Working Paper

Urban Systems and Global Change

Matteo P. Malvani

WP-95-128
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URBAN SYSTEMS AND GLOBAL CHANGE
Possible future urban trends and implications

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Abstract: An outline of the condition of urban systems on a global perspective and under diverse points of view is presented here. Some major theories on urban future are also considered, together with the situation of the current debate on sustainable city development. Quality of life in cities and the idea of a more compact and energy-efficient future pattern of urbanization are among other important issues. The metaphor of *Urban Metabolism* can be used effectively to aid scientific understanding by calling attention to a number of special conditions which are proper to living organisms, and the idea of the *Fractal City*, based on a concept of self-similarity in the urban structure, is introduced.The recent development of information technologies requires a re-organization of the city functions which should be made possible with new town planning rules. It appears necessary to guide in this way the process of urban change in ways to minimize the effects of congestion which determines the condition of non-governability common to most urban systems today. There is a set of possible measures which could be recommended for action to be taken. Some perspectives for future research in the form of a more applied phase (concrete case studies) and of a more detailed and scientifical research work dealing with some specific aspects of the subject matter considered are drawn in conclusion.

INTRODUCTION

The objective of this work is to give a first overview concerning some crucial problems of urban systems today, seen under a global perspective.
Some theorethical concepts on city development issues are therefore explored and some concrete examples are also mentioned before arriving at a proposal for a possible "way out".
As the subject matter is very broad and manifold, attention has been given mostly to specific aspects which are considered of greater interest in the framework of this sudy.

The research work was carried out with the support of the Italian National Council of Research (CNR) in the winter of 1993/94. A draft report was first issued for review in July 1994 and this final version has been worked out a year later on the basis of external reviews and with the help of the Institute for Urban and Regional Research at the Austrian Academy of Sciences (Vienna, Austria). Notes and references in the text and in the bibliography are updated to June 1994, but the author is aware of further work being published in the different subjects considered in this work.
A first follow-up applied research on the case study mentioned in the conclusions (and already outlined in the Appendix) will start at the above mentioned Institute for Urban and Regional Research (and with the support of the Austrian Federal Ministry of Science and Research) in the fall of 1995.

1. THE CITY AS A COMPLEX SYSTEM AND A NATURAL ORGANISM: CURRENT DEBATE AND FUTURE PERSPECTIVES

City development issues today can not be taken into consideration without mentioning the great environmental concern which they imply. The concept of sustainable development embraces now all aspects of "growth" and the implications on urban dynamics appear of great importance.
So as to better focus on the subject matter of sustainable city development some general introductory considerations about the widely debated theme of sustainable development should be made. Sustainable city development is in itself a very broad subject which would certainly require a specific monographic study. Therefore only an introduction to the current debate and to some reference work will be shown here.

1.1. About Sustainable Development and cities

The late 1960s and early 1970s were a heyday period of great publicity for future studies and environmentalism. The study *Limits to Growth* (Meadows *et al.* 1972) commissioned by the Club of Rome, has played an important role for the further advancement of these ideas [1]. If the 70s were the years where scarcity of resources was widely debated, during the 80s we see a shift to a new concept of Sustainability and of Sustainable Development. The danger of 'running out' of resources was not central anymore and appeared in other terms as stated before. The concern started to focus more on environmental issues and, more specifically, on a development based upon sensible management of environmental resources.

The Brundtland report (Our Common Future) is without doubt the 'textbook' of sustainable development which was there defined as a "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCDE 1987). The focus on Limits to Growth of a growth versus the environment has been shifted this way to a possible complementarity of economic growth and the environment.
According to Pearce this has been even too extreme and he argues, therefore, for a 'middle way' between the one of the environmental 'doomsters' "who have probably oversold the negative relationship between economic growth and environmental quality", and the advocates of 'environmental quality through wealth creation' "who have similarly understated the potential for economic change to damage the environment" (Pearce *et al.* 1989, pp.19-26).

Oversimplifying the whole philosophy behind the concept, one could say that sustainable development aims to achieve 'lasting' economic growth by increasing productivity without increasing natural resource use too much. And the key to this should be technological change.

It should be added here that a concept of Sustainable *Economical* Development implies also the fact of ensuring social equality and raising the standard of living, especially the one of the least advantaged in society. As already mentioned elsewhere, economic development, when just defined in the narrow terms of real GNP pro capita [2], does not necessarily eliminate

[1] For recent assessments on the evolution of the debate on scarcity and Sustainability see also Beder, S. (1993), Moll, P. (1991) and Pearce, D. (1993). A New periodical on the subject has also been recently issued: *The International Journal of Sustainable Development and World Ecology,* (Vol. 1, No. 1, March 1994).

[2] Troughout this work extensive reference is being made to GDP (Gross Domestic Product) and GNP (Gross National Product). Alan Gilpin in his *Dictionary of Economic Terms,* Butterworths, London 1973 (3rd ed.) gives for these the following definitions:

poverty. The economic (GNP) growth which has occurred worldwide over the last twenty years shows this quite clearly. Economic development should therefore be broadened to include other indicators of development such as education, health and some measures of the "quality of life", including human freedom [3].

The question on how to define Sustainable Development has actually brought in the last ten years to a wide discussion in which everyone seemed to find his own definition according on how to better suit personal needs and interests. However, nobody to date seems to have really managed to explain what it is. This question is actually outside the scope of the present study but, generally, what appears important is that the formerly often as separate regarded pillars of development and conservation have been now reconciled.

Nowadays the growing concern for environmental protection connected with development issues has become indeed a subject of almost daily attention even for the media. An increasing awareness that the earth is in danger can be now noticed not only in the activity of environmentalist movements but also at political levels; today most actual development policies and strategies must actually somehow include sustainable implications in one way or another.
If greater attention can be noticed within the economically more developed countries - even though with diverse concerns at regional and national levels (see i.e. Austria, Germany or Scandinavia as opposed to the mediterranean countries for the EU, or Australia - New Zealand in the Pacific) - it must be noticed that environmental and sustainable development issues are mostly ignored in the less developed South (see also figure 1, page 9). The so called More Developed Countries (MDCs) are actually responsible for today's menacing global environmental situation while the Less Developed Countries (LDCs) are becoming the greater polluters of the world, having to face urgent priorities with scarce technological means.

As will be discussed more in detail in chapter 3, it must be said that urban development issues determine important impacts on the global environment. Generally, demographical growth - which normally determines urban change - implies growing pressure on natural resources; more need for consumption is also accompanied by more waste being produced and dispersed into the environment. Also, more people - wether dispersed in the territory or concentrated in greater cities - still need more and more (still polluting and mostly private) transport possibilities.
There are some examples of growing cities (i.e. Vienna) where a comparatively high percentage of the urban population takes advantage of public transportation and where, in general terms, a better balance between city development and environmental protection has been achieved, when compared to other urban systems. Nevertheless it should be admitted that an optimal efficiency from this point of view can only be reached through political will and above all with appropriate technological infrastructure and financial means. A co-operation between LDCs and MDCs appears therefore particularly meaningful in this sector.

Gross Domestic Product at Maket Prices: The value of goods and services produced within the nation, charged at ruling prices. Prices include all taxes on expenditure, subsidies being regarded as negative taxes. Gross domestic product does not include net property income from abroad.
Gross National Product at Market Prices: The Gross Domestic Product at Market Prices *plus* net income from abroad (i.e. exports minus imports).

[3] This implies also a concept of Sustainable *Social* Development. For reference on the quality of life, see also note 27.

Yet, how can we consider the concept of sustainable city development as related to the context of urban systems? And what are the implications? In the more recent years some literature has flourished on the subject matter, even if generally the wide discussion on sustainable development has been mostly neglecting the spatial component [4].

In a recent book on *Sustainable Development and Urban Form* edited by M. J. Breheny the authors, generally, maintain that the major environmental issue of our time is global warming which is caused by greenhouse gas emission, mainly carbon dioxide, produced by burning fossil fuels. According to the authors, since commuting accounts for a substantial part of energy consumption and emission production, making cities more compact will reduce the problem. Additionally, if more people would walk, cycle, or ride public transportation, if greater use of combined heath and power production is made, and if cities could maintain more green space, so much the better (see Breheny 1992).
Although these conclusions sound logical and commonsense and, as a matter of fact, are widely recalled throughout this present study, the efficacy of reducing energy consumption as a result of compact city design doesn't seem to be conclusively demonstrated in the book. Moreover, making cities more environmentally friendly (as it is there argued) doesn't necessarily mean to make them also more 'people friendly'. Some attention should be devoted also on social problems and on the issues of urban structure on human welfare. Even if some authors conclude that lifestyle, political leadership and general economic conditions are probably more important factos in the sustainable development debate than urban form, the comprehensive picture suggested in the title doesn't seem to be provided.

Peter Nijkamp (1990) defining sustainability as a concept from (eco-) systems dynamics which refers to the morphogenesis of a dynamic system liable to evolutionary change, further states that Sustainability in an urban setting describes the potential of a city to reach qualitatively a new level of socioeconomic, demographic and technological output, which in the long run reinforces the foundations of the urban system.
Sustainability, in this framework, refers then to continuity of the urban system in changing situations.
According to Nijkamp, similar to ecosystems, urban systems exhibit in the long run a certain 'morphogenesis', a qualitative change in dynamics which moves an urban system towards a different level of organization. A war situation, a catastrophe, a decline of a dominant employer or a major new policy initiative may induce a very clear role change (e.g. from an industrial city to a recreational city; from a seaside resort to an electronics centre; from a railway town to a university city, etc.). If the urban system has reached a level of sustainability which enables it to "survive" it will then reach a new qualitative level. If the self-organization of an urban system fails, a phase of non-sustainability is likely to start, and this would imply a structural decline of the economic base of a city (reflected in population decline, loss of employment, out migration of industries and services, unbalanced sociodemographic composition, etc.).
Nijkamp's conclusion is that one of the keys factors for ensuring urban sustainability is innovation, as this leads to a qualitatively different base of the urban system which, in turn, may lead to continuity under different circumstances.

