental assessment and appraisal of how to manage growth, the IDF document provides very little evidence to support the claim that the plan-led development produces an environmentally friendly settlement pattern;
- while placing a great deal of emphasis on the capacity the site has to carry a distinctive urban culture in spatially compact forms, set within strong landscape frameworks and countryside settings, the model and the design solution it puts forward offer no formal assessment of its ecological footprint, biodiversity, or natural capital.

In their current form, the model and the design solution are vulnerable to many of the criticisms that Glasson *et al.* (1994) and Ratcliff & Stubbs (1996) have previously made regarding the new settlement phenomena and the sometimes less than friendly way in which plan-led developments of this kind treat the environment. These criticisms are also echoed by Lichfield (1996). The criticisms suggest that little has been learnt about the environmental values of the urban culture, spatially compact forms, strong landscape framework and countryside setting the model sets out, or how these in turn lead to a position where the population densities, socio-economic structures, energy-conscious public transport, high levels of both infrastructure and service provision advance a design solution which is efficient in greening economic development (also see Beatley, 1995; Campbell, 1996; Gibbs *et al.*, 1996; Cosgriff & Steinmann, 1998).

Little More than an Aesthetic?

Set against the said criticism of such models and the design solutions they advance, the environmentally friendly nature of the settlement pattern might be seen to add up to little more than an aesthetic—an aesthetic about the value of distinctive urban cultures, spatially compact forms and strong landscape frameworks in countryside settings. An aesthetic about—in this instance—the value of distinctive urban cultures, spatially compact forms and strong landscape frameworks, whose countryside settings have the population densities, land uses, socio-economic structures and public transportation systems forming the infrastructures needed to service high-quality living and working environments.

The Value of This Aesthetic

The value of this aesthetic may be seen to lie in the abilities it has to develop high-quality living environments that are 'friendly'. If this is where the value of the aesthetic is seen to lie, then both its limitations and its shortcomings need to be recognized. This is because in its current form it is not possible to say whether the high-quality environments appearing in the model are friendly because they are ecologically sound, or because the design solution allows the land market to produce the level of planning gain needed to be efficient in greening economic development.

The Limitations and Shortcomings

Asking whether the high-quality living environments are friendly because they are ecologically sound or efficient in greening economic development is instructive because it exposes the limitations of the model and the shortcomings of the design solution the aesthetic rests upon. It reveals that the limitations of the model rest with the inability of the design solution to illustrate whether the high-quality living environments are friendly because they are ecologically sound. It also goes a long way to contrast this shortcoming against the considerable lengths the model goes to in order for the design solution to show how the land market produces the level of planning gain needed to efficiently green the economic development in question.

Ecologically Sound and Efficient?

The question that remains unanswered is where the true value of the aesthetic lies—whether it is with the value of models that are ecologically sound, or with the ability of design solutions to efficiently green economic development. Ultimately, the question that remains unanswered is whether it is the former or if it is the latter that has the right to make claims about the environmentally friendly nature of the settlement pattern and the sustainability of the communities which the model and design solution propose to develop.

With the former—even though the model does not raise them—the questions are to do with the site's ecological footprint, biodiversity and environmental loading (Barton *et al.*, 1995). They are to do with environmental values and matters concerning biomass, the levels of energy consumption, waste and emissions. They are questions about levels of energy consumption, waste and emissions, whether the high-quality living and working environments are friendly and if this is because they are ecologically sound (Barton, 1997; Breheny & Archer, 1998; Barton & Kleiner, 2000; Stead, 2000; Guy & Marvin, 2001). With the latter the questions are not to do with the aforesaid, but about the land market and level of planning gain needed to be efficient in greening economic development. They are about the land market, the levels of planning gain needed to efficiently green the economic development and make it financially viable.

The Question of Integration

If such concerns about energy consumption, waste and emissions are seen to be key, then it shows there is a pressing need for these matters to be integrated into

such models. It also illustrates that there is a critical requirement for the design solutions that follow to demonstrate whether they are ecologically sound and, because of this, able to use land markets (and the levels of planning gain they in turn produce) in a manner that is not only efficient in greening economic development, but which also has the effect of making it financially viable to produce an environmentally friendly pattern of settlement. These needs and requirements are pressing, because as soon as a critical distinction is drawn between the environmental values of ecologically sound designs, land markets and the levels of planning gain needed to not only be efficient in greening economic development, but also to make it financially viable, questions arise about the following:

- the science and technologies needed to make the energy consumption, waste and emissions of the high-quality living and working environments friendly;
- how the said technologies provide the infrastructures required for the high-quality living and working environments to be friendly because they are ecologically sound;
- the degree to which it is the science and technologies of the infrastructures and ecologically sound designs, rather than articulation of the said land markets and planning gain, that efficiently green economic development;
- how the science, technologies, infrastructures and ecologically sound designs in turn use the said market and levels of planning gain to efficiently green economic development and make it financially viable;
- how this particular, ecologically sound use of land markets and planning gain is efficient in greening economic development and making it financially viable for experiments of this type to produce environmentally friendly patterns of settlement;
- how this environmentally friendly pattern of settlement is sustainable in terms of the communities that develop from plan-led experiments of this type;
- how the said settlement pattern is sustainable in terms of the relationship the communities in turn have to the city and its surrounding region (Deakin, 2000, 2002).

Against the science and technology of ecologically sound designs, it can be seen that matters concerning the articulation of land markets and planning gain reveal little about where the real issues associated with the transformation of the new settlement phenomenon currently lie. This is because by effectively reducing the environmental values of the settlement model to an aesthetic about the virtues of good design, it is simply not possible to say whether the solution advanced is friendly because of its ecological footprint, biodiversity or natural capital. Nor is it possible to say so in terms of the environmental loading, levels of energy consumption, waste and emissions the settlement pattern produces. As a result, and as ridiculous as it may seem, it is currently not possible to say whether the plan-led experiment is an environmental good or not.

