8
Managing Sustainable Urban Environments

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8.1. THE CITY AS A SOURCE OF EXTERNALITIES

The worldwide concern about environmental quality and economic development has a history of some 25 years, starting with the UN Conference on the Human Environment (Stockholm, 1972). In the past decade, the issue has received a new focal point in the concept of sustainable (environmental) development. Since the majority (approximately 70 per cent) of the world's population is living in cities, it is clear that it is there that the consequences of a rising world population are most keenly felt. Such consequences may be positive (for example, access to education and culture, economies of scale, social contacts), but also negative (for example, congestion, concentrated pollution, criminality). If the world population rises to some 10–15 billion people in the next century, it is conceivable that all cities will be faced with major challenges and threats in the future. In various countries, cities tend to grow much faster than the average national rise in population (for example, Nairobi, Dar es Salaam and Lagos have grown sevenfold in the period 1950–1980). Thus, the general trend is one where all cities will grow and where the bigger cities may even grow faster.

Throughout the history of mankind, the social and economic agglomeration advantages of cities have stimulated urban growth. Even though suburbanization has occurred, it is clear that the city has not lost its central position as a node in a broader socio-economic network. Since awareness of the environmental aspects of urban quality of life has grown, it is increasingly being questioned whether the positive externalities outweigh the negative externalities brought about by the city. As a consequence, much recent attention has been given to the carrying capacity of a sustainable city (see Banister, 1996a, 1996b; Breheny, 1992; Nijkamp and Perrels, 1994). The environmental carrying capacity of a city has two important aspects, namely an *intra-urban* and an *extra-urban* one. The intra-urban carrying capacity refers to the potential of the city to cope with environmental externalities within the city limits, for example, urban waste management, urban air and water pollution, traffic congestion and noise annoyance. The extra-urban carrying capacity concerns the use of land and other resources, which are necessary to ensure continuity of city life (for example, agricultural production, energy, wood, etc.). The total area needed as a life support system for a city, through the production of goods, resources or waste absorption, is often called the *ecological footprint* of a city (cf. Rees, 1992). This concept means essentially that a necessary condition for a city to survive is to import carrying capacity from the outside world.

It is interesting that the two above concerns of intra-urban and extra-urban carrying capacity are implicitly addressed in two policy documents of the European Commission. In the first, the *Green Book of the Urban Environment* (CEC, 1990a), the Commission sets out clearly that urban environmental policy should transcend a sectoral approach and focus on the social and economic choices which are the real root of the problem. In this context, a plea was made for a better coordination of urban environmental policies through more effective and integrated resource use, information provision, technological progress and use of economic stimuli.

In the second document, *Urbanization and the*

Though the chapter is the result of a common research activity by the three authors, R. Camagni has written Sections 8.3, 8.4.4 and 8.5; R. Capello Sections 8.6 and 8.7, P. Nijkamp 8.1, 8.2, 8.4.1, 8.4.2 and 8.4.3.

Functions of Cities in the European Community (CEC, 1990b), the emphasis was laid on the broader regional issues of the urbanization process (for example, spatial population distribution, networking, infrastructure and accessibility). Particular attention was given to the function of cities in regional development and vice versa, including linkages between the city and the outside world as well as the land use and environmental changes instigated by urban growth.

Urban issues appear to have come increasingly to the fore and to make up important items on policy agendas. Particular attention is often given to the problems of large cities, and these problems will be discussed in the next section.

8.2. LARGE CITIES, LARGE PROBLEMS?

Cities are a geographical concentration point of people and human activities, and are characterized by many of the problems of a modern society (see Fokkema and Nijkamp, 1996). Many cities in the developed and the developing world offer a rather depressing picture; economic growth, turbulent demographic movements, high mobility rates, poor urban housing and problematic urban public budgets put a severe stress on the urban environment and the urban habitat (see for example, Asian Development Bank, 1991; Hardoy et al., 1992; Haughton and Hunter, 1994; Pernia, 1994). Environmental degradation has apparently become a prominent feature of

Table 8.1 *Grouping of major world cities by regional/national economic performance*

High debt, high inflation, high primary export economies		Medium growth, 2–4% economies		High economic growth, 4% and over economies	
		USA	New York	*Japan*	Tokyo
			Los Angeles		Yokohama
			Chicago		Osaka/Kobe
			San Francisco		
		W. Europe	London		
			Paris		
			Milan		
			Rome		
			Rhein–Ruhr		
			Berlin		
			Madrid		
		E. Europe	Moscow		
			Leningrad		
Latin America		*South Asia*	Bombay	*NIEs*	Seoul
Buenos Aires	Argentina		Calcutta		Taipei
Lima	Peru		Dehli		Hong Kong
La Paz	Bolivia		Madras		Singapore
Santiago	Chile		Karachi		
Caracas	Venezuela		Dacca	*ASEAN*	Jakarta
Bogota	Colombia				Bangkok
Mexico City	Mexico	*Middle East*	Istanbul		Kuala Lumpur
Sao Paulo	Brazil		Teheran		
Rio de Janeiro	Brazil		Baghdad	*China*	Beijing
					Tianjin
Africa		*ASEAN*	Manila		Shanghai
Lagos	Nigeria				Guanzhou
Kinshasa	Zaire				
Cairo	Egypt				
Nairobi	Kenya				
Accra	Ghana				
Abidjan	Ivory Coast				
Algiers	Algeria				

Source: Lo, 1992: 198

modern city life. The continuing growth of large cities – and increasingly also of medium-sized cities – reinforces the management problems of our urbanized world (see Lo, 1992). The (socio)economic conditions in many large cities in the world are not homogeneous, but exhibit large differences (Table 8.1). Table 8.1 highlights the fact that there are clusters of cities in different regions of the world which are more uniform, but that globally many discrepancies in terms of urban economic performance can be observed. The resulting environmental problems are far reaching: a decline in air and water quality, soil pollution, waste disposal problems and fierce competition for scarce and congested urban space (cf. ESCAP, 1992; UNEP/WHO, 1992). The negative externalities of this development manifest themselves in various ways: poor health conditions, criminality, traffic insecurity, low productivity, large squatter areas, social deprivation, socio-psychological stress and ecological disturbance. A recent study of UNEP/WHO (1992) gives an illustration of the severe problems of air quality in many mega-cities. This alarming picture, however, needs some clarification. It is by no means true that big cities by necessity should have serious environmental problems. There are also several good counter-examples of cities that have developed an environmental policy which by and large serves properly the needs of the population (for example, Vancouver, Stockholm, Singapore). Large cities should not be paralysed by despair, but should try to develop effective strategies based on sound economic principles to improve the quality of the urban environment and the urban habitat.