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[4] See for instance Breheny (1992); Girardet (1992); Hardoy *et al.* (1992); Stren,White, Whitney (1992); Nijkamp, Perrels (1994). A good recent analysis of the global problematic is shown in the work of Alberti *et al.* (1994);
The subject of Sustainable city development has also been the main theme of the Global forum '94 in Manchester (UK), June 1994.

Jorge Hardoy (1992), who sees the problem more in ecological terms, maintains instead that a stress only on Sustainabiliy (as opposed to Sustainable Development) for the urban system would actually imply large investments in reducing the use of fossil fuels (especially coal), decreasing the throughput of freshwater and non-renewable resources, and controlling air and water pollution. It might then include draconian measures to prevent people moving to urban centres. Such policies, while doing little for poorer groups may, in many instances exacerbate their problems. And all this doesn't really seem to ensure durability to the urban system, at least in economical and social terms.
According to Hardoy, the disaggregation of sustainable development in its two components actually simplifies its discussion in regard to cities. The sustainability component is the impact of each city (or rather of the producers and consumers located within the city) on environmental capital: local and global sinks, renewable resources, and non-renewable resources. The development component is the performance of each city and its institutions in meeting its inhabitants' development needs. This is also an important environmental component since the quality of the home, work, neighborhoods and city environment, and the extent to which the inhabitants are protected from biological pathogens and chemical pollutants in the water, air, soil or food or other environmental hazards has a major influence on the health and well being of the population.

As it is clear from the couple of examples on the subject considered so far, much intellectual effort is involved and is being devoted in trying to define also what *sustainable city development* is all about, and whether specific policies or paths taken are actually *sustainable* or not. Maybe, instead of investing so much energy to foster an important discussion which, however, in terms of actual actions to be undertaken may sound somehow fictitious if our scope is to solve concrete problems, it would appear more sensible to direct efforts towards identifying the consequences of actions and evaluating alternative choices.

As first concluding remarks it must be reckoned that a form of development is certainly necessary for the healthy life of the urban organism and to ensure durability and an aptitude to change to the urban system. It should be recalled, nevertheless, that the main objective to be pursued is to grant urban citizens with increasing higher levels of quality of life, enabling them to live well in functional cities - where attention should be granted also to esthetical values - and in a good balance with the environment.

Under this point of view it should be mentioned that even though environmental aspects are of utmost importance in city development issues, great attention should also be granted to other aspects which may also be considered as important indicators of the quality of life.
When making for instance realistic analyses previous to the actual planning process, socio-anthropological factors should not be forgotten. This implies trying to keep in mind who are the actual subjects for whom urban planning issues are meant. Similarly, it appears important to devote attention to the possible impacts of innovation and technological development on the social and physical structure of cities. Long-term policies able to identify alternative scenarios could be helpful in this sense.
Moreover, city development should be also seen in *functional* and not only physical terms.
Attention to important organizational aspects should combine need for travel within and among cities with enabling citizens to take advantage of services and facilities without having to invest too much time and energy. This means, in other words, to improve access modality.

The key factor of innovation identified by Nijkamp for ensuring urban sustainability (as mentioned above) can now actually be seen in the role of the new communication

technologies. These are developing very fast and the great potential contained in their possible range of applications should be carefully planned and possibly foreseen with great advance.
A drastical reduction of the use of resources (as mentioned by Hardoy) appears as difficult as having to suddenly change habits of people. Nevertheless it would be interesting and maybe worthwhile to show eventually with pilot projects wether it may be possible to reach satisfactory levels of development with less effort (in terms of energy consumption) and less emmission of hazardous pollutants.

In conclusion, before worrying about the sustainability of the urban sistem (which actually means its survival in a development process) it would actually be more important trying to understand how a city works. The methaphor of *urban metabolism* explored in paragraph 1.2. may therefore give some useful hints, recalling even the idea of sustainability of living organisms.[5]

It can be now of interest to mention some concrete cases of cities which have somehow managed in reaching a form of development while preserving their natural environment. What follows is the example of two special asian cities which experienced an interesting urban transformation dynamics which is worth mentioning.

1.1.1. Two examples of cities 'that work'

In a recent Symposium held in Kobe in September 1993 Prof. Pang Eng Fong presented an interesting comparative analysis of two cities which succeeded in transforming resources and energy in ways that improve human health and welfare while preserving the natural environment (Fong 1993).

The two cities, Kobe and Singapore, are quite different from each other, not only for the historical, cultural, social and political backgrounds they have but also for their physical and environmental settings. Nevertheless, they show similarities in the way vital problems have been faced by local authorities in the different existing conditions. In both cases success in urban redevelopment was the outcome of integrated planning of institutional and financial processes in an expanding economy. Both in Kobe and Singapore the authorities studied the problems thoroughly and considered carefully the direct and indirect impacts of their proposed solutions. According to Pang Eng Fong, the lesson from their experience lies not in the nature or design of the new organizations the two cities set up or in their project financing methods. Rather, it lies in their approach to problems, an approach that combines a long-range pragmatic planning orientation with an emphasis on flexible, institutional response.

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[5] The following methaphor even though it may sound at first somehow ingenuous, may give an idea on how far the concept of sustainability can be extended:
The human body, like any other living organism, is a sustainable system: it grows and develops both physically and intellectually but remains balanced and healthy as it becomes old, reproduces itself ensuring the survival of the species before death comes. Some action of man may actually not be considered sustainable with regard to the outer world, as it causes pollution and destruction while using resources to sustain the body and secure its survival. In ancient times (before big polluting mega-cities existed) man lived in balance with the eco-system, as still occurs with many animal species. Man is not only a physical entity and he is also, among others, the actor of development. Cities are made of human beings to satisfy their needs and problems originate with growing numbers and concentrations. Men grow in number (more than in size!) but concentrate in cities making them over-sized: too many people imply too much pressure on the environment, which, accompanied with greater demand for development, may eventually bring to a state of 'non-sustainability'.

In this study, the three combined aspects of population growth and urban redevelopment, transportation and urban living, and environmental protection are analyzed and compared for the two cities.

Kobe, a city which grew intensively especially in the 50s and 60s because of its port and of industrial activity was soon faced with a highly congested port and old central city area. The solution, together with early successful measures to revitalize the central city area, was to build a new island from landfill taken from parts of the Rokko Mountains. Occupying a narrow strip of land 30 kilometres long and two to four kilometres wide and with the Rokko mountains at its back, Kobe could this way expand its physical area greatly by reclaiming land from the sea. The project - originally considered risky, costly and disruptive - of the construction of Port Island was then begun in 1966 and was completed in 1981 at a cost of 530 billion yen (a third of which came from the central government and the rest of which was raised by issuing municipal and Port Authority bonds internationally). The project, managed and coordinated by a specially created organization, produced high financial and social returns. The city more than covered its costs by selling land and facilities, and the creation of Port Island and Suma New Town in parts of the mountains which were cut away helped move population away from the congested city centre and into new housing units (altogether housing and amenities for 20,000 inhabitants).

Singapore, like Kobe, owes its existence to a deep harbor. The traditionally multi-racial population of this city-state grew steadily till the 60s, slowing down during the 70s and 80s and reaching 3 million in 1990 (twice that of Kobe in the same year). With an area only one fifth larger than Kobe, Singapore has a much higher population density. Compared to Kobe, Singapore's geography of fairly flat terrain presented few problems: land could be easily developed for the expanding population without the risk of any natural hazard. The challenges the city had to face were merely economic, social and political rather than physical. In the early 60s the newly elected government acted quickly to remove the administrative and legal obstacles which impeded the execution of its economic and social development programs. As a result of an innovative and flexible organization the government created new public agencies like the Housing Development Board (HDB) (established in1960) and later the Urban Redevelopment Authority (URA) (since 1974), which, with new laws like the effective Land Acquisition Act of 1961, successfully managed in relieving the congestion in the Central Area. By the mid 60s the HDB had built 54,000 apartments (4000 more than the planned number) bringing the proportion of the population living in government built apartments from 1% in 1960 to 23% in 1965. As a consequence of the take-off of the economy (following the influx of foreign investment from developed countries) this proportion was then to grow till 90% in 1992, with steady attention being devoted always more on the improving of the quality of public housing and to urban redevelopment. Since 1965 the implementation of the Ring Concept Plan for physical planning provided also a series of measures among which the creation of new satellite towns separated by open spaces and the location of heavy industries in the outlying western and northern areas of the island, so as of light non-polluting industries near the new towns. The realization of this plan has greatly altered the physical face of Singapore and contributed much to the quality of life on the island.

In the case of Kobe the mayor and his team played a critical role in the projects undertaken and the City government worked closely with the central government to secure financing and to ensure that the port expansion project was in line with Japan's development plans. On the other hand Singapore's peculiar condition of an independent city-state with efficient and far-sighted administrators was certainly also an asset. In both cases, however, urban planning

would have failed in the absence of a sound economy that provided the financial resources for development or improved the capacity to borrow from the international financial market.

The approach of the two cities is actually revealed in their capacity to develop long-term projects and plans. Kobe has also drawn a Third Master Plan for the year 2001 with the objective of raising further the quality of life of its residents. It plans to create a city in which people participate fully in the community, and enjoy productive lives in harmony with the environment. In Singapore, the long-term objective is similar. The government plans to "create a city within an island which balances work and play, culture and commerce; a city of beauty, character and grace, with nature, water bodies and urban development woven together" [6]. The Plan envisions that when Singapore's population reaches four million, it will be a city surrounded with regional centres of 800,000 people each, working near home, and living in a city with cooling waterbodies and cloaked in the greenery of parks and protected tracts of forests. Singapore's aspiration is to be a tropical city of excellence and an international investment hub with an Asian identity.