The Outstanding Matter

The matter still outstanding is that of assessing whether plan-led experiments of this kind are environmentally friendly and able to produce a pattern of settlement that is sustainable because it is both ecologically sound and efficient in greening economic development. In meeting this challenge the following matters need to be given particular consideration:

- the terms of reference adopted as a framework to develop the settlement model and the design solution it advances as sustainable communities (Deakin *et al.*, 2001);
- how this framework structures the relationship between the environmental values of the settlement model and the design solution advanced to efficiently green economic development (Bentivegna *et al.*, 2002);
- the protocol(s) adopted to assess the sustainability of the communities undergoing development and evaluate how ecologically sound the settlement model is (Deakin, 2002);
- the environmental assessment methods needed to evaluate the sustainability of the communities and model whether the ecology of the design solution is not only sound, but also efficient in greening economic development (Deakin, 2000, 2002);
- whether this in turn makes it financially viable for plan-led experiments of this kind to produce environmentally friendly patterns of settlement (Deakin *et al.*, 2002a,b);
- the question of what methods should be used in undertaking such an environmental assessment (Deakin *et al.*, 2002a,b).

These considerations are particularly challenging because they demand a shift of attention away from understanding the environment as an aesthetic and towards a knowledge of its status as an ecological system—an ecological system that has a particular set of values which in turn make it possible to measure the environmental loading, levels of energy consumption, waste and emissions, as opposed to the land markets and levels of planning gain needed to be efficient in greening economic development.

In recognizing this, the problem that surfaces is over the methods adopted to carry out such an environmental assessment. This task is particularly difficult because there are two classes of environmental assessment methods: those providing environmental valuations and those assessing the sustainability of development. With the former it is important to recognize that this class of methods provides an index of the problems that have been experienced when the environment is reduced to little more than an aesthetic and not represented as an ecological system (Deakin *et al.*, 2002a,b). With the latter the emphasis is firmly upon assessing the environment as an ecosystem logically connected to the economy. This requires a systematic modelling of the relationship between the ecology of design solutions and their economic structures. This in turn requires that the models and design solutions advanced are themselves subjected to an environmental assessment, capable in this instance of evaluating whether the ecology of the model is sound and if the resulting design solution is efficient in greening economic development.

At present very few such models exist, and their design solutions tend to be citywide rather than district or neighbourhood based. However, those that can be made use of include the following:

- the Net Annual Return (NAR) model;
- the eco-neigbourhood model;
- the transit-orientated settlement model.

These models illustrate a strong environmental inheritance and constitute serious attempts to assess the sustainability of communities in terms of their ecosystems and underlying economic structures.

The NAR model provides a critique of the discounting mechanism underlying the greening of economic development (Deakin, 1996, 1997, 1999). It offers an environmental assessment of the impact this has upon the ecosystem and provides a model of how the discounting mechanism can be rehabilitated to provide a design solution producing the levels of planning gain needed to make any greening of economic development financially viable (Deakin, 2000, 2002). The eco-neighbourhood model focuses on assessing the ecological footprint, biodiversity and natural capital in terms of the environmental loading, levels of energy consumption, waste and emissions this greening of economic development produces (Barton & Kleiner, 2000; Stead, 2000; Deakin *et al.*, 2002a,b). The transit-oriented settlement model provides a design solution which assesses whether eco-neighbourhoods have the environmental loading, levels of energy consumption, waste and emissions that are friendly because of the infrastructures required to service such high-quality living and working environments, have the land markets and levels of planning gain needed to be efficient in greening economic development and make such a course of action financially viable (Calthorpe, 2001).

The value of approaching the matter as an assessment rests with the potential such exercises have to evaluate the environmentally friendly nature of settlement patterns in terms of whether their sustainability develops in terms of the ecological, economic and financial qualities needed to guard communities against changes which are seen to threaten them—in particular, the coalescence of settlements, loss of identity and break-up of communities resulting from the type of infill development traditionally associated with peripheral expansion.

Conclusion

This paper has reviewed a plan-led experiment aimed at developing sustainable communities and has found the 'state-of-the-art' settlement model put forward for such purposes wanting. The review has also found that in its current form the model is unable to tell us whether the high-quality living and working environments which the design advances are ecologically sound.

The paper has also suggested that asking whether the high-quality living and working environments are friendly because they are ecologically sound, or if this is because the land market produces enough planning gain to be efficient in greening economic development, exposes the limitations of the model and the shortcomings of the design solution it puts forward. It has gone on to suggest that, in its current form, the model is limited because the design solution it advances is not able to say whether the high-quality living and working environments in question are ecologically sound, only if the land market produces the level of planning gain needed to efficiently green economic development and make it financially viable.

As the discussions have gone some way to point out, the challenge which remains outstanding is that of establishing whether models of this kind, and the type of design solution they advance, are able to represent the environment as an ecosystem and something more than an aesthetic for greening economic development. To meet this challenge, the paper has looked at the environmental

assessment methods that can be made use of to overcome the problems which are associated with the existing models and the design solutions they currently put forward. In meeting this challenge, the paper has outlined the main elements of the assessment methodology it is possible to adopt for the purposes of evaluating whether such models are ecologically sound and if the design solutions they advance are efficient in greening economic development. Having outlined the assessments in question, the paper has gone on to examine how it is possible to integrate both the ecological and economic dimensions of the said methodology. Here attention has focused on how to integrate such qualities into an assessment methodology that is able to evaluate whether the model adopted is ecologically sound, not only because the design solution advanced is efficient in greening economic development, but also because this makes it financially viable to produce patterns of settlement that are sustainable. The examination has also gone some way to demonstrate, the contribution that integrated assessments of this kind can make is noticeable, because with such a methodology it becomes possible to evaluate not only whether the model is environmentally friendly but also whether the design solution advanced produces a pattern of settlement which is sustainable.