In popular wisdom it is usual to regard cities – and especially cities in developing countries – as 'sources of evil' (in terms of environmental decay, congestion, poor health conditions etc.). Although it has to be recognized that many cities exhibit signs of decay and high social costs, it should be emphasized that the ongoing process of urbanization on a worldwide scale suggests that cities – or urban areas – all over the world exert centripetal forces which favour further city growth. Apparently, the economies of scale of a modern city far outweigh the negative externalities of urbanization. This observation sets the tone for this chapter, which takes for granted that cities are 'islands of opportunities in seas of decay'. We will argue that the city – or city size – is not necessarily the problem, but rather poor management of the city and the unprofessional organization of scarce urban space. A major reason for the low socio-economic performance of major cities in our world is institutional inertia and inefficient bureaucratic procedures which serve at best some group interests, but fail to exploit the enormous potential embodied in a modern city. In this context, the lack of business-oriented principles for urban governance is noteworthy. Therefore, a necessary condition for urban survival – or preferably urban sustainability – is the implementation of a blend of market-based development principles and long-range public infrastructure provision which ensure urban sustainability in terms of social economic and environmental benefits for all actors in the urban space. The quality of the urban habitat will be determined decisively by its accessibility to the means of both physical and non-physical network infrastructures (see World Bank, 1994a, 1994b). This means that transportation and communication are in principle vehicles for urban sustainability, provided all social costs (and benefits) involved are charged to all users in such a way that a socially acceptable and equitable market result emerges. The recent popularity of market-based policy principles for sustainable urban development (such as, tradable area licensing schemes, or tradable car emission permits as proposed at present in, for example Mexico City) illustrates that creative policies are necessary in order to ensure that cities are – and remain – the 'home of (wo)man' (see Nijkamp and Ursem, 1998; Verhoef et al., 1996). The central role of a city in an industrialized society appears to turn into a centripetal role in a modern network society; cities are becoming 'local networks in networks of cities'. In this context, it ought to be recognized that a necessary condition for a city to survive and to ensure continuity will be a sufficient degree of accessibility via a broad spectrum of physical and non-physical networks. In this regard, communication and transportation are a *sine qua non*, as mobility (of material and non-material goods) is the necessary consequence of accessibility. However, mobility creates many negative externalities which are detrimental to urban sustainability. Rather than uncritically developing initiatives to reduce accessibility, a sound urban sustainability policy would be used on user charge principles in order to reconcile efficiency, equity and environmental quality.

Thus, urban sustainability is not a simple environmental quality objective, but is the result of a relationship between economic, social and ecological principles (see Camagni et al., 1997; Capello et al., 1999; Nijkamp, 1994; van Pelt, 1993). This means that the concept of sustainability should not be interpreted from three different angles, but is the result of a bilateral or trilateral integration between these principles (see also Figure 8.1). This distinction has implications for sustainable urban development, and for policies addressing related transportation and communication issues. Here it is advocated that the success of urban governance will depend on

the professionalism of local/regional policy-making governed by sound principles drawn from business practice in corporate organizations. This seems to be a critical factor for success in also serving the needs of those living in substandard housing conditions. We will also argue that strict policies have to be developed and implemented in which the notion of urban environmental utilization space may play an important role (see Nijkamp and Opschoor, 1997). This implies that for dedicated sustainability policies threshold conditions (for example, critical loads, carrying capacity) have to be specified which have to be respected in all aspects and by all policies. We argue that the allocation of rights to use such a space may be based on fair market principles (for example, tradable permits) which should serve the needs of all citizens. The chapter concludes with some policy guidelines.

8.3. URBAN SUSTAINABILITY: THE NEW CHALLENGE

Since the publication of the Bruntland Report by the World Commission on Environment and Development (1987), the paradigm of sustainable development has gained not only widespread cultural and political recognition, but also significant theoretical acceptance among economists and environmental scientists. It is noteworthy, however, that a widespread application of the same paradigm to the particular case of cities, in spite of its acknowledged relevance for humankind in the perspective of both actual and future generations, is still largely lacking a sound theoretical foundation; consequently, policy strategies are often designed on the basis of common sense, trial and error procedures or even theologies and 'tastes'.

Two major background considerations may be mentioned here: the complexity of the theoretical enterprise, and the lack of full recognition of the nature and role of cities in the present debate. Regarding the first issue, we have to admit that the already high complexity (and consequent uncertainty) that governs the relationships between economic processes and the biosphere rises by at least an order of magnitude if the social, economic and cultural interactions that constitute the city are taken into account. But even if these latter interactions are fully accounted for in a theoretical framework, we are confronted with an intriguing paradox: we are trying to make use of theoretical tools developed from *natural* resource management in order to understand and regulate an intrinsically *non-natural* urban environment.

This is one reason for the ambiguity of much of the present literature on urban sustainability: the failure to accept that the city was born in direct opposition to the countryside, and that the city is growing as an artefact designed to attain social goals like human interaction, agglomeration economies, or effectiveness in the management of economic, cultural and knowledge processes.

The direct consequence of this is that we cannot directly transfer the theoretical tools developed in the case of natural resources to an urban environment: the city means renouncing a model of life and social organization based on human–nature integration, in favour of a model based on a human–human integration; renouncing a production function based on land and labour inputs in favour of one based upon social overhead capital, energy and information (Camagni, 1996).

In terms of the usual concepts developed in the case of natural resources and global sustainability, the city is by definition un-sustainable: it replaces non-renewable resources like fertile land by asphalt and concrete; it overcomes the carrying capacity of its territory by discharging a flow of waste water, air pollution and urban waste to the countryside; and it uses resources taken from distant territories (White and Whitney, 1992). Approaches based on 'strong' sustainability principles, allowing only a very limited substitution between natural resources and generated capital – actions that are probably the most suitable for natural resources management (Victor et al., 1994) – are almost automatically meaningless in an urban environment.