In the field of urban transport planning, the two cities have successfully designed transport systems to enhance accessibility and mobility. In both cases transport planning is carried out not in isolation but as an integral part of development and land use planning; land use development strategies have been adopted to minimize travel time, for example, by locating labor-intensive industries and amenities like schools and shopping centres near or within housing estates. In particular, the long-term goal of Singapore's government is not to provide for greater mobility of residents but to increase their access to goods and services, encouraging the decentralization of economic activity and governmental services and promoting the use of information technology.
Unlike Kobe, however, Singapore has introduced since the early 70s a series of increasingly tough restraints on the use of private cars and on car ownership. Besides increasing parking charges and road and import taxes on cars, Singapore was in 1975 the first country in the world to introduce an Area Licensing Scheme requiring cars entering the Central Business District to pay a fee. In 1990 the government introduced a Certificate of Entitlement (COE) scheme. Only new cars with COEs (issued by the government for the number of cars allowed in the road) will be registered, and COEs are compulsory for cars older than ten years. To give an idea of what this means, cars in Singapore cost on average four to five times that of similar cars in developed countries and COE price for small cars is about twice the landed value of the car. An Electronic Pricing System (ERP) is also planned for 1996. It will monitor traffic at key locations on busy streets charging car owners automatically, through electronic sensors, on how often they use the road.

Both Kobe and Singapore paid early attention to the quality of their environments through a series of Ordinances and campaigns dating back to the late 60s and early 70s which have been very successful in improving especially air and water quality. In Singapore laws which provide for stiff penalties for offenders (among which also "corrective work orders" - that is, pick up litter -) have been introduced. News of a foreign tourist being publicly and legally 'beaten' for dirtening a wall with colour spray is a quite recent matter which has also attracted international media attention.

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[6] Urban Redevelopment Authorithy (URA). 1991. *Living The Next Lap: Towards a Tropical City of Excellence.* Singapore

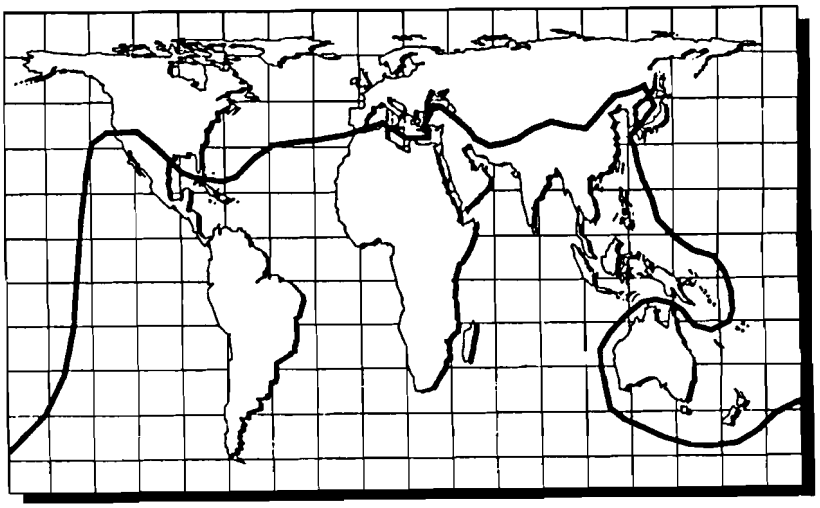
In the case of Singapore it is worth mentioning that a sort of philosophy seems to justify such 'tough-minded' approach to problems. In its view, the right of the society to survive must take precedence over the rights of the individual, and therefore if it is to protect and advance the interests of the country, the State must have the powers to override sectional and individual interests. In general terms it can be argued that this approach may be extreme if we consider the well being of the individual as an important indicator of the quality of life.

1.1.2. The tropical belt cities: different conditions and priorities in the Third World

The subject of the peculiar conditions of the big Mega-Cities in the LDCs is a special subject on its own and requires deep and careful attention. Some considerations on demographical and economical data are made in chapter 3 but the question is so broad and complex that it should be treated separately in a monographical study.

The trends occurring in the South of the World are indeed quite different from the situation of the cities in the more industrialized North (see figure 1) , and even if each reality has its own specific aspect, some common lines can be traced.

Figure 1: The North / South Divide



Source: New Internationalist, April 1992

Generally, we have to reckon that a transition from rural to urban economies is taking place at different scales in many Developing Countries. This, together with the still high rates of population growth on absolute terms, can be seen as a major fact in the urbanization process taking place (see also fig. 9, page 32).
One of the biggest problems in Third-World Mega-Cities is certainly that of urban poverty, associated with housing and sanitary issues. These problems suggest the fact that a concept of *Urban Health Management* should be further developed and implemented through effective policies. A series of vital problems - which regard the mere survival of individuals - should be faced before it may be possible to devote the required attention also to environmental problems, which are here, indeed, very threathening especially on a global perspective.
A good picture of the urban condition in LDCs is given by Gilbert and Gugler (1982), Oberai (1993) and Hardoy (1992). This last one explicitely refers to environmental problems in Third World cities.
As already mentioned elsewhere in this paper (see paragraph 3.5.), Berry (1990) foresees a pattern of Global Urban network for the future, in which a growing number of very large cities are located in the so called World periphery - that is in the South of the World. The greatest modifications of the biosphere will occur in these massive urban agglomerations, periferal to the main channels of global interdependence, changing the regional environments within which a growing proportion of the world's population live marginal lives, pressed to the treshold of subsistence. Berry points then out that "the scale of Third World urban growth is such that even if First World environmental impacts are significantly reduced, the reductions will be swamped by the increase occuring elsewhere. It is for the Third World's economic growth and

urban concentration that the most serious regional threats to the global environment will come". (Berry 1990 - 118)

1.2. Urban Metabolism

Cities can be considered as complex living systems or organisms characterized by basic *metabolic* processes. They take in people, resources, energy and products, transform these into a distinctive quality of life, and emit people, products energy and waste (Ness 1993).

The term urban metabolism is used as a metaphor to aid scientific understanding by calling attention to a number of special conditions which are proper to living organisms.

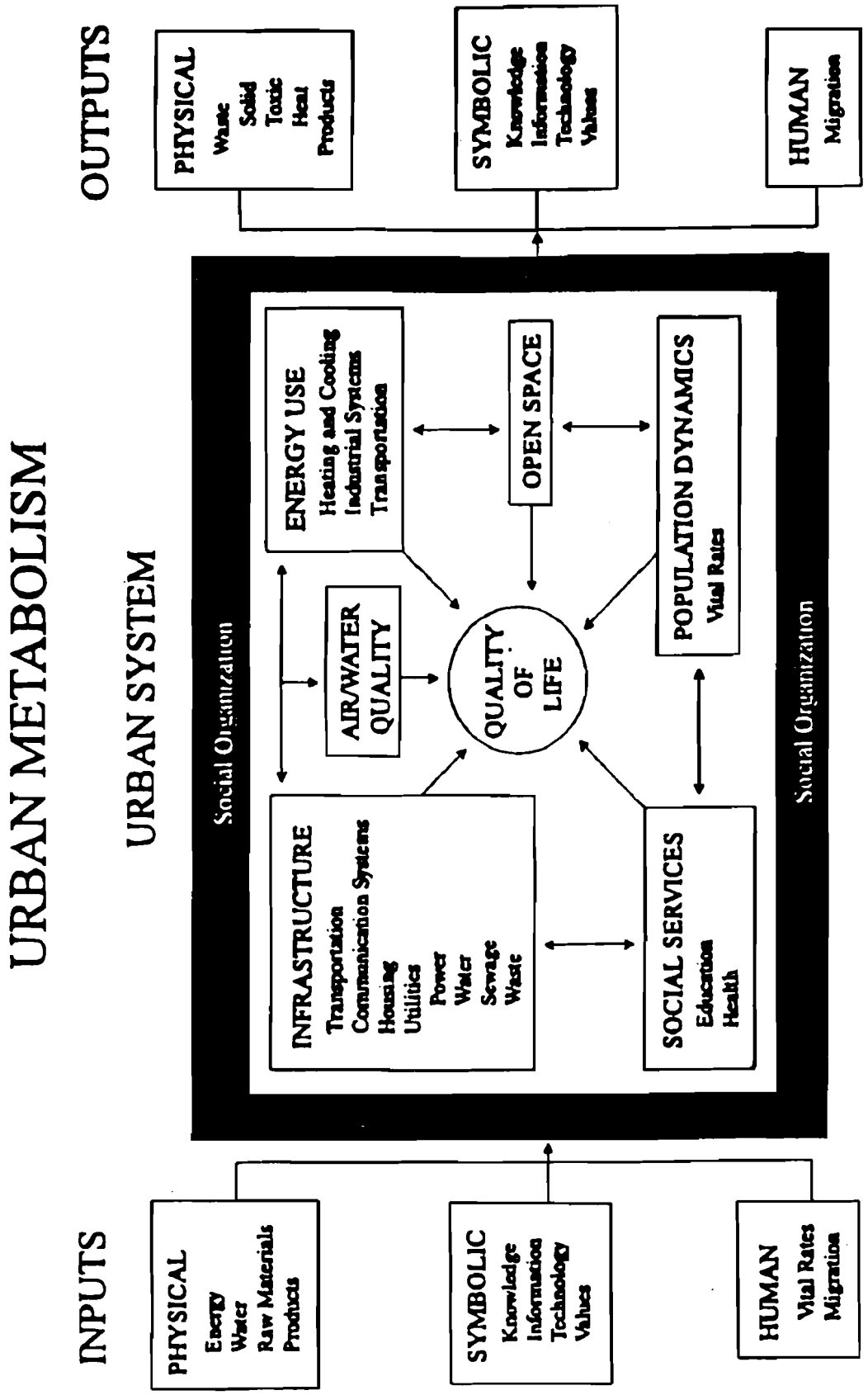
The human being is itself a metabolic system, receiving inputs like food and sunlight from the external world and sending back products like work and waste. Our bodies are made up of millions of small units, cells that join other cells to constitute tissues and, ultimately, organs that are the components of highly ordered systems. Metabolism is the process by which these cells, tissues and organs transform inputs in the body, through different steps at different cells, each using inputs for their own survival and growth, defense and detoxification. All of the body's cells interrelate, having direct and indirect contact through the blood stream. Through immunological and detoxification systems, this complex structure is ready to defend itself against external aggressors like bacteria, virus or toxic agents. The human body generates waste through heath, carbon dioxide, urine, feces, vapor. Most waste is expelled from the body in non-toxic elements. When the metabolic and detoxification processes are overloaded, toxicants might get stored, but this is not the rule. Urban systems, on the other hand, have waste storage organs and generate by-products that are toxic to the environment.