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PRACTICE NOTE

Rebuilding the Urban Structure of the Inner City: A Strategy for the Repair of Downtown Oakland, California

PETER BOSSELMANN & STEFAN PELLEGRINI

ABSTRACT *In a contribution to urban morphological studies, the authors demonstrate how typological and morphological research can be used as a design strategy for the repair of a medium-sized American inner city, Oakland, California. Early typological and morphological research explained how socio-economic processes govern the production of cities and changes to the urban fabric over time. The approach is rooted in the work of M.R.G. Conzen from the early 1900s in Berlin, at a time when he and other geographers tested a morphological approach to the study of urban settlements. Architects and urban designers, chiefly in Italy, have been influenced by this approach and have used 'typomorphological' studies. In much of the literature on urban morphology the city is analysed as a product of history, as traces of the past are inescapably ingrained in the dynamics of urban environments. This article traces the history of Oakland from its beginnings in the 1850s. Morphological studies, combined with research on urban form, are used to describe potential future conditions of the inner city where overlapping and interlocking uses could make for liveable, potentially safe urban places. This approach is not new. Jane Jacobs wrote about urban vitality as early as 1961, but there is still no comprehensive text that explicitly introduces the design practitioner to the growing data on urban form and urban form making that have been generated by research in typology and morphology. Gaps in knowledge about density, centrality, mix of uses, urban ecology, city culture and the all encompassing term, urbanity, are admitted; a reminder is given of the issues urban designers are expected to address in the context of repairing cities, and that much data still needs to be compiled. The subject matter is complex; there might never be a state of completion, but that conclusion should not prevent urban designers from conducting more research on the subject of urban form.*

Introduction

American cities have struggled to maintain the centrality of their downtown areas. As retail and office uses have continued to move into suburban areas and outlying regions, many local governments—especially those of smaller and medium-sized cities—have all but given up on the prospect of replacing the commercial vitality once found in many city centres. The ability to attract a

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DEVELOPING SUSTAINABLE COMMUNITIES: THE SETTLEMENT MODEL, DESIGN SOLUTION AND MATTER OF ENVIRONMENTAL ASSESSMENT

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Sustainable communities are seen as offering the opportunity to manage growth in plan-led and environmentally friendly patterns of settlement. This paper examines the settlement model put forward for the development of sustainable communities in the United Kingdom and shows that while in Scotland, the growth management strategy is clearly plan-led, the degree to which the design solution can be seen to be environmentally friendly is questionable. The paper suggests this is because in its current form, the model is not able to show whether the design solution advanced is ecologically sound. Whether, in particular, the solution is ecologically sound and because of this, not only efficient in greening economic development, but in also making it financially viable for plan-led experiments of this kind to produce environmentally friendly patterns of settlement.

Keywords: Sustainable communities; environmentally friendly settlement patterns; models; design solutions; ecology; efficiency; economic development; financial viability; assessment methodology.

Introduction

The on-going review of structure plans in the United Kingdom has highlighted the attractiveness of new settlement developments as an alternative to cramming, peripheral expansion and urban sprawl. What follows examines the arguments for new settlements that appear in the United Kingdom (England, Wales and Scotland) and how in Edinburgh the phenomenon is being transformed into the

search for plan-led environmentally friendly patterns of settlement which are sustainable. Taking the form of a case-study, the paper examines the transformation of the new settlement phenomenon that is currently going on in the South East Wedge of Edinburgh. Under the heading of *developing sustainable communities*, the paper examines *the settlement model and design solution* advanced by the City for a plan-led, environmentally friendly pattern of settlement in the South East Wedge. After examining the settlement model and design solution the City advances, the paper goes on to raise some questions about the environmentally friendly nature of the settlement pattern for the development for sustainable communities in the South East Wedge.

The paper finds that while the proposals put forward by the City for the development of sustainable communities in the South East Wedge of Edinburgh are clearly plan-led, the degree to which the they can be seen to be environmentally friendly and form a sustainable pattern of settlement is less obvious. This, the paper argues, is because in reducing the environment to an aesthetic, it is not clear whether the pattern of settlement has the ecologically-sound, economically efficient and financially viable qualities needed to sustain the communities undergoing development. After presenting these findings, the paper goes on to examine how it is possible to represent the environment as something more than an aesthetic and integrate the said ecological, economic and financial qualities in a pattern of settlement that is sustainable in terms of the communities which develop. In going on to address this issue, the paper turns attention to *the matter of environmental assessment*. Here the environmental assessment methodology needed to integrate such qualities is outlined. This examination draws attention to the methodology needed to integrate the ecological, economic and financial qualities of the settlement pattern in question and evaluate the sustainability of the communities undergoing development.

Previous papers on the subject have looked at the settlement model and design solution put forward for the plan-led experiment (Deakin, 2000, 2002, 2003). This paper examines the "environmental-friendly" nature of the settlement pattern put forward by the City and advanced for the development of sustainable communities in the South East Wedge of Edinburgh. This examination focuses attention to the strategic issues the plan-led experiment has sought to address during the first five years of development (1995–2000) and highlights the questions this raises about the environmentally friendly nature of the settlement pattern for the development of sustainable communities. This in done in the interests of exposing the limitations of such "state-of-the art" settlement models and drawing attention to the shortcomings of their design solutions. The limitations and shortcomings that in turn raise particular questions about the way in which

plan-led experiments of this kind not only assess the environmentally friendly nature of the settlement patterns they promote, but evaluate the sustainability of the communities they also seek to develop.

It should be noted that the examination is drawn from discussions taking place on the new settlement phenomenon, settlement models, design solutions and environmental assessment methodology going on in text books and journal publications. The case-study material forming the main body of the paper, is drawn from the 1994 Lothian Structure Plan Review document and 1996 Interim Development Framework commissioned by Edinburgh as the settlement model and design solution for the proposal.

The New Settlement Phenomenon

As Ward's (1992) review of new settlements in the United Kingdom establishes, with the privatisation of the New Towns Commission, private consortiums have sought to develop new settlements as an alternative to peripheral expansion and urban sprawl. It is a development Glasson *et al.* (1994) also examine. Their research shows that during the review of structure plans, carried out between 1988–93, 46 new settlement proposals had been submitted to planning authorities throughout the England and Wales and out of this only two developments were successful in receiving outline planning consent. As Ratcliff and Stubbs (1996) also note, while the tight fiscal regime local governments operating during this period made the development of new settlements by private consortiums attractive, they were too speculative, not supported by the planning system and unable to allay fears the public had about their impact on the environment.

In Scotland the new settlement phenomenon is a matter that has found its way into the statutory planning system and review of the structure plan for the City of Edinburgh (see Fig. 1). In respect of this review, the 1994 Structure Plan states: "the development of Edinburgh can no longer be accommodated within the existing boundaries of the City". The "cramming of development in brown field sites is no longer an option for Edinburgh", neither is development by peripheral expansion around the edge of the City's greenbelt seen as a viable option. This is because there are "simply not enough brown field sites to develop in Edinburgh and peripheral expansion around the edge of the City would put too much pressure on the greenbelt and result in urban sprawl" (p. 14). The solution, the statement suggests, rests with the development of new settlements and in particular with the "development of new settlements on a 1,600 hectare site at the periphery of Edinburgh and in an area of the City's greenbelt known as the South East Wedge" (p. 15).