In the light of the above, it may be more meaningful to explore another pathway to the theorization of urban sustainaility. Under scrutiny should be not the city in itself – a macro-historical phenomenon that has manifested itself in all civilizations, that does not need to be justified and that only superficial romantics can reject[1] – but rather some recent trends that endanger its primordial role as the locus of social interaction, creativity and welfare. We refer here to those unlimited and chaotic growth processes that happen mainly in the phases of economic take-off and fast industrialization; in particular those recent patterns of diffused, low-density urban expansion that have been labelled as 'sprawl', 'metropolization', 'periurbanization', '*ville éclatée*', '*ville éparpillée*', 'megalopolis', 'edge–city development', all phenomena that blurred the conceptual distinction between city and countryside, leading to a geography of non-cities and collapsed rural environments (Boscacci and Camagni, 1994; Camagni, 1994; Camagni et al., 2000). These processes exacerbate the issue of mobility expansion and energy consumption as they lead to a car-dependent pattern of land use. But we refer also to the new processes of ghetto

creation on the periphery of the big metropolises of the developed and developing world, partly linked to the recent global transformation of society and to the time lag by which government policies have come into being and tried to manage the problem. The latter issues have to be considered as part of the frame of urban sustainability, where, on the one hand, they denote imperfect or limited accessibility to the benefits of the urban environment by different groups and, on the other, they have particular impacts on the internal functioning and attractiveness of the city itself.

Further, the concept of urban sustainability should refer not to some earthly paradise in which some form of ecological equilibrium is attained, but to a multi-dimensional archetype which addresses the different major functions of the city: the functions of supplying agglomeration economies, dynamic proximity advantages, welfare, internal social interaction, proper accessibility to the external world and economies of scale in energy consumption (Camagni et al., 1997; Capello, 1997). In order to achieve the maximum welfare for the local population in the long run, the different environments which constitute the city – the economic, social, natural and built environments – have not only to interact by maximizing cross-externalities and feedbacks, but also to co-evolve in a process of virtuous dynamic adjustment (Camagni et al., 1996).

The main features of such a new conceptualization of urban sustainability may be summarized as follows (Camagni, 1996):

1 It is necessarily based on a '*weak*' definition of sustainability, as far as substitution between natural and human inputs is concerned. Sustainability in an urban setting refers to the goal of meeting continuously rising (or non-declining) welfare and utility levels for the city's population (Solow, 1986), while maintaining a respect for clear environmental constraints and the long-term economic viability and attractiveness of the city for internal and external firms.
2 It is based upon a '*procedural*' *rationality* in the sense of Simon (1972), defined as the coherence of a dynamic process of understanding and decision-making, as opposed to a 'substantive' rationality, which supposes the possibility of a never-decreasing coherence between means and goals. A procedural rationality appears as the only appropriate framework for theorization and decision-making in a condition of high complexity and widespread uncertainty regarding the fundamental relationships that shape the object of our inquiry (Faucheux and Froger, 1995; Froger, 1993; Vercelli, 1994). In fact, when complex dynamic processes are the norm, implying positive and negative feedback, synergy, network externalities and irreversibility, the possibilities of precisely anticipating the future outcomes of present conditions and policy decisions are limited, and in such circumstances a deterministic approach must be superseded by continuous monitoring, fast reaction, flexible decision-making and long-range scenario-building, these being the most suitable procedures to replace (or better accompany) static or comparative-static optimization exercises.
3 It is thus based on the principle of *risk aversion* and *precaution* (Pearce et al., 1989, 1993), implying the necessity for cautious behaviour in the presence of the possibility of coping with significant negative effects ('if pessimists were right') or of trickling irreversible trends.
4 It is necessarily based on the consideration of '*local*' effects and dynamics, avoiding huge negative transborder externalities, whilst trusting that environmental virtuous behaviour will also positively affect the global equilibrium of the biosphere. Elsewhere (Camagni et al., 1996) we have argued that a 'local' approach to environmental problems presents numerous advantages with respect to a 'global' one in terms of operationality and effectiveness, due to reduced distance between polluters and victims (the 'locality theorem').
5 Once the field of inquiry is restricted to local trends and interactions, an important consequence emerges: the timespan for the full unfolding of all (negative) feedbacks and cumulative processes among the three environments that represent the city – the economic, social and physical environments – becomes much shorter than in the case of global interactions. Equally, the possibility that the *present* generation will suffer from present decisions becomes considerably higher.

This last element brings about two consequences. First, it means we can avoid, at least partially, the intriguing and probably (theoretically) unsolvable problem of the representation of future generations at the negotiating table of present decisions (Heister and Schneider, 1993; Pasek, 1993): in fact the concerns about urban quality of life conditions of both present and future generations are by and large the same. Secondly, from a normative point of view, it allows us to overcome the weakness of intervention processes proposed for the sake of inter-generational equity, for which the willingness to pay by the present generation is probably limited. The urban society we are going to build is one which some of us at least are bound to live in too (Camagni, 1996).

8.4. THE ECONOMY/SOCIETY/ENVIRONMENT RELATIONSHIP IN THE URBAN SETTING

8.4.1. Prologue

Modern cities are the 'home of modern (wo)man', in both the developed and the developing world. Thus, the urban habitat and its network configuration are a focal point of interest. It has been argued above that cities are not only problem areas, but also islands of new opportunities. Even though it has to be recognized that in many Third World cities a significant share of the urban population is living in substandard housing, it is also a fact that cities – through their potential economies of scale – have many more possibilities in coping with the externalities caused by their social, economic, political, technological and cultural functioning. In principle, they are in a good position to offer an urban milieu in which welfare, a good quality of life, culture and science can flourish. Both structural causes (for example, climatological or demographic conditions) and government failures caused by inertia and mismanagement are responsible for a substandard quality of urban life dominated by poverty, social stress and environmental decay (cf. Chatterji, 1984).

The ambition to reach a sustainable form of urban development means that strict measures have to be taken in order to alleviate current problem cases and to pave the way to a more acceptable urban future. Given the fact that the majority of total world population (including that in developing countries) is living in urban areas, an intensified effort has to be made to cope with the global urban challenge. As advocated in Agenda 21 of the Rio Conference, the problems of the urban habitat have to be put more at the forefront; this means that first of all sufficient information has to be collected on measurable indicators for sustainable habitats and sustainable city initiatives. By placing the problem of human settlements at the centre, other related fields (for example, technology, transportation, urban economy, social facilities) come immediately to the fore. Second, it is necessary to develop creative new types of sustainable policy, which simultaneously do justice to long-run efficiency, equity and environmental objectives. This means that inertia in urban management would have to be replaced by flexible and innovative corporate policy-making. This holds for all fields in the city, in particular transport, housing and land use. In the next subsection we will deal more specifically with urban environmental quality indicators which may impact on the city's sustainability. Then we will address urban sustainability policy, followed by a discussion of the need for a sustainable urban transport policy. The main message is that cities are not a source of despair, but rather a window of promising development opportunity. Nevertheless, it is of primary importance to pay due attention to the negative externalities of modern cities.