Metabolic processes are central to life itself, but they can function well and efficiently in a healthy manner or badly and inefficiently as in sickness. If they are efficient, they produce a healthy and vigorous organism. If the process is deficient they leave an organism less vigorous, sick or even produce death. Cities in the world today certainly show great variation in their health and vigor. Some cities produce a high quality of life for their inhabitants with relatively little energy and waste. This is the case of many cities in Europe, Japan and the USA which, for example, have become more efficient in the past decades. In Eastern Europe, Russia or China, cities seem to use instead increasingly high amounts of energy and emit vast wastes while producing a low quality of life.

The analogy between a large organism and a city is therefore effective. The health of the urban ecosystem depends very much on a continuing supply of essential materials, energy and information, and on the disposal of unwanted wastes. As urban systems grow in size, the air and water systems are called on to dispose of more and more waste and the importance of man-made circulatory systems (man-managed transport systems) is also increased.

Besides *human* and *physical* resources, the city needs certain *symbolic* imputs as well, since it is itself a human system. These include values, knowledge, and information, some of which originate also outside the city. Within the urban system, demographic processes also generate human resources, social services, and physical infrastructure. The interaction of these factors produces a distinctive quality of life. The systems emits to the rest of the environment *physical* outputs, including products and wastes, *human* migrants, and *symbolic* products (see figure 2).

Figure 2: Schematic diagram of urban metabolism.



Source: Ness (1993)

In 1965 Abel Wolman was probably one of the first to use the term "metabolism of cities", and Ken Newcombe carried a pioneering study on the metabolism of Hong Kong in 1978. Since then, the most recent studies and activities on the subject are the ones coordinated by Gayl Ness and Richard Berk [7].
The study on Hong Kong carried out by Newcombe *et al.* (1978) presents interesting data from a city of the tropical Far East which has lower quantities of materials and energy investment (on a pro capita basis) than those usual in a developed industrial nation, but whose population enjoys a quality of life comparable, by many indicators of physical, mental and material well-being, with populations of the developed world [8] (see figure 3).

Herbert Girardet (1993) also sees the main role of the modern city as a giant processor of materials but points out the importance of reorganizing their functioning, developing a form of *circular* metabolism. Every output can theoretically be re-used as an input into the production system, this way reducing the impact of cities on a much smaller hinterland than now and mitigating energy consumption as well as pollution flow intensities. Most cities function today with a linear metabolism which implies 'taking-in' from a vast area (Global Hinterland) with no thought for the consequences, and 'throwing away' the remains without returning anything from where it was taken. As an example of circular metabolism Girardet points out how the cities of China to this day return human waste in form of urban sewage fertilizer to the belt of farmland that surrounds them and which is maintained by them. These interesting considerations, although original, are not sufficiently supported by significant background material and references and are not developed in detail.

The metabolic metaphor requires also an interdisciplinary approach to the problems of cities and their futures. As complex living systems, cities cannot be studied by one discipline alone. Like other living systems, cities must breathe, eat, digest, generate energy and eliminate waste. Each of these activities is often studied by different scientific disciplines. The specialization of scientific disciplines while being greatly helpful in increasing our understanding of the way things work, may also create barriers to understanding by restricting communication among the disciplines. It is therefore of vital importance to increase the communication and collaboration between the natural and social sciences, engineering, law and other professional perspectives. In this view, none of the problems of cities can effectively be solved by one discipline alone.

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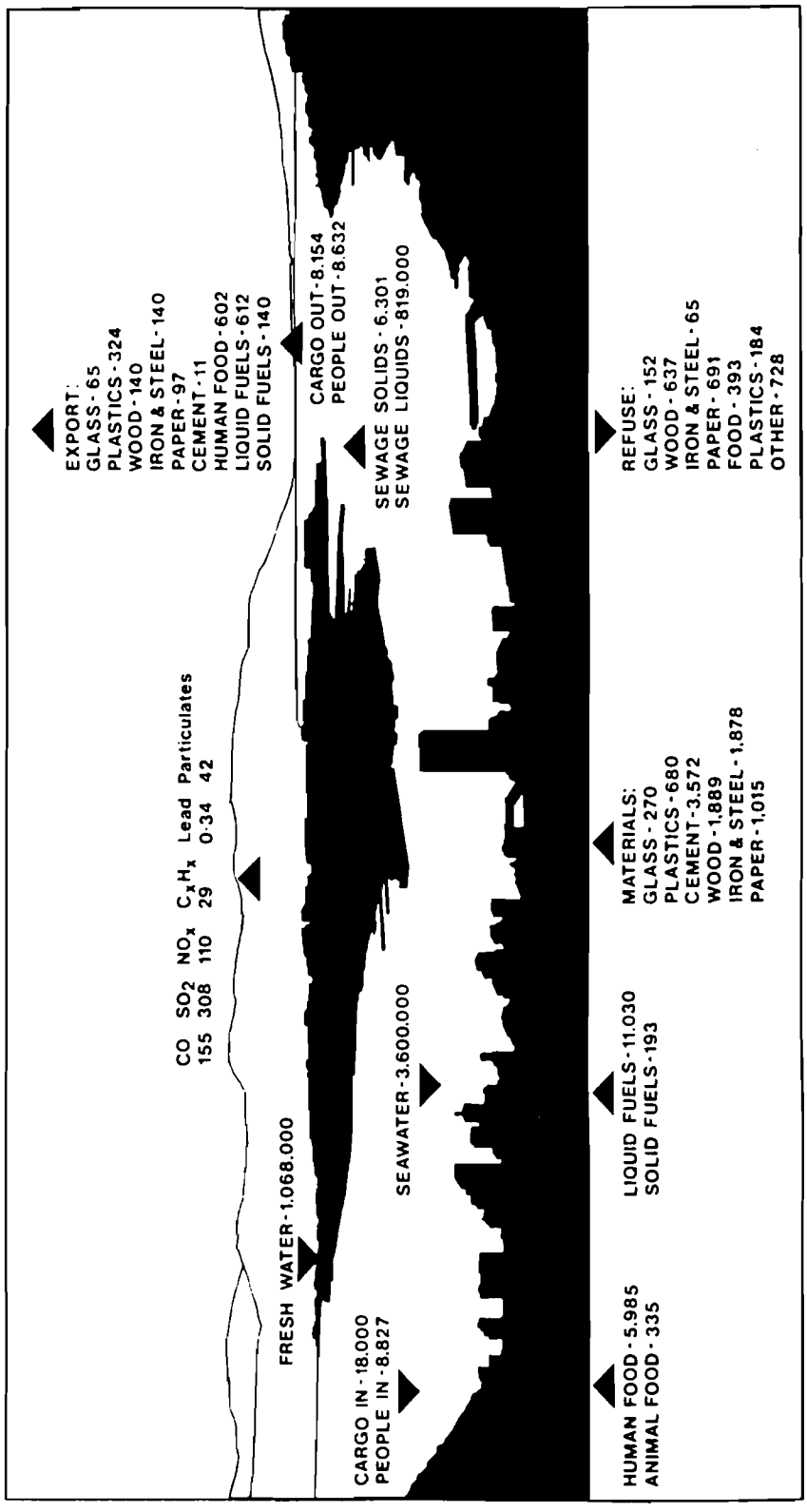
[7] For reference on urban metabolism see Wolman, A. (1965), "The Metabolism of Cities", *Scientific American,* September, 179-88; Newcombe *et al.* (1978) "The Metabolism of a City: The Case of Hong Kong", *Ambio,* 7, 3-15.
In September 1993 Prof. Gayl D. Ness, Director of the Population-Environment Dinamycs Project of the University of Michigan at Ann Arbor coordinated - jointly with the Asian Urban Information Center of Kobe (AUICK) - an International Symposium on 'Urban Metabolism' in Kobe, Japan. Proceedings of the Symposium will be published this year.
Prof. Richard Berk (Center of the Study of the Environment at UCLA) is organizing a follow-up meeting to the Kobe Symposium for next July 11-13 1994 in Los Angeles. A Later appointment of the scientific community is then planned in Brisbane for the fall of 1994.

[8] In 1971 a total of 87 MJ (megajoules) per person of energy was used per day, which was one sixth of the consumption of developed countries and three times more than that of developing countries. Annually 2.39 million tonnes of plant nutrients entered Hong Kong food supply system: just over a half tonne per person per year. In 1971 the annual output of waste gases in Hong kong was 255,000 tonnes, about six tonnes less than a more sprawling city with the same population in a developed country. Anually waterborne sewage solids amounted to 2.3 million tonnes, 80 % of which was pumped untreated into Victoria Harbour. Daily the city discharged 2850 tonnes of solid waste, 0.7 kg per person (see Newcombe *et al.* 1978).

Figure 3: Diagrammatic representation of the flow of important materials into and through the settlement of Hong Kong.



Note: All units are in metric tonnes per day. Arrows are intended to give some indication of the direction of flow of materials.
Source: Newcombe (1978).

The necessary understanding of the characters of the metabolic processes requires the need for research and monitoring. A broadly based standardized monitoring of urban conditions should be finalized to the promotion not only of an understanding of the metabolic process itself, but also to distinguish more from less efficient processes. The Plan of Action of the Kobe Declaration and the Kobe Protocols which were the outcome of the 1993 International Symposium on Urban Metabolism, insist on the importance of a concerted and continuous commitment to data collection within the highest feasible scientific standards. Global monitoring is common in the physical and natural sciences but is quite rare in the social sciences. This social measurement requires the development of standard accounting systems and standard protocols so that the same conditions will be monitored around the world.