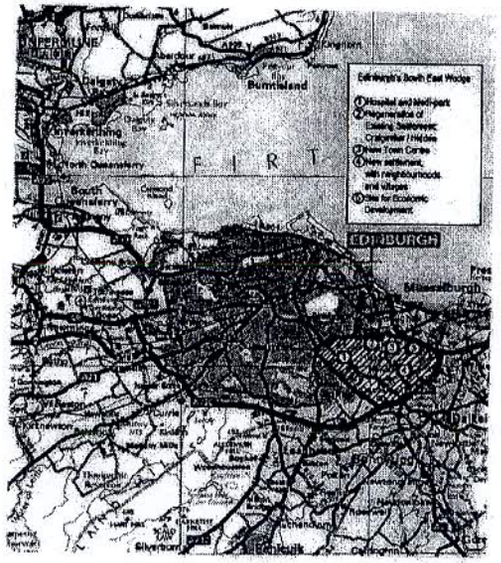

Fig. 1. Edinburgh's South East Wedge.

New Settlements in Edinburgh's South East Wedge

As an exercise in the management of growth, the statement suggests that plan-led experiments of this kind can protect the environment and the proposal to "develop new settlements in the South East Wedge of Edinburgh, provides the City with just such an opportunity" (p. 15). The reasons put forward to explain why the development provides such an opportunity are as follow:

- representing less than 10% of the greenbelt, the site has the capacity to accommodate 35% of Edinburgh's land use requirements, 60% of the City's population growth, 15% of additional households and 30% of future employment opportunities;

- the site is able to carry such a level of growth due to spare capacity in both the utility and transportation networks and because it is already well serviced with out-of-town shopping centres, retail and warehouse parks, leisure and entertainment facilities;
- in releasing pressure for speculative development around the edge of the City and protecting the greenbelt, the site provides the opportunity for Edinburgh to make sure the use of land, utilities, transportation networks and both retail and leisure services, is environmentally friendly and fosters a sustainable pattern of settlement.

It is noticeable that the proposal to develop new settlements in Edinburgh's South East Wedge goes a long way to avoid the difficulties experienced by many of its predecessors.

In comparison with the experiences of new settlements in England and Wales, it is noticeable that the proposal to develop sustainable communities in the South East Wedge of Edinburgh is not only supported by a written statement, but is an experiment which also has the advantage of being plan-led and environmentally friendly. While going a long way to distinguish the development of new settlements in Edinburgh from previous experiments of this type, it is not these qualities that mark it out from its predecessors. As a more advanced experiment in the modelling of alternatives to peripheral expansion and urban sprawl, the qualities that distinguish this proposal from its predecessors lie elsewhere. They lie in the advantages it has of being not only plan-led and environmentally friendly, but able to produce a pattern of settlement which is also sustainable in terms of the communities it develops.

Developing Sustainable Communities

The search for a pattern of settlement that is sustainable in terms of the communities it develops, is a matter the 1996 Interim Development Framework addresses (Chesterton, 1996). The settlement model the document puts forward as a design solution appears under the heading of "sustainable communities" (see Fig. 2). Under this heading attention is drawn to the principles of sustainable development which the document argues such settlements should be based upon.

Modelling the development of sustainable communities, the document proposes that Edinburgh's experiment in managing growth through plan-led, environmentally friendly patterns of settlement in the South East Wedge, should be based on the following:

- a distinctive urban culture;
- a spatially compact form;

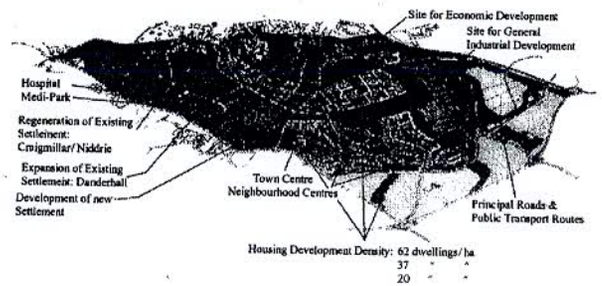

Fig. 2. The settlement model and design solution.

- a strong landscape framework in a countryside setting;
- a set of neighbourhoods;
- a high density of population;
- a balance of land use, economic and social structures;
- an energy conscious public transportation network;
- high levels of infrastructure and shared service provision;
- a pattern of settlement that is able to integrate existing communities with those emerging from the development and;
- a financial structure that is viable in the short, medium and long term horizon.

These design features reflect the findings of Breheny (1992a, 1992b, 1995), Breheny and Rookwood (1993) and Breheny *et al.*'s (1993) study of settlements models in the UK. The settlement model and design solution also draw attention to the experiences of sustainable developments from a number of UK cities. The experiences Cambridge, Portsmouth and Swindon are reported on by Selman (1996) and Brown, (1998). Hall and Ward's (1998) examination of such developments draw particular attention to the fiscal regimes regulating the infrastructures needed to service the settlement's high quality living and working environments. Similar examinations are also provided by Roberts *et al.* (1999) and the Urban Task Force (1999).

What these examinations all have in common is their tendency to represent their settlement models and design solutions as prototypes for the development of sustainable communities.

The Settlement Model and Design Solution

In Edinburgh the plan-led experiment focuses on the development of sustainable communities in the City's South East Wedge and defines the qualities of the settlement model and design solution it advances. They are defined in terms of the following six key features.

Distinctive urban culture

Within the settlement model the proposal to design a distinctive urban culture is of general concern. This is defined as an alternative to the suburban lifestyle with its particular brand of resource intensive consumerism, linked to demands for expansion into the periphery through the speculative development of green field sites. The speculative development of green field sites that results in the coalescence of settlements around the edge of the city and which leads to the break up of communities.

Spatially-compact form, strong landscape framework and countryside setting

The settlement model proposes that such an outcome can be avoided by restricting development around the edge of the city and concentrating it in a spatially-compact form. The design solution allows for the development to build from existing peripheral housing estates and a former mining village. Set in a strong landscape framework, the model goes on to propose the countryside setting should make use of natural features, woodlands and country parks, to separate the existing and new settlements from one another. The model also proposes an urban regeneration programme and limited town centre expansion for the former mining village, so as to retain its identity and position in the settlement pattern.