It is clear that urban sustainability policy requires operational insight into environmental quality conditions, measured by means of indicators. In our discussion of urban environmental problems we will make a distinction between impacts on the natural and on the social environment of a city.

8.4.2. Environmental Problems with an Impact on the Natural Environment

Atmospheric pollution

All pollutants discharged to the atmosphere are – beyond critical concentrations – harmful to plants, animals and humans. Some are harmless in typical ambient concentrations; others have indirect effects that may be harmful. Some have effects that are local or regional, and some have global effects. In many urban areas atmospheric pollution causes severe problems. We can distinguish different emissions which pollute the urban atmosphere (cf. Nijkamp and Ursem, 1997). Examples are:

- Carbon dioxide (CO_2). Carbon dioxide emissions stem from the combustion of fossil fuels. They are seen as the main contributors to the greenhouse effect. Even relatively high amounts of carbon dioxide have no direct known detrimental effect on personal health. The problem of carbon dioxide is that it prevents heat escaping from the planet, which may generate climatic changes. Climate modelling indicates that by the year 2030 the atmospheric CO_2 concentration may result in an average temperature rise of the earth's climate of between 1.5 and 4.5 degrees centigrade. The results of global warming include a rise in the sea level, caused mainly by the thermal expansion of the oceans, with the risk of coastal area floods. When we keep in mind that a large number of big cities are located in coastal areas, the CO_2 emissions are not only a global threat but also a local threat.
- Nitrogen oxide emissions (NO_x). At transboundary levels, nitrogen oxide emissions converted to nitric acid and combined with sulphur dioxide form a significant component of acid rain, which has serious detrimental effects on many ecosystems.
- Sulphur dioxide. Sulphur dioxide can cause bronchitis and other diseases of the respiratory system. It is also the main contributor to acid

rain. The consequences of acid rain include damage to aquatic life, forests and field crops, and corrosion of structures and material. Clouds bearing acids may travel hundreds or even thousand of kilometres across several borders to precipitate acid rain.

- Carbon monoxide (CO). Carbon monoxide is especially a problem in urban areas where synergistic effects with other pollutants contribute to produce photochemical smog and surface ozone (O_3).
- Volatile organic compounds. These comprise a wide variety of hydrocarbons and other substances. They generally result from incomplete combustion of fossil fuels. When combined with nitrogen oxide emissions in sunlight, hydrocarbons and some volatile organic compounds can generate low level ozone. Ozone dims sunlight and causes watering eyes and discomfort for many people, but it normally appears not to have long-term serious health effects.
- Particulate matter. Particulate matter contributes significantly to visibility reduction and, as a carrier of toxic metals and other toxic substances, exerts pressures on human health.

Water pollution

Most people think of water pollution only in terms of water for drinking and other domestic purposes. Domestic use, however, is only a small part of the water story. The most important distinction regarding water use is between instream and withdrawal uses. The instream uses are those for which water remains in its natural channel (like commercial fishing, sports fishing, pleasure boating, swimming etc.). Withdrawal uses are those such as municipal use, industrial processing, cooling and irrigation which require water to be withdrawn from its natural channel.

The various uses of water also require different water qualities: the quality required for pleasure boating can be lower than the quality of drinking water, for example. The various uses also affect water quality differently. In using water, humans discharge an enormous variety of wastes causing water pollution. The most important ones are organic materials using dissolved oxygen in the water as they are degraded. The dissolved oxygen content influences the kind of fish and other life-supporting systems that can only survive in the water, and affects virtually every use of water.

Depletion of energy resources

Due to the high use of energy in the city by transport, houses and industry, many energy resources are overexploited. Excessive exploitation of carbon-based fuels is often seen as the major problem. Although the exploitation of the resources causes only few environmental problems in itself, the effects of overexploitation have severe negative effects on future generations. In this context, renewable energy plays a potentially important role in sustainable city initiatives.

Solid waste disposal

Solid wastes, like paper, plastics, glass and metals, which are generated in large amounts in urban areas, are still increasing annually. Roughly speaking, the weight of municipal waste in the USA generated per month is about the weight of the population that generates it (Mills and Hamilton, 1994). By far the predominant form of disposal is sanitary landfill, that is, an open space where wastes are dumped. An important problem is that cities are running out of potential places for dumping waste. One possibility in coping with this problem is to burn the waste, but the problem here is that, because of the high amount of plastics, burning may generate toxic fumes, so that a careful energy conversion system is needed. Nevertheless, this form of renewable energy is promising and deserves to be further developed.

8.4.3. Environmental Problems with an Impact on the Social Environment

Noise

The noise caused by the different economic activities of an urban area is a big problem. It has been estimated that about 110 million people in the industrialized world are exposed to noise levels in excess of 65 dB(A), a level considered as unacceptable in OECD countries. Noise has several different affects on health and well-being: it affects activities such as communication and sleep, and these effects further induce psychological and physiological disorders such as stress, tiredness and sleep disturbance.

Accident risk

In urban areas accident risk is a high social (environmental) cost. The high volumes of surface transport and the many high-risk industries (even though often located at the edge of an urban area) cause numerous accidents every year, and are therefore detrimental to urban sustainability.

Congestion

Strictly speaking, excessive traffic congestion, while an externality in an economic sense, really involves a lack of internal efficiency of transport

operations rather than constituting a serious environmental problem. It is, however, closely associated and generally highly correlated with pollution and other environmental problems, which makes it a topic of concern.

Finally, it should be noted that in many cases energy indicators are appropriate tools to measure urban sustainability, as most environmental threats in the city are directly or indirectly correlated with energy use (Desai, 1990; Nijkamp and Perrels, 1994). Thus, such indicators can be used in a policy analysis to measure the impact of sustainability measures. This holds in particular for urban traffic, since the use of fossil fuels is a necessary input for mobility patterns in the city. Clearly, the economy, society and environment of a city are interrelated, calling for their holistic analysis.

8.4.4. An Integrated View on Sustainable Cities

The focus of any theoretical reflection on urban sustainability should be the relationships between the three environments or sub-systems that constitute the essence of the city: the economic, the social and the physical – natural and built – environments (Figure 8.1). In a previous paper (Camagni et al., 1997) the present authors have proposed a dual way of assessing the interaction among these environments.