The next step of action implies a transfer of information among cities to pursue the ambitious goal of building sustainable cities for a sustainable global society.

The metaphor of urban metabolism appears as an important key for understanding how cities actually 'work'. It can be, therefore, of great help in guiding the process of the definition of concrete action for a re-organization of city functions in a resource and energy efficient way (see paragraph 2.2.).

1.3. The Fractal City

Topographically and functionally a natural city has a *fractal* structure.

Using this terminology, borrowed from the mathematical sciences, the attention is intentionally stressed on a system in which each element or part of the whole is structured similarly to the whole system itself [9]. The concept of self-similarity involved in this theory can effectively be applied to the study and to the interpretation of the inner structure of urban systems. An example of a fractal structure is shown in figure 4. The analogies with natural urban settlements are in these cases quite apparent.

It has been previously highlighted that cities are natural organisms with metabolic processes. If we consider the social structure of cities we can also state that the city is nothing more than a *'machine to communicate'* [10]. These two concepts, apparently quite different from each other, are indeed not antithetical.

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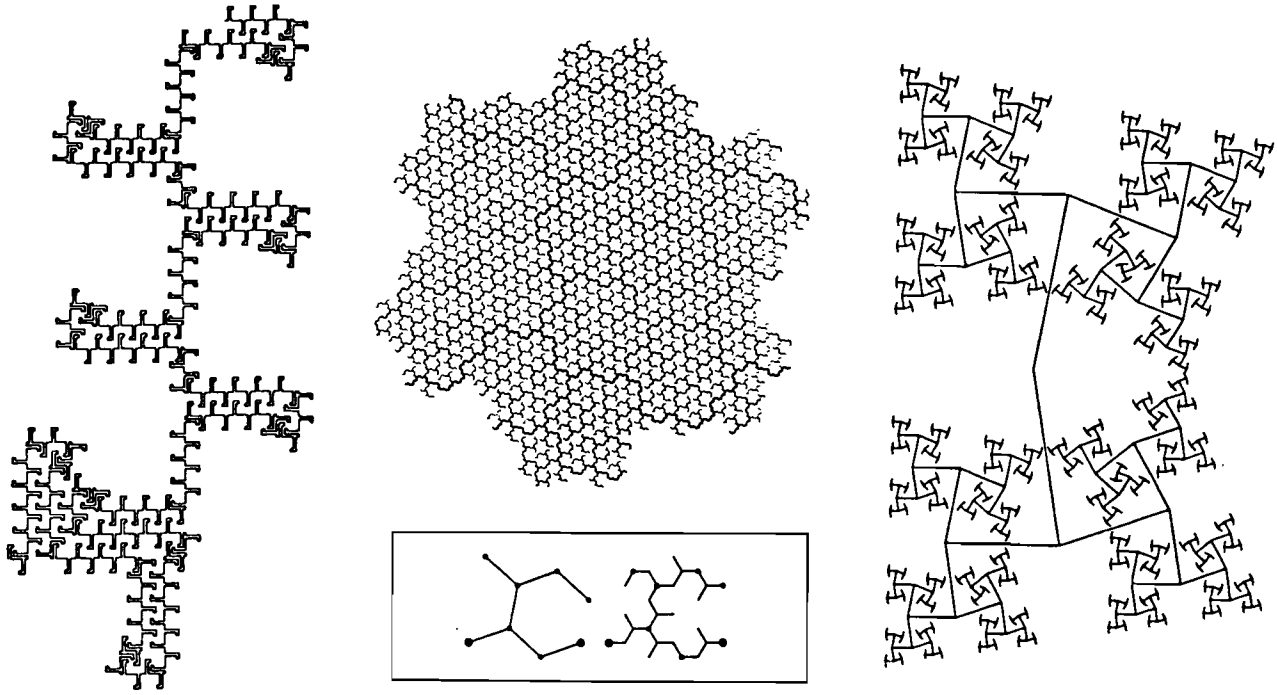
[9] The concepts of *fractal dimension* and of *fractal geometry* were first introduced by B.B. Mandelbrot (1967; 1982) in trying to define shapes which are irregular but self-similar, such as snowflakes, trees, crumped newspapers, mountains or coastlines. Such shapes are considered to have a fractional of fractal dimension (nonintegral dimension, from the latin *fractus* = broken).
Some scholars, among which Michael Batty and Roger White developed a line of research based, respectively, on the concept of fractal dimention and of self-similarity applied to curves describing the urban boundaries of towns, and on the application of *cellular automata* to urban systems. (see Batty 1986 and White 1993)

[10] In the 1930s Le Corbusier, considering the residential function of the city as one of its most important priorities, actually referred to it as to a *'machine à habiter'*.Whith the idea of the *'machine to communicate'* we actually paraphrase the great master of modern architecture without any critical intention. About the meaning of the 'communication' role of cities, see also the paragraph on the quality of life in chapter 1 of this study.

Figure 4: Fractal figures



4.1. 4.2 4.3

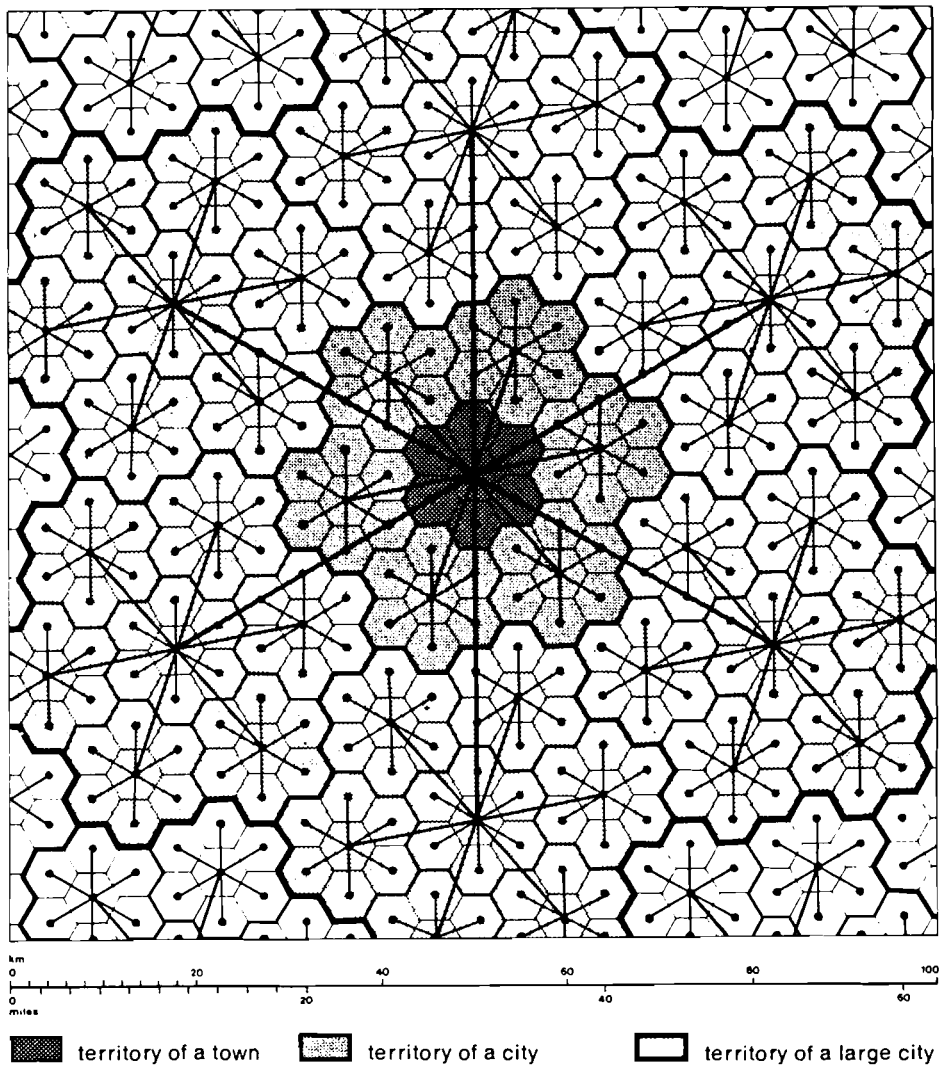
Note: In the Euclidean geometry a line has a dimension 1 and a plane has a dimension 2. All these self-similar figures have a 'fractal' or undefined dimension (which is situated between 1 and 2), as the level of definition depends on the scale used for measurement. Similarities with naturally grown human settlements are quite apparent. While figure 4.2. recalls the image of a city, the form of layout plan shown in figure 4.3. has actually often been suggested by town-planners as an ideal layout for residential housing areas.
Source: Mandelbrot (1982).

The urban system is characterized by an intermingling of material and informational flows (inputs) which enter the system and are processed and diffused in it before being transferred away again (to other similar systems) as outputs. Communication in the city occurs through an exchange of information, services, objects but especially in form of direct face-to-face contacts and interactions among people. At the village dimension this sparkling process occurs inside one simple 'container', without any level of specialization. When the urban system grows, services and contacts become organized according to hierarchical patterns.

The hierarchical organization of functions within the city pushes the system itself towards greater dimensions, and the wider the base, the more differentiated the functional hierarchy will be - that is, in other words, - the degree of specialization.
People are attracted to the great cities since the functional hierarchies make it possible to utilize diverse talents and arts and to insert the individual in a broader social milieu.

The primary community of the Fractal City is the *quarter* or neighborhood. Daily life is managed at the local neighborhood level. Schematically, the single neighborhoods join together in groups of seven, with the central one hosting the functions of the next hierarchical level, e.g. that of weekly activities (see also figure 5).

Figure 5: A theoretical pattern of territorial organization of large cities.