Neighbourhoods, high population densities and balanced land uses

Elsewhere, it is proposed that up to 20,000 people should be accommodated within three new settlements. The model also proposed these should be designed as neighbourhoods of approximately 5,000 residents. The model allows for the neighbourhoods to have a high population density (forecast to be between 50 and 200 persons per hectare) and a balanced set of land uses, comprising residential, commercial (light industrial, business, warehouse and distribution and retail) and community services (transportation, recreational, education and health). The design also allows for each neighbourhood to have a balanced (low, middle and upper income) economic and social structure in a diverse structure of tenure. That is

to say, in a mix of owner-occupied, private and social rented accommodation at affordable rates of occupation.

Living and working environment

In the interests of providing a "high quality working and living environment", the model allows for the development to have an energy conscious transportation system. It suggests the transportation system should incorporate a number of measures: for example, a public transport corridor, bus priority proposal, park and ride system and traffic calming scheme. It also suggests that some of the neighbourhoods should be car free and that residents should to be within easy walking distance of public transport facilities.

Infrastructure requirements

The infrastructure requirements are considerable. They include land consolidation works, sites and service provision, transportation, recreation, education and health provision. In view of this, the model proposes the transportation, recreation, education and health services should be shared between the peripheral housing estate, former mining village and neighbourhoods forming the settlement pattern it puts forward for the development of sustainable communities. This is because the neighbourhoods emerging from the development will not be able to provide either the employment, recreational, education, health or retail services needed to support the high quality working and living environment the model suggests is needed for the development of sustainable communities. It is this sharing of the infrastructure and service provision that is seen to represent the key factor integrating the peripheral housing estate, former mining village and neighbourhoods into a settlement pattern which is sustainable.

Financial viability

The financial viability issue tackles particular difficulties associated with the geology of the site and high level of both infrastructure and service provision needed for the settlement pattern to develop. Given the abnormal preparation costs, high infrastructure and service content, the framework sets out what the development will yield in the form of land receipts. The cash flows making up these land receipts are analysed over the short, medium and long term horizons and discounted at the opportunity cost of capital. The income takes the form of receipts from the sale of sites making up the mixed set of land uses (residential,

light industrial and retail). The income represents the development value of the sites with planning permission. The costs include the purchase of land at existing use value (i.e., without the development proposal) and capital expenditure on the infrastructures required to service the sites. The existing use value is taken to represent the sum of agricultural and "hope value". The capital expenditure represents the cost of site preparation and providing the recreation, education, health and public transportation networks. The discounted cash flow analysis supporting the appraisal illustrates the project should yield a 11% internal rate of return (i.e., surplus of income over cost of development). The details of this discounted cash flow analysis are documented in the Interim Development Framework (see Chesterton, 1996).

As a development appraisal, the exercise follows the guidelines set out in the DOE's (1991) publication on *Policy Appraisal and the Environment*. It also makes use of DOE's (1993) document on *Making Markets Work for the Environment* and publication from the Local Government Management Board (1994) on *Greening Economic Development*. Drawing upon these sources a number of economic instruments: for example, cash flow analysis, discounting procedures and cost benefit analysis techniques, are made use of to establish whether the quality of the working and living environments making up the development, produce enough planning gain for the land market to fund the infrastructure services upon which the settlement pattern is based and the sustainable communities are seen to rest.

The environmentally friendly nature

The immediate difficulties faced in trying to establish the development's environmentally friendly nature, rest with the effective absence of the data needed for such an assessment. This is because:

- despite drawing upon the DOE's Planning Research Programme (DOE, 1993, 1993a, 1994) and using NPPG 1 (Scottish Office, 1994) to guide the on-going review of the structure plan, strategic environmental assessment and appraisal of how to manage growth, the IDF document provides very little evidence to support the claim that the plan-led development produces an environmentally friendly settlement pattern;
- while placing a great deal of emphasis on the capacity the site has to carry a distinctive urban culture in spatially compact forms, set within strong landscape frameworks and countryside settings, the model and design solution it puts forward offers no formal assessment of its ecological footprint, bio-diversity, or natural capital.

In its current form the model and design solution it puts forward, is vulnerable to many of the criticisms Glasson *et al.* (1994) and Ratcliff and Stubbs (1996), have previously made about the new settlement phenomena and the sometimes less than friendly way which plan-led developments of this kind treat the environment. These criticisms are also echoed by Lichfield (1996). The criticisms suggest that little has been learnt about the environmental values of the urban culture, spatially compact forms, strong landscape framework and countryside setting the model sets out, or how this in turn leads to a position where the population densities, socio-economic structures, energy conscious public transport, high levels of both infrastructure and service provision, advance a design solution which is efficient in greening economic development. (also see Beatley, 1995; Campbell, 1996; Gibbs *et al.*, 1996; Cosgriff & Steinmann, 1998).

Little more than an aesthetic?

Set against the said criticism of such models and the design solutions they advance, the environmentally friendly nature of the settlement pattern might be seen to add up to little more than an aesthetic. An aesthetic about the value of distinctive urban cultures, spatially compact forms and strong landscape frameworks in country side settings. About — in this instance — the value of distinctive urban cultures, spatially compact forms and strong landscape frameworks, whose country-side settings have the population densities, land uses, socio-economic structures and public transportation systems forming the infrastructures needed to service high quality living and working environments.

The value of this aesthetic

The value of this aesthetic may be seen to lie in the abilities it has to develop high quality living environments which are "friendly". If this is where the value of the aesthetic is seen to lie, then both its limitations and shortcomings need to be recognised. This is because in its current form it is not possible to say whether the high quality environments appearing in the model are friendly because they are ecologically sound, or because the design solution allows the land market to produce the level of planning gain needed to be efficient in greening economic development.

The limitations and shortcomings

Asking whether the high quality living environments are friendly because they are ecologically sound, or efficient in greening economic development is instructive

because it exposes the limitations of the model and shortcomings of the design solution the aesthetic rests upon. It reveals that the limitations of the model rest with the inability of the design solution to illustrate whether the high quality living environments are friendly because they are ecologically sound. It also goes a long way to contrast this shortcoming against the considerable lengths the model goes to in order for the design solution to show how the land market produces the level of planning gain needed to efficiently green the economic development in question.