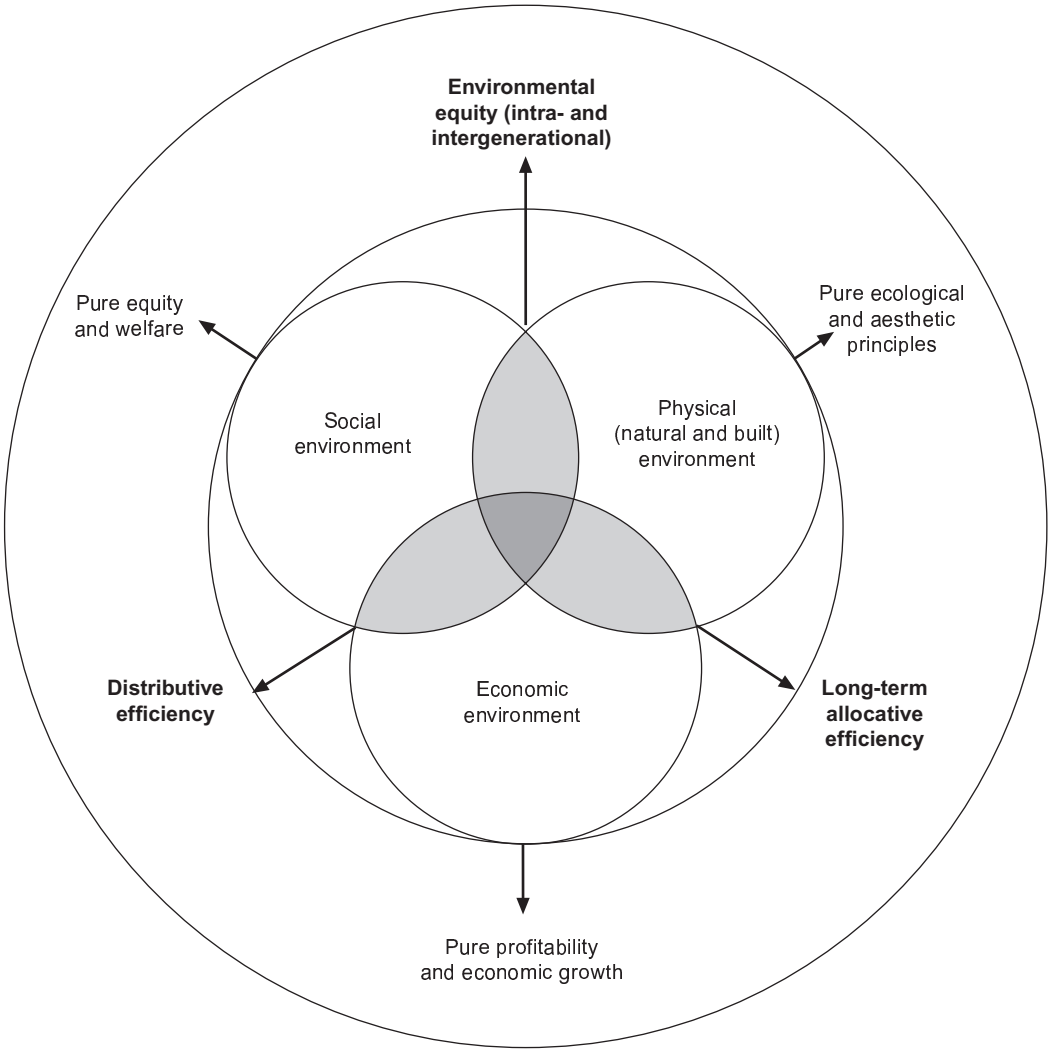


Figure 8.1 Sustainability principles and policies (Camagni, 1996; Camagni et al., 1997)

Table 8.2 *Positive and negative external effects of the interaction between the different environments in a city*

	Interaction between economic and physical environments	**Interaction between economic and social environments**	**Interaction between social and physical environments**
Positive external effects	Efficient energy use Efficient use of non-renewable natural resources Economies of scale in the use of urban environmental amenities	Accessibility to qualified housing facilities Accessibility to qualified jobs Accessibility to social amenities Accessibility to social contacts Accessibility to education facilities Accessibility to health services Diversification of options	Green areas for social amenities Residential facilities in green areas Accessibility to urban environmental amenities
Negative external effects	Depletion of natural resources Intensive energy use Water pollution Air pollution Depletion of green areas Traffic congestion Noise	Forced suburbanization due to high urban rents Social frictions on the labour market New poverties	Urban health problems Depletion of historical buildings Loss in cultural heritage

Source: Capello, 1998

1 *A static and structural approach*, focused on the study of how the external effects of the three sub-systems impinge upon each other, positively and negatively (Table 8.2). The scale and quality of the respective assets may represent:
   - positive cross-externalities for the other assets, when the presence of the former assets determines the productivity, attractiveness or marginal utility of the latter (for example, environmental assets increase the economic attractiveness of the city; economic development allows welfare policies and a wider accessibility to urban amenities, services and jobs; lower social conflict increases effectiveness of the local activities, etc.);
   - negative externalities when, due to the limited physical space in which all relationships happen, decreasing returns and bottlenecks appear both in economic terms (rising costs of factors, generating selective crowding-out effects on population and firms) and in physical terms (congestion, conflict, limited accessibility to scarce urban assets). All these effects act as positive or negative location factors.

2 *A dynamic and evolutionary approach*, focused on the assessment of the dynamic relationships among the subsystems, in the form of synergies, positive feedback effects, cumulative processes (for example, the virtuous relationship between infrastructure improvement, efficiency and growth, or between rising incomes, demand for urban amenities, their supply and consequent further development), or in the form of idiosyncrasies, negative feedback effects and irreversibility (depletion or contamination of natural resources like water may irreversibly affect the economic and residential viability of the city; infrastructure improvements may generate further urbanization processes and decreasing accessibility levels within the city).

As far as the normative side of this double argument is concerned, the suggestion put forward by Camagni (1996) was to abandon the logic of pure short-term efficiency, pure equity or pure environmental principles, which was bound to lead to growing contradictions between the three subsystems, in favour of new integrated principles of:

- Long-term allocative efficiency (taking care of the possible long-term impacts of decreasing environmental quality on the efficiency and attractiveness of the city).
- Distributive efficiency (taking care of the long-term viability of equitable social systems).
- Environmental equity (taking care of the negative distributional effects of environmental policies assessed in mainly economic terms).

Pure short-term, profitability principles should evolve into a *Long-term allocative efficiency*, through the internalization of negative externalities, the embedding of certain behavioural rules with respect to the environment into common business practices, and the adoption of a long-term perspective in the allocation of resources and in the definition of benefits and costs.