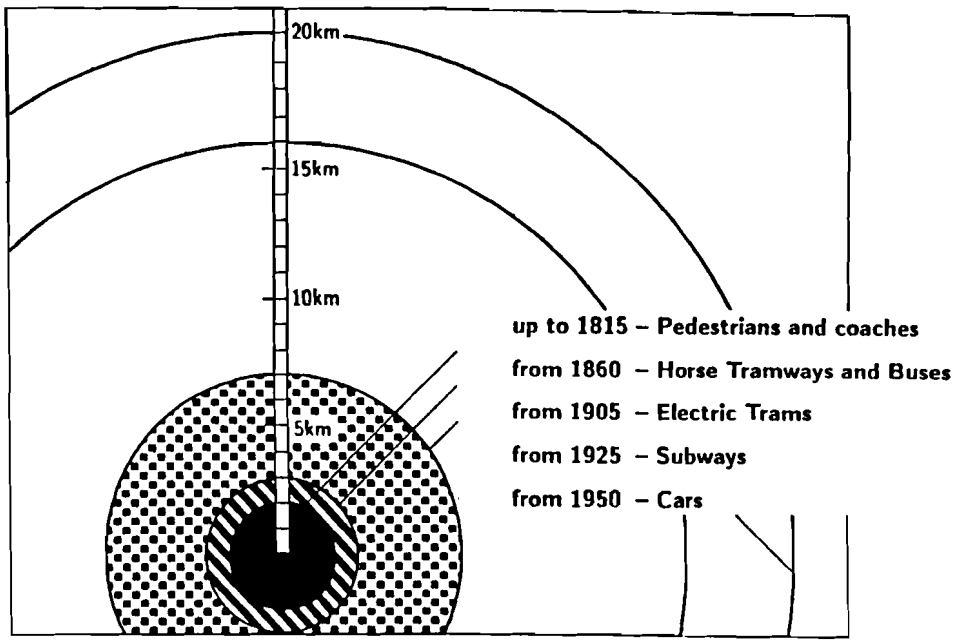
Note: This self-similar urban pattern shows the functional hyerarchy whithin a city. The network of relations among the neighborhoods and the centres is a fractal figure.
Source: Doxiadis (1974).

This type of organization permits the inhabitant of the big city to live in the village where he is protected by the 'warmth' of the daily social interactions and to move to the next hierarchical levels to take advantage of more specialized functions. The seven basic functions should be made possible within the neighborhood: housing, work, free-time leisure, education, supply provision, and communication. This last one, especially, implies a minimization of traffic flows. The re-concentration of functions will tie people more to places, enhancing again walking connections as a ground possibility to ensure accessibility to the work place and to services. Walking distance and bicicle scale will also be enhanced by clusterings of trip ends, according to a more rational and compact dislocation of services.

Neighborhoods and 'sub-centres' within the city should be connected by a net of high frequency, fast speed computerized transport net (maglevs) with an average accessibility of the stations in the range of 500 metres. This will ensure longer distance connections. The

overall functional dimension of the urban system will depend on the speed and frequency of the transport system [11] (see also figure 6).

Figure 6: The growth of a big city (Berlin)



Note: The fact that the "daily radius" depends on the speed of transportation is clearly shown by the evolution of the size of the city of Berlin. The 1800 Berlin was very compact with a radius of 2.5 km determined by a speed of 5 km/h, the speed of a man walking. With the introduction of faster and faster means of transportation the radius of the city grew in proportion to their speed, and reached now about 20 km relating to a mean speed of cars of about 40 km/h. The centre of the city can be defined then as the point which the largest number of people can reach in less than 30 minutes.
Source: From Lehner, Marchetti (1992)

The type of city organization described up to now is potentially both an energy efficient and energy flexible structure. Savings can be made in travel and in space heating. The reduction of unnecessary travel is made possible by a higher functional compactness and by the mixing and closer integration of land use, associated with eventual clusterings of trip ends. Moreover, these conditions appear particularly suitable also for the economic introduction of energy efficient combined heath and power generation systems (CHP/DH) [12]. Small scale exploitation of solar power and other renewable energies are also not incompatible with the characteristics of this pattern of diffused concentration. Energy flexibility is in any case ensured in the sense that facilities are available if mobility were to become restricted in the future (see Owens 1986).

[11] The dimension of the city depends on the type of transport available. Interesting studies have been carried out by Marchetti of IIASA and Zahavi of the World Bank. (see Marchetti, C., *Trasporti e città. Le linee Guida*, internal publication, IIASA, Laxenburg, undated.

[12] CHP/DH: This system generates electricity and produces hot water as a byproduct. This water, which is heated up as it cools the turbines, is piped into homes, factories, public buildings, and swimming pools. Inner-city or compact districts with high population densities are particularly suitable for CHP because hot water can circulate through the relatively short distances of insulated pipes: cities as Stockolm, Stuttgart and Helsinki already operate the system. For further reading on CHP District Heating, see also Owens (1986, 51-59) and Nijkamp, Perrel (1994) for examples of applications.

The megalopolis is basically not necessarily incompatible with the human being if its structure grants and respects the anthropological contexts of his inner nature. Under this point of view also esthetical values should find their place in the city. 'Beauty' is a supreme calming and comforting value and man draws reassuring signals from the quality of living structures. In the ancient town this value was ensured by bringing art into to the city through the work of great masters and by the presence of horticultural gardens within the city walls. In the town of today the safeguard of the natural environment and of the cultural heritage, together with the attention for quality in architecture and the built environment should be given a special priority.

A fractal structure in the city can theoretically be achieved both in the case of a re-structuring and re-organization of already built-up areas and also in the designing of new expansion districts to be integrated as self-sustainable elements to the existing city.
The concept can be further developed in detail only when considering practical examples which relate to specific urban contexts. Therefore the need for applied case studies (see also paragraph 2.2.).

1.4. The Wired City

The idea of the *wired city* dates back to the early 70s, when pilot experiments with interactive cables were first supported by the U.S. National Science Foundation (see Dutton 1987). Since then we can assume that today every city of modern industrial societies is 'wired' in the literal sense that its residents have access to telephone and broadcasts services. Maybe the new electronic media have not yet become as centrally important for individuals, businesses or communities as the proponents of wired cities expect they will. However the speed at which technological innovation is developing, together with a consequent ever-increasing awareness of the socio-cultural impact on lifestyles is certainly affecting everyday city-life.

Without wanting to go too much into detail on specific aspects of the idea of the wired city (for which extensive reference is available) it is now important to have a quick look at some possible implications on the organization of land use in urbanized areas [13].
The main outcome is to conceive and accept the consequences of a transformation of the way to communicate based on the transfer of pure information instead of objects, goods or people.
A wisely planned application of the new telecommunication technologies can have direct implications on the organization of cities and on town-planning strategies. We are now living an era of transition between the city of the motorcar (which still seems to be well established) to the city of electronics.
The new information technologies have broken down the spatial and temporal constraints on information. According to Remy Prud'homme (1992) these new technologies will have first of all an impact on the economy, contributing to global economic development. This will imply the production of more and better goods and, by eliminating waste, mistakes and repetitive tasks, also a boosting of productivity. Among the direct consequences, there may be a globalization and liberalization of world markets.
The increased importance of information and its easier flow will actually allow people and firms to operate from any location, and may thus lead to the decentralization of activities and to a possible decline of major cities. Teleworking - working from a computer terminal at

[13] For further reference see also: Brotchie *et al.* (1985;1987;1991); Dutton *et al.* (1986); Beguinot (1989); Beguinot, Cardarelli (1992); OECD (1992).

home, linked to a large number of existing data banks, in a quiet and pleasant location, far from the polluted and noisy environment of the city - will become easier and more popular, emptying the cities of at least some of those involved in handling information. Telefax machines and teleconferences will reduce meetings and the concentration of economic agents in the urban location. Within this framework, we could assume that there will no longer be any call for exchange located at the centre of the city.

On another hand it could also be argued that the growing volume of activities in creation, design, training, organization, management, co-ordination, information, and also recreational, social and religious activities, will generate an increasing demand for people to speak, meet and trade with one another, a demand which can be satisfied only by even larger cities. A certain number of face-to face contacts will always be necessary in the location of productive activities and where household consumption takes place, that is in the city.
If we look at the effects of the development of the telephone technology it is certainly possible to state that the number of interpersonal contacts have certainly increased instead of being taken over by the new technology. The same may - and probably will - happen also today.
Therefore, as to the fact wether the new information technologies will attract more people to cities or drive them away, it is difficult to make clear and definite statements right now.
According to Brian Berry (1990) in the developed countries of the North growth will probaby disperse. As already mentioned in par. 3.5., he suggests a picture of of a Global Urban Network (*the Polycenter*) which will connect metropoplitan regions of North America, Western Europe, Japan and Korea. In this view we would really go towards an urban civilization without cities (see also fig. 20, page 54).
And where would locate, for instance, firms in the territory? In this case we can assume that these would tend to locate where salaries are lower (therefore in 'poorer' de-centralized areas) but also where information is plentiful or where there are people capable of exploiting information (and in this case probably in cities and in the wealthiest regions).
As a concluding remarks it can be stated that rather than encouraging or discouraging city-life and city concentration, the new information technologies can actually offer people a choice for a free location.
The concept developed by Berry appears quite fascinating and to some extent also credible. As to the fact that in the more developed North we would go towards an "urban civilization without cities", the present situation doesn't appear to be very encouraging.
As can be read in chapter 3, it is true that a halt in urban growth has been mainly occurring in Europe and North America, but we can not so easily assume that the big cities of today will decline. A new form of organization within the city will rather probably occurr and people will depend less and less on the physical/spacial dimension of settlements. The point is wether the inner nature of man will allow urban residents to renounce to the challenges and to the advantages provided by city life (see also paragraph 3.4. Quality of life in the city).