Ecologically sound and efficient?

The question that remains unanswered is where the true value of the aesthetic lies. Whether it is with the value of models that are ecologically sound, or if it lies with the ability of design solutions to efficiently green economic development. Ultimately, the question that remains unanswered is whether it is the former, or if it is the latter that has the right to make claims about the environmentally friendly nature of the settlement pattern and sustainability of the communities which the model and design solution propose to develop.

With the former — even though the model does not raise them — the questions are to do with the site's ecological footprint, bio-diversity and environmental loading (Barton *et al.*, 1995). They are to do with environmental values and matters concerning bio-mass, the levels of energy consumption, waste and emissions. They are questions about levels of energy consumption, waste and emissions, whether the high quality living and working environments are friendly and if this is because they are ecologically sound (Barton, 1997; Breheny & Archer, 1998; Stead, 2000; Barton & Kleiner, 2000; Guy & Marvin, 2001). With the latter the questions are not to do with the aforesaid, but concern the land market and level of planning gain needed to be efficient in greening economic development. They are about the land market, the levels of planning gain needed to efficiently green the economic development and make it financially viable.

The question of integration

If such concerns about energy consumption, waste and emissions are seen to be key, then it shows there is a pressing need for these matters to be integrated into such models. It also illustrates there is a critical requirement for the designs which follow to demonstrate whether they are ecologically sound. Whether they are ecologically sound and because of this able to use land markets (and the levels of planning gain they in turn produce) in a manner that is not only efficient in greening economic development, but which also has the effect of making it

financially viable to produce an environmentally friendly pattern of settlement. These needs and requirements are pressing, because as soon as a critical distinction is drawn between the environmental values of ecologically sound designs, land markets and the levels of planning gain needed to not only be efficient in greening economic development, but make it financially viable, questions arise about:

- the science and technologies needed to make the energy consumption, waste and emissions of the high quality living and working environments friendly;
- how the said technologies provide the infrastructures required for the high quality living and working environments to be friendly because they are ecologically sound;
- the degree to which it is the science and technologies of the infrastructures and ecologically sound designs, rather than articulation of the said land markets and planning gain, that efficiently greens economic development;
- how the science, technologies, infrastructures and ecologically sound designs in turn use the said market and levels of planning gain to efficiently green economic development and make it financially viable;
- how this particular, ecologically sound use of land markets and planning gain, is efficient in greening economic development and making it financially viable for experiments of this type to produce environmentally friendly patterns of settlement;
- how this environmentally friendly pattern of settlement is sustainable in terms of the communities that develop from plan-led experiments of this type;
- how the said settlement pattern is sustainable in terms of the relationship the communities in turn have to the city and its surrounding region (Deakin, 2000; 2002).

Against the science and technology of ecologically-sound designs, it can be seen that matters concerning the articulation of land markets and planning gain reveal little about where the real issues associated with the transformation of the new settlement phenomenon currently lie. This is because by effectively reducing the environmental values of the settlement model to an aesthetic about the virtues of good design, it is simply not possible to say whether the solution advanced is friendly because of its ecological footprint, bio-diversity, or natural capital. Nor is it possible to say so in terms of the environmental loading, levels of energy consumption, waste and emissions the settlement pattern produces.

As a result and as ridiculous as it may seem, it is currently not possible to say whether the plan-led experiment is an environmental good or not. This is because in line with the conventions and traditions built up since the 1980s (under the policy of privatisation, resulting "boosterism" of civic privatism and drive towards the all pervasive marketisation of the public sector), the main point of concern

lies elsewhere (Deakin, 1996; 1997; 1999a). Not so much with plan-led experiments aimed at assessing the ecology, bio-diversity, natural capital and environmental loading of distinctive urban cultures, having spatially compact forms and strong landscaping frameworks in countryside settings, as with the need to provide accountability, value for money, economic, efficiency and effectiveness disclosures (Deakin, 1999b). The accountability, value for money, economic, efficiency and effectiveness disclosures needed for the land market to release the level of planning gain required from the neighbourhoods, population densities, land uses, socio-economic structures and public transportation networks forming the high level of infrastructure and service provision the settlement model puts forward as the design solution.

The Matter of Environmental Assessment

The matter still outstanding is that of assessing whether plan-led experiments of this kind are environmentally friendly and able to produce a pattern of settlement which is sustainable because the model and design solution are both ecologically sound and efficient in greening economic development. In meeting this challenge there are the following matters to consider:

- the terms of reference adopted as a framework to develop the settlement model and design solution it advances as sustainable communities (Deakin *et al.*, 2001);
- how this framework structures the relationship between the environmental values of the settlement model the design solution advanced to efficiently green economic development (Bentivegna *et al.*, 2002);
- the protocol(s) adopted to assess the sustainability of the communities undergoing development and evaluate how ecologically sound the settlement model is (Deakin, 2002);
- the environmental assessments methods needed to evaluate the sustainability of the communities and not only model whether the ecology of the design solution is sound, but efficient in greening economic development (Deakin, 2000; 2002);
- if this in turn makes it financially viable for plan-led experiments of this kind to produce environmentally friendly patterns of settlement (Deakin *et al.*, 2002a; 2002b);
- the question of what methods should be used in undertaking such an environmental assessment (Deakin *et al.*, 2002a, 2002b).

These considerations are particularly challenging because they demand a shift of attention away from understanding the environment as an aesthetic and towards

a knowledge of its status as a ecological system. As an ecological system that has a set of values which in turn make it possible to measure the environmental loading, levels of energy consumption, waste and emissions, as opposed to the land markets and levels of planning gain needed to be efficient in greening economic development.

In recognising this, the problem that surfaces is over the methods adopted to carry out such an environmental assessment. This task is particularly difficult because there are two classes of environmental assessment methods: those providing environmental valuations and those assessing the sustainability of development. With the former it is important to recognise this class of methods provide an index of the problems that have been experienced when the environment is reduced to little more than an aesthetic and not represented as an ecological system (Deakin *et al.*, 2002a; 2002b). With the latter the emphasis is firmly upon assessing the environment as an ecosystem logically connected to the economy. This requires a systematic modelling of the relationship between the ecology of design solutions and their economic structures. This in turn requires that the models and design solutions advanced are themselves subjected to an environmental assessment, capable in this instance of evaluating whether the ecology of the model is sound and if the resulting design solution is efficient in greening economic development.