The resort to market principles is maintained as the most effective way of allocating resources; but this market is enriched in order to take into account – through subsidies, taxes and some regulations – the cases where a pure market fails or does not exist, or does not operate on a sufficient time horizon. The direction is towards the construction of what philosophers and theorists of justice call the '*good market*', incorporating environmental considerations in the same way as the present labour market incorporates modern working and wage conditions.

Looking at the interplay between the principles regulating the environmental and the social spheres, an *environmental equity* principle should be developed, guaranteeing both inter- and intra-generational fairness. While the former is generally underlined in many current environmental debates, opening the way to the possibility of inter-generational paternalism, the latter looks particularly crucial, in that not just the provision of environmental assets should be secured, but also that the accessibility to these assets should be fair in social terms. In the absence of this, environmental policy could become the public provision of luxury goods. Equity in terms of income distribution is quite a different matter; here we draw attention to the substantial inequalities in access to, for example, land, water, energy, environmental and sanitation facilities. In Third World cities this problem is not related only to social services, but also to the basic urban environmental services, such as clean drinking water, sanitary facilities and solid waste collection; the degree to which these services are available in all cities and all parts of the cities should be driven by environmental equity. This is especially true for the poorer segments of the population in Third World cities. Urban sustainability policies should address these differences in resource endowment by either enhancing the level of supply of public facilities (water, electricity, housing, sanitation) or by defining and (more equitably) allocating private property rights to environmental assets (Nijkamp and Opschoor, 1997).

Finally, the integration between profitability and equity principles calls for a *distributive efficiency*: this means operating through redistributive mechanisms in order to secure social stability, fair access to education and health services, wider access to options of economic upgrading and vertical societal mobility. A sustainable city is not a city of equals, but requires a wide accessibility to those basic elements that allow the continuous regeneration of its professional basis and its creative potential.

A city where distributive efficiency and environmental equity principles are established can be labelled a 'good city' in the tradition of some urban planners and urban scientists; as we mentioned above, a 'good city' is a city where the eco-dimension (both natural and built) is maintained, while progressive change is permitted (Lynch, 1981). But this is possible only when distributive efficiency as well as environmental equity principles are satisfied.

Summing up, the tentative definition of urban sustainable development which form the basis of our policy reflections is *a process of synergetic interaction and co-evolution among the basic subsystems that constitute the city – namely the economic, the social, the natural and built environment – which guarantees a non-decreasing welfare level to the local population in the long run without jeopardizing the development options of the surrounding territories, and which contributes to the reduction of the negative effects on the biosphere.*

8.5. THE ROLE OF TIME

8.5.1 Time as Irreversibility

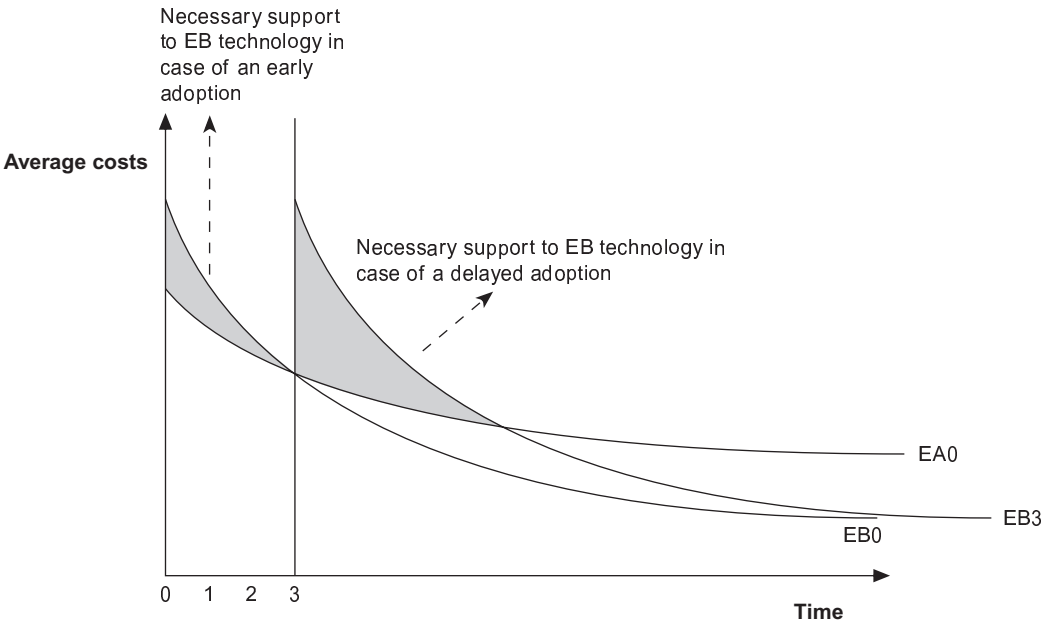
Irreversibility is a central theme underlying sustainability. How cities develop and are planned results in outcomes which may be difficult to reverse, e.g. low density residential development. The development trajectory of urban areas is subject to very different processes and outcomes: sudden or explosive growth, sudden decline, catastrophic jumps, converging or diverging cycles, or chaotic behaviour. Most of these outcomes are characterized by strong irreversibility in the long run (see Camagni and Capello, 1996; Nijkamp and Reggiani, 1992).

This element (of irreversibility) calls for a clear distinction between a short-term and a long-term perspective, both in analysis and in policy-making. In the short term, all events happen in the neighbourhoods of the contingent historical condition (a 'local' equilibrium point), and urban sustainability policies can work by exploiting the (limited) elasticity of substitution among the inputs of the production processes (for example, stimulating energy-saving techniques) or among the transport modes in the mobility pattern of the local population (for example, stimulating the use of public transport facilities).

On the other hand, in the long run we are confronted with a radical change in the policy framework: in the production and transportation spheres technologies can change, while in terms of land-use patterns the urban form can change. But these processes of change imply in both cases huge cumulative effects via learning processes (in the case of technologies) and positive feedbacks (in the case of the transportation supply – land-use change – transport demand cycle). Once a technological or territorial trajectory gets started, usually the sunk costs encountered for changing its direction are huge and are often overlooked by the comparative static approaches based on an optimizing logic (Erdmann, 1993). If these sunk costs are high, alternative solutions or different equilibrium points may never be achieved, in spite of their possible superior efficiency, and the systems remains 'locked-in' by its historical, possibly sub-optimal, trajectory.