There is of course also a danger in a wider uncontrolled development of the form of technological innovation determined by new telecommunication technologies, that is the scarce adjustment of man to the innovation itself. Similarly as in the civilization of the motor car we risk to have to face the negative consequences of a consuming society. And in order to avoid this danger it may be sensible to concentrate resources into the acceleration of the process of adjustment of man to the technological level reached, rather than to determine a further increase in the speed of technological innovation.
The wired city (or better the *'cabled' city,* as it is also referred to with some stress on a more specific meaning of the term) should not refer to the 'network town' or 'the town of the intelligent buildings' where new networks are simply added to the previous ones and where buildings are made precious with technological showy decoration. The cabled town is rather

the town where the right and carefully planned use of technological innovation becomes a precious contribution in terms of functional re-organization (both on an urban scale as well as on a mere architectural one) by contributing in raising the degree of liveability, security, and of vitality of the complex system. Change should be neither casual nor controlled by the additive logic and by the culture of expansion; the cabled town is the town where the scientific and technological progress is able to keep its promises and, by contributing to raise the quality of urban life, succeeds in restoring the balance among the *stone town*, the *relation town* and the *town of the real life* (see Beguinot, Cardarelli 1992 - 31).

From a more philosophical point of view, it could be stated that the new fast-developing information technologies should actually allow for the 'development of mankind'. Development, in this sense, means first of all a re-enhancement of the memory of one's own story, of our common past - history - which has always represented a basis for thought and decision for the future.
According to that, it appears important that the use of new technologies should be bound to a re-vitalization of urban values. The innovative possibilities provided from telematics should be therefore applied to a new way of managing urban systems and urban functions (see par. 2.2).

2. A PLAN OF ACTION: TOWARDS A MORE FUNCTIONAL URBAN STRUCTURE

Some important aspects among primary issues and current debate on urban problems and urban trends on a global perspective have been examined up to this point. Following the useful hints which have risen from the general considerations being made, it appears now important to focus the attention also on some general concrete suggestions. Some indications may come out in view of possible applications to specific case studies and for further action to be taken.

2.1. The new Charter of Town Planning: diffusion and implementation

Following an international competition in 1993 which involved more than 300 participants from 27 countries, the *Charter of Megaride 94* has been officially presented to the public in Naples (Italy) on the 29th of May 1994 [14].

The ten principles on which this new document is based have been named: I. City and Nature; II. City and Peoples; III. City and Citizens; IV. City and Mobility; V. City and Complexity; VI. City and Technology; VII. City and Recovery; VIII. City and Security; IX. City and Beauty; X. City and Time (see table 1).

Table 1 — THE CHARTER OF MEGARIDE 94
THE TEN BASIC PRINCIPLES

I - City and Nature *Future city, balance, environment, sustainable development*	**VI - City and Technology** *Future city, telematics, improvement, humankind, relations*
II - City and Peoples *Future city, inter-raciality, equality, differences, identities*	**VII - City and Recovery** *Future city, re-functionalization, re-use, semantic value*
III - City and Citizens *Future city, informations, freedom, civil rights, social duties*	**VIII - City and Security** *Future city, flexibility, bearing, accessibility, evacuation*
IV - City and Mobility *Future city, collective transportation, effectiveness, new forms*	**IX - City and Beauty** *Future city, meanings, inner world, expressiveness, specificness*
V - City and Complexity *Future city, sub-systems, management, architecture, territory*	**X - City and Time** *XXI century city, peace, science, history, innovation, culture*

Source: Di.Pi.S.T. - I.Pi.Ge.T. (1994).

[14] According to a well-established tradition, town-planning charters are given the name of the place where they were first conceived. It is not mere chance that the places chosen almost always has highly simbolic associations. Emblematic examples are the *Athens Charter* of 1933, which choose as its symbol the place where the modern idea of the city arose, and the *Charter of Machu Picchu* in 1977, which deliberately chose a country and a place which could not be associated with Western urban culture - a warning about the supremacy of the richer countries over the poorer ones -. The new charter of town-planning principles, the Charter of Megaride 94, stems from the meeting of the international scientific community which took place in Castel dell'Ovo, in Naples (29/05/94). In That case, why wasn't it called *Naples Charter*? The name 'Naples' comes from *Neapolis*, which means new town. The old town was actually called *Palepolis* and before that *Parthenope*. But the first nucleus (9th Cent. B.C.), the place where the *stone town* arose, developed on the *islet of Megaride*. On this islet, where, after successive stratifications, Castel dell'Ovo was built, the international community gathered together and wrote the new town planning charter. Megaride contains several symbols, especially for those who find in the city the main source of their interests and for those who find in urban history the starting point of any discussion about the city. From the place of the first foundation, the process of re-foundation starts, in order to realize the *city of peace and science*: Megaride is the most suitable name for a new charter of principles for planning the city of the 21st Century. (From the introduction to the Charter of Megaride, Di.Pi.S.T. - I.Pi.Ge.T. 1994).

As can be read in the indroduction to the document (see Di.Pi.S.T., I.Pi.Ge.T. 1994) the whole idea stems from the consideration that the new complexity and the global interdependence of phenomena related to cities today require a global co-ordination for managing resources and human settlements which couldn't be percieved in the thirties.
The word *system* was not yet included in the town-planning vocabulary, even if the fact that the city was not an isolated entity had already gone beyond the stage of pure intuition.
Moreover, the *time* dimension should now be taken into consideration for the role it plays in the process of urban construction and transformation as well as the influence that *speed* (which depend on the temporal dimension) exerts in the use and perception of urban spaces.
Coordinated action following new guidelines should be taken, therefore, to manage the urban system and to direct its further development before it is too late.
The Charter of Athens of 1933 is not criticized for the recognized value of its contents, but it is pointed out that many of its 95 points appear now to be inadequate or not anymore up-to-date. The five principal items that were the essence of this CIAM (International Congresses of Modern Architecture) document are no longer enough to explain the present critical condition of the city. They still persist but their importance has changed, and they have taken on different connotations, with highly complex interrelationships.
Moreover, in the thirties the subject of criticism was the ancient town with its inability to cope with modern times. Today, critical attention is devoted both to the existing town and also to the modern city, with all its evils which could not be foreseen.
The Charter of Megaride indends to be a dynamic document able to change and to prove itself capable of facing always new unpredictable situations.

The general principles contained in the Charter have been thoroughly approved by the scientific community which gathered in Naples and this new document has been internationally recognized as a fundamental stronghold for current and future urban development issues.
The new Charter, however, wouldn't have of course much value if it should remain there as an ineffective declaration of intents just to be read with passive attitude. It must be given, instead, ways to further enhancement and development; joint commitment from all sides is therefore necessary.

The most important aspect which arose from the debate following the presentation was infact the one of a necessary diffusion of the principles elaborated and especially their implementation on current and future policies regarding urban planning and management.
Regarding these two points the following steps could be undertaken.
First of all the necessary preliminary phase of publicizing the contents of the Charter among the citizens should take place:

a) through the media (TV and radio programmes and debates, newspapers articles, etc.);
b) through municipal and regional administrations, in form of information material and publications; with the organization of symposia, meetings, public hearings and discussions; financing research and related activities; etc.
c) through citizen organizations;
d) through professional organizations and institutions, directly among members and affiliations;
e) through schools and universities, organizing lectures, seminars and exhibitions; promoting study and research on the subject matter; etc.

Municipal administrations, professional organizations and universities, together with other scientific or academic institutions, have also a very important role for what concerns the implementation of the principles into planning and actual management instruments. The co-operation of these bodies should bring to the organization of applied research activity and

studies on concrete situations and prove the validity of the outcomes. International seminars and workshops bringing together scholars, professionals and public administrators would be therefore an ideal testing ground. The outcomes, together with eventual architectural and town planning projects elaborated on specific and previously agreed study areas could make part of travelling exhibits which may tour several cities. The exhibits could then be enriched at every station with new proposals on different local situations; other comparative discussions and symposia would therefore take place in every city. The possibility of launching international competitions of ideas open to joung architects and students should be considered as well. A dynamic programme of different activities connected to each other, within the frame of a common scope, and with each single action focusing on specific aspects of urban problems to be solved should indeed take place. Adequate space and publicity would be given in the media, enabling all citizens and interested bodies to be fully informed of the contents and scopes of the programme and to become eventually involved in the process taking place.

2.2. Re-organizing vital urban functions within the city

Out of evidence and following what is being discussed throughout this paper it becomes clear that cities are today clogged with increasing streams of polluting and energy-consuming public and private traffic flows which make them un-governable with traditional urban and regional planning schemes. The city doesn't function as it should because utilities and services are dispersed 'at random' in the territory or became not easily accessible. Accessibility today is mostly still based just on a spatial dimension and on the only possibility offered by physical mobility. Public efficient transportation is generally not provided and people must invest time, energy and money to move from one part to the other of a chaotic city which produces stress and alienation and also has a negative impact on the surrounding environment, as discussed previously.

The city has some functions which it should provide in order to exist and offer its inhabitants an certain quality of life. Among these we could name for instance: residence, work, education, culture, free-time, health, justice, production, trade, services, public administation, transportation ...
At the moment, in general terms, it is not possible to say that urban dwellers take advantage of such functions in satisfactory ways.
The idea of a possible re-organization of city-functions is therefore a consequence of the recognized necessity of being able to guide the processes of urban growth and transformation in ways to minimize the effects of congestion. Congestion determines the condition of non-governability which is common today to most urban systems.

With a new spatial and functional city pattern based on the structural re-organization of the city examined in paragraph 1.3. (the *Fractal City*) and through the application of the new telecommunication technologies (see paragraph 1.4. - the *Cabled City*) it is possible to reach successful results which could simplify the complexity of the problems that 'rule' the city of today. The challenging process of re-designing the city on the basis of a new balance determined by the speed of transfering information, images and news instead of objects and people, associated with easy and confortable accessibility of primary services on a local scale could therefore prove extremely effective.
This would ensure a psychologically sound and human-friendly environment within the big city, with the amazing advantage of determining a sort of 'freedom' from the spatial dimension which can actually reduce the distance between physically or geographically separated locations.