The assessment methods

At present very few such models exist and their design solutions tend to be city-wide rather than district, or neighbourhood based. However, those that can be made use of include the following:

- the NAR (Net Annual Return) model;
- the eco-neigbourhood model; and
- the transit-orientated settlement model.

These models illustrate a strong environmental inheritance and constitute serious attempts to assess the sustainability of communities in terms of their eco-systems and underlying economic structures (see Table 1).

The NAR model provides a critique of the discounting mechanism underlying the greening of economic development (Deakin, 1996; 1997; 1999). It offers an environmental assessment of the impact this has upon the eco-system and provides a settlement model of how the discounting mechanism can be rehabilitated to provide a design solution producing the levels of planning gain needed to make any greening of economic development financially viable (Deakin, 2000; 2002).

Table 1. The environmental assessment methods, models and attributes.

Model	Attributes		
	Ecological	Economic	Financial
NAR	Critique of discounting mechanism underlying CBA type models and rehabilitation of this particular environmental assessment technique.	Use of land market to release planning gain as a means of support major infrastructure expenditures required to green economic development.	Analysis of return on capital investment in terms of a discounting mechanism adjusted to fund high quality living and working environments.
Eco-neighbourhood model	Assessment of ecological footprint, bio-diversity and natural capital as an evaluation of environmental loading, levels of energy consumption, waste and emissions of settlements.	Resource consumption analysis, costing of infrastructure expenditures.	Consideration of funding mechanisms for repair and maintenance of design solutions as part of a total cost analysis.
Transit-orientated settlement model	Assessment of transport and mobility requirements, interaction with land uses, environmental loading, levels of energy consumption, waste and emissions on settlements.	Growth management strategy for greening economic environment through regulation of transport and mobility and use of design solution to raise environmental standards.	Effect of increased revenues on local budgets and expenditure of tax revenues on public services.

Sources: Deakin (2000, 2002); Stead (2000); Barton (2000) and Calthorpe (2001).

The eco-neigbourhood model focuses on assessing the ecological footprint, bio-diversity and natural capital in terms of the environmental loading, levels of energy consumption, waste and emissions this greening of economic development produces (Stead, 2000; Barton & Kleiner, 2000; Deakin *et al.*, 2002a; 2002b). The transit-orientated settlement model provides a design solution which assesses whether eco-neighbourhoods have the environmental loading, levels of energy consumption, waste and emissions that are friendly because the infrastructures required to service such high quality living and working environments, have the land markets and levels of planning gain needed to be efficient in greening economic development and make such a course of action financially viable (Calthorpe, 2001).

The value of approaching the matter as a question of assessment rests with the potential such exercises have to evaluate the environmentally friendly nature of settlement patterns in terms of whether their sustainability develops in terms of

the ecological, economic and financial qualities needed to guard communities against changes which are seen to threaten them. In particular, the coalescence of settlements, loss of identity and break-up of communities resulting from the type of infill development traditionally associated with peripheral expansion.

The rehabilitation of CBA based environmental assessment methods

While going a long way to rehabilitate CBA based environmental assessment methods and meet the ecological, economic and financial demands of sustainable development, it would be wrong to suggest that the class of methods which are outlined here — the NAR, eco-neighbourhood and transit-orientated settlement models — can be easily applied to the evaluate the communities in question. This is because the assessment of the environmental loading, levels of energy consumption, waste and emissions, greening of economic development and financial viability are highly complex matters and is contingent upon the terms of reference adopted for the development of sustainable communities. This is a contingency that cannot be overlooked because without the vision and foresight needed to scope the right terms of reference, it is not possible for the framework, settlement model, design solution and protocols to integrate the ecological, economic and financial qualities needed to be environmentally friendly and produce patterns of settlement which are sustainable in terms of the communities that in turn develop.

The vision and foresight needed to scope such terms of reference is key because it provides the critical insight needed for the framework, settlement model, design solution and protocol to systematically integrate the said ecological, economic and financial qualities and in turn have a material bearing upon whether they are environmentally friendly or not. Have a material bearing on whether the distinctive urban cultures, spatially compact forms, strong landscaping frameworks and countryside settings of the said model, solution and protocols are environmentally friendly or not to see if they are not only ecologically sound, but efficient in greening economic development, making it financially viable to produce patterns of settlement which are sustainable in terms of the communities that develop.

Key to all this is that without this much needed critical insight, it would not be possible to systematically integrate the said ecological, economic and financial qualities, but target the environment loading, levels of energy consumption, waste and emissions, which need to be assessed in order to evaluate how the greening of economic development makes it financially viable to produce sustainable patterns of settlement. This in turn means that it would not only be impossible

for the framework, settlement model, design solution and protocols to target the environment, but to also carry out any meaningful assessment of what it adds to the greening of economic development. This is because in separating the ecological from the economic, all that is left to target is the land market and level of planning gain needed to support the infrastructures upon which the high quality living and working environments rest. What remains to be done is an assessment of what the land market produces in terms of planning gain and an evaluation of what the expenditure on infrastructures offers as a rate of return on capital investment. What this assesses is whether the settlement model, design solution and protocols are efficient in greening economic development and if this is valuable because it is financially viable.

What the CBA does not assess is whether the environment loading, levels of energy consumption, waste and emissions are valuable in terms of what they contribute to the land market and if the ecological sound nature of these qualities add to the level of planning gain needed to efficiently green economic development and make it financially viable. If this is the case and the environment loading, levels of energy consumption, waste and emissions are valuable in terms of what they contribute, then it would follow that it is the ecologically sound nature of these qualities and not the land market, which require rewarding in terms of the planning gain released. With the existing settlement model it is interesting to note such qualities carry little — if any — weight and tend to go unrewarded, leaving the aesthetics of the design solution to be compensated by the land market and level of planning gain is released. The level of planning gain is released not for being ecologically sound, but because it is efficient in greening economic development and making it financially viable to produce a pattern of settlement which in turn develop as sustainable communities.