On the transportation technology side, the following example may clarify the message and show just how important an anticipatory and early response capability by the relevant public body can be. In Figure 8.2 the learning curves of two competing transportation technologies are drawn, an EB – environmentally benign technology – and an EA – environmentally adverse – one. In the case of an early adoption (time 0), the EB technology may need only a small amount of public subsidy in order to overcome its higher short-term cost disadvantage, but in case of a lagged adoption at time 3 the subsidy requested could easily grow bigger, as a consequence of internal learning processes on the EA technology and external investments on complementary assets (Camagni, 1996).

Irreversibility and path-dependency find another clearcut example in the territorial pattern of metropolitan expansion that has taken place in countries like the United States. As Sternlieb and Hughes (1982) rightly put it more than 15 years ago, when the issues at stake were the risk of oil shortage and the goal of energy saving: 'the U.S. has invested the bulk of its (urban) capital development since World War II in an increasingly centrifugal fashion. We cannot declare this obsolete without bankrupting the country.' This observation also highlights the importance of appropriate normative policy foundations.



EB0 = Learning curve of the environmentally benign technology adopted at time 0

EB3 = Learning curve of the environmentally benign technology adopted at time 3

EA0 = Learning curve of the environmentally adverse technology adopted at time 0

Figure 8.2 Time trajectory of the economic advantages of alternative technologies (Camagni, 1996)

8.5.2. Time as a Positive Externality: Building Environmental Awareness

From the preceding remarks, it appears clearly that the relationship between economic development and environmental quality is much more complex, indirect and mediated than is commonly thought, especially in the urban realm where social, cultural, political and historical elements interact and co-evolve with respect to the production system and the natural environment.

The usual negative trade-off between per capita income and environmental quality is, therefore, probably also a valid relationship in a short-term *ceteris paribus* condition. In this case, it is certainly true that development, whenever it occurs, builds upon the exploitation of some natural resources: soil, energy, biomass. It impinges on the surrounding environment through the results of the manufacturing process: non-recyclable and non-degradable products, combustion gases, dirty water and waste. But 'other things' do not remain equal in the process of economic development and urbanization: infrastructure construction (and in particular sewerage and drinking water systems) and also health care, housing and social infrastructure improve at a pace that outstrips the simple effect of demographic density and agglomeration; priorities and social values with respect to quality of life and environmental goods change, and communities are increasingly willing to allocate resources in that direction[2] (Beckerman, 1993).

In most developing countries, evidence exists to show that those elements of environmental quality that matter most, namely access to safe drinking water and sanitation, relate positively with average income levels, and show higher scores in urban than in rural areas (see Beckerman, 1993, for details). On the other hand, in the cities of developed countries, even a first glance suggests that the concentration of the more traditional forms of air pollution, sulphur dioxide and smoke, is much lower than in cities of developing countries. In Britain, for example, during the 1960s average smoke concentration in urban areas fell by 60 per cent, and concentration of sulphur dioxide fell by 30 per cent. In Greater London smoke emissions decreased by over 80 per cent in the period 1958 to 1970, in the presence of an increase of at least 30 per cent in output (Beckerman, 1993).

Our understanding of the development–environment relationship therefore is that the short-term trade-off shifts upwards as time passes, brought about by the evolution of social overhead capital of cultural and political awareness with respect to the environment, by government intervention and through economic transformation.

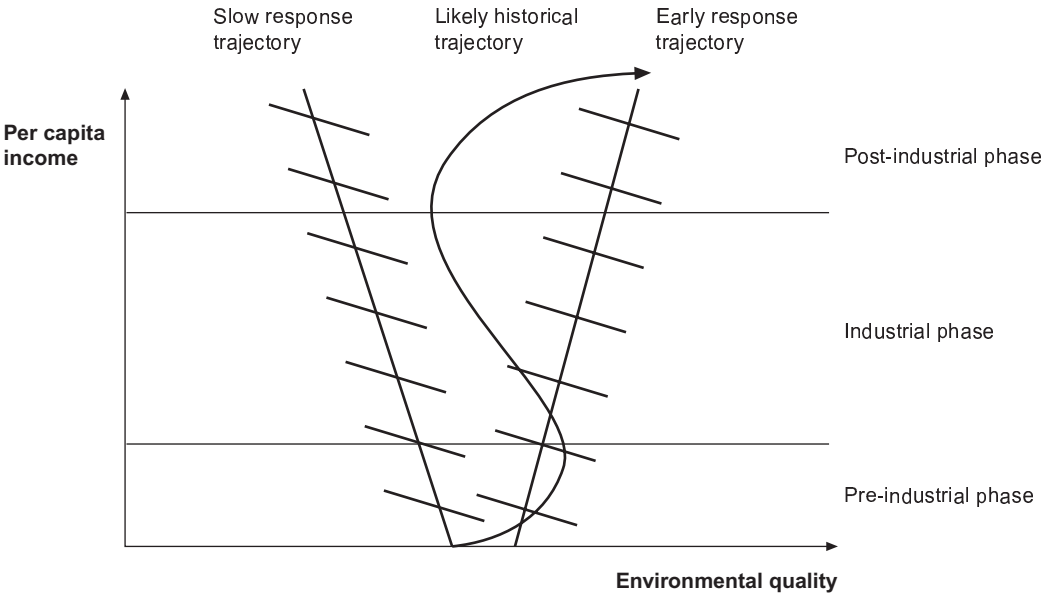


Figure 8.3 The development–environment trade-off: the VASE model (Camagni, 1996)

Through the interpolation of short-term relationships one gets the long-term trajectory of the same relationship, that may show different abstract shapes: a positive shape, in the case of an early and successful response of the local community to environmental decay, and a negative shape in the case of a slow response and low environmental awareness. These alternative outcomes are depicted in Figure 8.3, where the so-called VASE model is presented: Value-driven Alternative Sustainability Evolutions (Camagni, 1996).

While econometrics does not supply us with a definite response on the long-term shape of the development–environment relationship, mainly due to the fuzzy and subjective nature of most environmental indicators, our proposition is that the most likely relationship has an S-shape (Camagni et al., 1997), implying:

- *a positive relationship* in the early stages of development and urbanization, when social overhead capital provision show wide and increasing returns;
- *a negative relationship* in the intermediate phase of development, coinciding with rapid industrialization and metropolitan growth;
- *a positive relationship* again in the case of post-industrial societies, thanks to the emergence of new social values with respect to the environment (environmental quality is in fact a luxury good, increasingly appreciated at high income levels) and the decline of the share of polluting, manufacturing activities.