The key outstanding research question

The key outstanding research question emerging from this discussion is: how do we carry out an environmental assessment that uses the three models referred to and use them in a way which not only shows why the ecologically sound nature of the environment loading, levels of energy consumption, waste and emissions, ought to be rewarded, but also what form of compensation this should take? Framing the question in this way, the settlement model and design solution acknowledge the valuable contribution that ecologically sound qualities make and recognise this is something which should not go unrewarded in terms of compensation from the land market and level of planning gain released. This requires answers to the following:

- what the ecologically sound qualities of the environmental loading, levels of energy consumption, waste and emissions contribute to the land market and add to the level of planning gain released;
- why they are valuable and should be rewarded;
- how the compensation paid for the said qualities would raise environmental standards, be efficient in greening economic development and making it financially viable for experiments of this type to produce friendly (ecologically sound, efficient and viable) patterns of settlement;
- how this environmentally friendly pattern of settlement is sustainable in terms of the communities that develop from plan-led experiments of this type.

Without a clear commitment to the ecologically sound qualities of these environmental values — as standard measures — and the need to both reward and compensate them, as a matter of course, as a rule and without exception, the settlement model and design solution may have all the aesthetic virtues needed for the land market to produce the required level of planning gain (that which is required to green economic development and make it financially viable), but within a pattern of settlement that does little more than reproduce the kind of resource intensive consumption which is unsustainable. The kind of resource intensive consumption that is unsustainable because while financially viable in greening economic development, the planning gain released from the land market is anything but environmentally friendly in the manner which it manages growth at the expense of conservation. That is to say, manages to reward growth, but at the expense of conservation and the burden which such an intensive level of resource consumption imposes on the environment. The burden which such an intensive level of resource consumption not only imposes on the environment, but is also unsustainable in terms of the settlement pattern that it produces. That is unsustainable in terms of the settlement pattern and communities which this in turn develop, no matter how well it safeguards against the coalescence and loss of identity traditionally associated with peripheral expansion.

If such an unfortunate state of affairs — the so-called "rebound effect" — is to be avoided, it is necessary for the settlement model and design solution to incorporate the kind of rewards and compensations that lead to what might be perhaps best referred to as an ecological modernisation of the land market and for this set of values to structure the planning gain around environmental standards which manage to break the link between growth and consumption and conserve resources through a process of de-materialisation. Around environmental standards, which, it might be added, manage to break the link between growth and consumption and conserve resources through a de-materialisation that does not allow the land market to down load the costs of energy consumption, waste and

emissions, because the level of planning gain released is not only ecologically sound, but also efficient in greening economic development and making it financially viable to produce environmentally friendly patterns of settlement. That is to say, through a de-materialisation which is ecologically sound, efficient and financially viable, producing environmentally friendly patterns of settlement that — as a matter of course, as a rule and without exception — are sustainable in terms of the communities which they in turn develop.

Conclusion

This paper has reviewed a plan-led experiment aimed at developing sustainable communities and has found the "state-of-the-art" settlement model put forward for such purposes wanting. The review has also found that in its current form the model is unable to tell us whether the high quality living and working environments which the design advances are ecologically sound.

The paper has also suggested that asking whether the high quality living and working environments are friendly because they are ecologically sound, or if this is due to the fact the land market produces enough planning gain to be efficient in greening economic development, exposes the limitations of the model and shortcomings of the design solution it puts forward. It has gone on to suggest that in its current form, the model is limited because the design solution it advances is not able to say whether the high quality living and working environments in question are ecologically sound, only if the land market produces the level of planning gain needed to efficiently green economic development and make it financially viable to take such a course of action. As the discussions have gone someway to point out, the challenge which remains outstanding is that of establishing whether models of this kind and the type of design solution they advance, are able to represent the environment as an eco-system and something more than an aesthetic for greening economic development.

To meet this challenge, the paper has looked at the environmental assessments methods that can be made use of to overcome the problems which are associated with the existing models and design solutions they currently put forward. In meeting this challenge, the paper has outlined the main elements of the assessment methodology it is possible to adopt for the purposes of evaluating whether such models are ecologically sound and if the design solutions they advance are efficient in greening economic development. Having outlined the assessments in question, the paper has gone on to examine how it is possible to integrate both the ecological and economic dimensions of the said methodology. Here attention has focussed on how to integrate such qualities into an assessment methodology that is able of evaluate whether the model adopted is ecologically sound and the design

solution advanced is efficient in greening economic development for the reason this also makes it financially viable to produce patterns of settlement which are sustainable.

As the examination has gone some way to demonstrate, the contribution that integrated — ecologically sound efficient and financially viable — assessments of this kind can make is noticeable, and this is because with such a methodology it becomes possible to evaluate not only whether the model is environmentally friendly, but also if the design solution advanced produce sustainable patterns of settlement. Evaluate — it might be added — not only whether the model is environmentally friendly, but also if the design solution advanced produce patterns of settlement that are sustainable by virtue of the ecologically sound, efficient and financially viable qualities which they exhibit. The ecologically sound, efficient and financially viable qualities which the said settlement patterns exhibit and real possibility this in turn offers to develop communities that are sustainable because they provide alternatives to the peripheral expansion of urban sprawl.

Alternatives — it might be added — to the peripheral expansion of urban sprawl that are sustainable because the genuinely 'friendly' nature of the high quality living and working environments which they provide, offer the possibility of settlement patterns capable of putting a stop to the coalescence, loss of identity and break up of communities it is traditional to associate with infill development. The coalescence of settlements, loss of identity and break up of communities it is traditional to associate with the infill developments of peripheral expansion and process of urban sprawl. The peripheral expansion and urban sprawl that prior to the modelling and design of sustainable communities (underpinned, it ought to be added, with the much needed environmental assessments and integrated evaluation of their requisite ecological, efficient and financially viable qualities), was understood to be a development process for which there is no credible alternative.

Having undertaken a critical examination of just such an alternative, it is noticeable the paper has chosen to finished on a cautious note. This has been done with the intention of drawing attention to the research question that still needs to be addressed if the kinds of settlement models, design solutions and integrated assessments which have been outlined in this paper are not going to run the risk of rebounding back on themselves and ending up being counter-productive. That is to say, if they are not going to run the risk of being alternatives which, like their predecessors also end up merely reproducing a resource intensive level of consumption in plan-led settlement models whose design solutions may well have a distinctive urban culture and spatially compact form, but nonetheless still lack the content needed to qualify the living and working environments as friendly. There is still a lack in the content that is needed to qualify the living