Our remarks show once again that urban evolution is not taking place in a deterministic world, in which effects follow mechanistically from causes and where trends (or 'stages') are fatally linked in time sequences defined from the beginning. Complexity of interactions and co-evolutions mean a wide spectrum of possible paths and outcomes, difficult to control and to forecast, but very much open and sensitive to discretionary practices and policy decisions, provided that they are shared by the vast majority of the local community and are implemented in a far-sighted and anticipatory way. The role of autonomous environmental values, emerging in the cultural and political spheres and embedded in grass-roots movements, research efforts, public declarations and policy engagements on both a supranational and a local scale, is clear and fundamental in this context.

8.6. DIFFERENCES AND COMMONALITIES IN DEVELOPING AND DEVELOPED COUNTRIES

Is it possible to treat sustainability problems in cities of developing and developed countries with the same logic, and with the same analytical and normative tools? As is often the case in scientific reasoning, the answer is at the same time yes and no.

As far as the goal of urban sustainability is concerned from the limited local perspective, it seems widely acceptable that this should represent a common, fundamental goal in all societies. Sustainability means the possibility of reaching and maintaining a sufficient level of well-being for the urban population in the long run, through the provision of economic advantages, social equity, and cultural and environmental assets. Provided that each community ranks differently the elements or factors of its social utility function according to its own priorities and values, and given the fact that the ways by which social utility is reached may be diverse (according to the specificities of each case), no difference exists between the urban conditions in developing and developed countries. Trade-offs on resources allocation are similar; negative feedbacks and cross-externalities among the different sub-systems are similar; and similar in character also is the role of (and the difficulties facing) the planner. Of course, local conditions in developing countries are often (but not always) much more dramatic, as the very subsistence of parts of the population is threatened.

On the other hand, a wide difference between the two cases does emerge when urban sustainability is viewed in a wider perspective, taking into consideration the role of cities in the national development context and the forces that determine their expansion. In developing countries, cities are magnets attracting human resources from outside as a consequence of their role as nodes of infrastructure and development potential. In the developing world, cities are often also the recipient of masses of desperate people, pushed out of the countryside by the crisis in the agricultural sector. In developed countries the city is a factor in the increased efficiency of the rural areas (for example, through the transfer of know-how and technology to the agricultural sector and the dispersal of industry); in developing countries it is the effect of the crisis of the non-city which stimulates much urban growth.

All this has far-reaching consequences for urban science and environmental planning. In a condition of relative demographic and economic equilibrium between city and countryside, the destiny of cities depends heavily upon the quality of their own physical lay-out, internal functioning and equilibrium between the built and the natural environment. In a condition of imbalance, on the contrary, their destiny depends upon the development process that is happening outside them; any policy intervention on urban assets is destined to amplify the perceived disparity in the development potential between the city and the

countryside, fostering cumulative immigration processes that annihilate the potential effects of the initial intervention (Lo, 1992). Consequently, in developing countries, policies addressed to the sustainable development of big cities should be complemented in parallel by:

- policies focused on a balanced regional development, and in particular policies for the development of rural areas;
- policies focused on the construction of a balanced urban system, based on a creative, country-specific blending of the traditional hierarchical pattern of centres and the modern network pattern of specialized centres (Camagni, 1992; Camagni, 1994).

8.7. URBAN SUSTAINABILITY PRINCIPLES AND POLICY IMPLICATIONS

As mentioned above, the strict application of urban sustainability requires a focus on the economic, social and environmental aspects of urban life (cf. Newman and Thornley, 1994). This calls usually also for a strict urban energy conservation policy (see Banister, 1996b; Newman and Kenworthy, 1989, 1991). In many cases, targets and critical limits for various aspects (indicators) of urban sustainability have to be specified (for example, noise level, CO_2 levels, density, traffic etc.). If the actual level of negative externalities exceeds such threshold levels, a proper policy has to be designed so as to guarantee a sustainable outcome. In principle, two contrasting types of policies may be distinguished, namely standards based on regulations and market-based instruments. These measures have been discussed extensively in the literature. A more recently developed and increasingly popular concept is that of the urban environmental bubble, which defines the urban utilization space for different categories of substances which affect urban sustainability. This sustainability model presupposes two types of information: the definition of critical threshold levels for urban sustainability indicators, and indications as to the proper way of allocating the remaining constrained activity levels in terms of economy efficiency, social equity and environmental effectiveness.

In this framework, an allocation system based on market principles has in recent years gained popularity, namely the idea of tradable permits in the city, especially emission trading. Although the theory of tradable emission permits dates back to the 1960s, it has only recently become a tool in environmental policy. Emission trading is based on the objective of guaranteeing an urban environmental outcome that is in agreement with *a priori* defined critical threshold levels and which is achieved at the lowest costs possible. In a perfectly operating market these permits will be traded until the marginal abatement costs of all actors are equal to the market price of the emission permits. Various types of trading systems have been proposed, such as Ambient Permit Systems and Emission Permit Systems. Of course, there needs to be a control authority which acts as a clearing house. Given the high transaction costs of these systems, intermediate forms have emerged, notably the Pollution Offset System, which is more flexible, especially if it is accompanied by the possibility to bank credits.

Such trading systems may also serve to integrate economic and environmental aspects. Social aspects may also be covered if permits are granted to all actors in the urban space with the right to sell these rights on the market. In this respect, tradable permits are more flexible and offer more certainty than other policy systems (effluent fees for example). It should be added that there is often a strong tendency to approach urban sustainability issues from a sectoral perspective (specific industries, transport, etc.), but that an important integrating mechanism is neglected, namely land use (cf. Hayashi et al., 1992). Just like energy, land use is one of the driving forces for the city to become an 'island of sustainability'. Land use management is a *sine qua non* for proper industrial location, environmental, transport and housing policy. For example, illegal housing (such as squatters) is at odds with a policy aiming at a sustainable urban development. This is indeed reason for concern about negative urban externalities, but it ought to be recognized as well that the city also creates positive externalities. The very existence of such positive externalities warrants pro-active policy intervention based on the view that urban governance has to be driven by clear and professional management principles.

NOTES

1. Haughton and Hunter (1994: ch. 1) give an interesting list of such definitions of the city as a 'parasite on the natural and domesticated environment', a 'cancer', a 'lethal illness', 'overgrown monstrosities', 'systems of disharmony'.

2. In the USA, expenditure on PAC (pollution abatement and control) rose at an average annual rate of 3.2 per cent between 1972 and 1987, and represents a rising share in GNP; similar data are available for Germany (3.4 per cent increase during the period 1975–1985) and for Japan (with an increase of 6.1 per cent from 1975 to 1986, referring only to public expenditure); see Beckerman, 1993.