The re-organization of functions, which could also be seen as a re-location of these, should therefore take place both at the local and the metropolitan levels. If we take it for granted that a number of un-necessary trips could be avoided we could imagine the fact of someone going to work to a de-centralized office branch located 'around the corner' together with other collegues who themselves inhabit the same area. Daily 'video-interaction' with collegues in the main office or in other branches would be available 'on line' and necessary longer distance trips could take place maybe only once or twice a week. Schools for children, equipped with interactive multi-medial systems and with PCs linked to net systems, would also be located nearby (without requiring all teachers to be physically there every day) as well as shops for daily needs. In the evening, after having walked (or cycled) home I may want to decide to take the maglev subway train (or even my own private vehicle, if I like) and go dowtown - if not to another town - for entertainment or to a special restaurant, if I am not satisfied with the movies being shown in the local cinema or with today's menu of the district's restaurants.

Altough all this migh sound theoretically very nice, there are of course some practical aspects which should also be taken into consideration as well as a series of directly connected implications. First of all we have to assume (for instance) the possibility of actually being able to live near the work-place, which is not always the case, and which may not even be always possible today. Once houses and work places could find place in the same area, in the case of public-owned dwellings a policy of strong incentives and regulations would be necessary to enable employees to live nearby their offices. Otherwhise, it would be also possible to imagine some forms of tax-deductions or other privileges both to firms and to individuals who succeed in pursuing this scope. However, this would also imply the somehow problematic fact (especially from the socio-cultural point of view) of having to adapt oneself to new neighboroods or to new lifestyles in a more flexible way.
A mixed land use pattern where different compatible activities and functions could be located in the same areas is of course a fundamental requisite. Just to name some, we wouldn't have mere specialized business districts or uniquely residential 'bedroom' neigborhoods any more.
The negative aspects of the mono-functional zoning which was the effect of planning policies over the last fifty years are mentioned also in chapter 3 (see for instance the reference being made to Jane Jacobs 1965).

Private mobility can not be eliminated. It is clear that incentives could be found to enhance a widespread use of public transportation, provided the fact that it is easily accessible, fast, functional, and also price-competitive with private transportation. No matter what man will presumably always want to be able to move with his own private mean, but a series of restrictions could objectively be thought of. The case of Singapore mentioned in paragraph 1.1.1. seems to be very effective even if rather drastic. In a way it could be more sensible to invest resources (which could be partly raised also through eventual higher carbon-emission taxes) into the development of technological options and innovation strategies towards wider accessibility to small ecological and non-polluting vehicles. You certainly do not need a big Mercedes or a Ferrari (assumed that you can afford one!) to drive around streets where maximum speed should be kept anyways below 40 Km/h, or even less. The problem is, nevertheless, not so much the incompatibility between the form of the historic city and the function of vehicle traffic but rather the incompatibility with a widespread use of the motorcar. It is, in short, a problem of quantity. However, among possible measures to be undertaken, it would be possible to admit only low-speed and non-polluting small vehicles into the city centre. Of course this would imply the fact of an actual availability on the market of the technological means required (which should also be price competitive).

In any case it will be a rather long process before people would realize the advantages of leaving their big car at home and maybe accept the fact of having to rely on other status symbols. Ideally, this should be the result of a free choice rather than of autoritative strong restrictions and laws. What is certainly not sensible is to keep on investing excessive amounts of money in road construction and development (as it is still happening for example in many european countries and in North America) and influencing public opinion against the lowering of speed limits both within and outside city limits. Especially in countries where the business of car industry is rather powerful and well established private interests easily override public welfare. In Italy, for example, relatively large amounts of public money are still invested in the further development of motorways and the pressure of important private enterprises (such as FIAT, e.g.) can be noticed also in the media.
Common trends worldwide show that the use and the diffusion of the motor car in urban areas is still increasing, regardless of any hazardous environmental implication or energetic constraint. Some exceptions, like the one of Singapore, seem to confirm this general trend.

If this type of theoretical re-organization of the city may appear feasible for a newly planned city or for new expansion areas, what is to happen with the existing city?
We already highlighted the different conditions of cities in the industrial North in comparison with the ones located in the less 'developed' South, but we can assume that a hundred years from now the existing cities of today will still be there. We will have maybe new towns, enlarged metropolitan areas or, as Doxiadis (1974) forecasted, a sort of *Ecumenopolis* (see paragraph 3.1.).
During the past century an increasingly growing attention has been devoted to the safeguarding and conservation of cultural as well as natural heritage, and the exigence to protect and restore historical city centres is now deeply radicated in our culture. Even if in different measures this is true both for cities in MDCs and also in LDCs [15]. The historical city will still be there in a hundred years time and it will stand as a testimony of the past which will have to be integrated in contemporary life and adapted to the needs and functions of the city of the future. This is why one of the most important issues for the sustainable development of the city of tomorrow is to devote primary attention to a qualitative rehabilitation and to an organizational adaptive reuse of the city of the past. An integration of the ancient city with the new city will be an absolute necessity. The city of today should be functionally upgraded and the city of tomorrow should be newly thoght of and planned in an innovative way.
Instead of always adding new built areas to the existing city, with uncontrolled expansion which implies the actual consumption of unbuilt green space, it would be more sensible to make a better use of the existing city [16].

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[15] Many projects bound to the safeguarding and conservation of Cutural heritage are undertaken in the whole world both with bilateral projects between countries, multilateral projects coordinated by UNESCO as executing agency and financed mostly by UNDP (or other extra-budgetary funds), and also through the work of NGOs.
The European Charter of Architectural Heritage (Amsterdam 1975) states that our historic settlements constitute a spiritual, cultural, economic and social capital of unique value. It introduced and recommended the practice of *"integrated conservation"* as a result of the joint action of the techniques of restoration and of the research of appropriate functions.
More recently (Washington 1987), The International Council for Monuments and Sites (ICOMOS) promoted the *"International Charter for the Safeguarding of Historical Cities"* which, integrating the *"Charter of Venice"* of 1964, perentorily restates the problems of the *compatibility* of the historical city as a priviledged place of the life of relation between men and modern functions, the contemporary ones and the future ones.

[16] Urban expansion, which in the sixties occurred in developed countries as a result of growing urbanization, doesn't take place only with urban growth. In the seventies cities growed as a result of suburbanization and through the development of infrastructure which required high land-use. Hahn and Simonis (1991) calculated that in the big European cities the surface of settlements pro capita doubled in the last 100 years. The fact that

For some time the new field of town plannig experimentation determined by the new telecommunication technologies has directed itself towards innovative housing and town planning proposals which were bound to add new elements (the 'modern ones') to the existing built environment. Integrative intervention has failed on the urban fabrics which had been thought of in other times, for other lifestyles and above all for a technological standard totally different from today, which has been then judged in many ways backward. This meant interventions of drastic building renewal or total urban restructuring bound to adapt space to the new technical means even in areas where projects of urban rehabilitation and re-vitalization were actually possible.

The philosophy of the so called 'scientific planning' which was popular in the seventies was based on this sort of deterministic approach to planning, founded on the convicement that it was only function to create space and to give it architectural and urban forms. But this approach, in reality, appears to be not scientific at all, in the sense that it doesn't take the values of the human sciences into account. If we look back in history there are plenty of examples which deny the bi-univocal relation form-function. The persistence of forms which survive for tousands of years the function which generated them and which had a much shorter life because linked to men and cultures is evident. Form, remaining beyond the duration of its originary functionality, continued to be made use of, eventually altered, under-utilized or used in a reduced way, according to the needs of other times within the frame of different cultures - classic, arab, christian - and often for functions which had very little in common with the original one. Typical examples of transformism and of a free relation between form and functions are for instance the cases of anphitheatres converted into fortresses, mausoleums into castles, basilics into churches and then into mosques, convents into schools or offices and so on.

Therefore the importance of enhancing a functional re-vitalization rather than a mere spatial rehabilitation in the city. Urban rehabilitation should not occur any more with the traditional approach based on conservation areas but with a new concept of re-enhancement of functions and of systems of functions within the urban system. The area-based approach has the direct consequence of 'dismembering' the unitary body of the city-organism into different parts subject to different uses and regulations. Like the medical sciences do with the human organism, urban and land-use sciences should help the city to live and develop harmonically and in a healthy way, congruent with the possibilities offered by the new technologies. It is actually possible to utilize technologies which are very innovative under a scientific point of view to transmit information at a distance and re-vitalize spaces which have become un-liveable because of congestion and decay. Free ground (unbuilt areas) is now commonly considered a primary good to be preserved and should be devoted to green space. To re-vitalize the city also means a re-enhancement of urban values which find no way to express themselves today anymore. The ultimate scope is to ensure the 'governability' and the historic continuity of urban settlements, which could be made possible through the semplification of the organization and the management of the city.
This is the way to an 'intelligent' urban rehabilitation. The modern city is neither the city of the utopists nor the one of urban planners: the real modern city is still the ancient city, intelligently used, equiped, re-vitalized with an extremely advanced technology.

Urban expansion occurs also in the absence of growth is shown by the fact that the city of New York grew 61% in its extension but only 6% in population over the last 25 years.

It is quite obvious that a series of basic problems would necessary appear with a more detailed analysis of the concepts defined so far when finalized to an effective application to specific concrete realities and to the praxis of town planning. For example, how would the implementation of a functional re-organization program for a north american suburban urban-sprawl area look like? Or what concrete actions could be taken in order to re-organize the urban functions of a densely inhabited central urban area in Europe or Asia with valuable historical and cultural stratifications?
Even if it is clear that a common set of necessary actions should be implemented on a large scale it is nevertheless true that specific case studies would automatically imply the detailed definition of the actual problems to be faced and of their possible solutions on a more realistic scale, directly applied to concrete situations. Hence the importance of experimental projects on pilot urban functions to be studied as a necessary follow-up applied phase.

2.3. A policy-oriented Agenda

There is a set af possible actions which could be recommended as a first approach to the implementation of some of the concepts discussed so far. A tentative list is given below as an example of possible measures to be thought of.

a) First of all it appears necessary to devote more attention to long-wave trends when considering planning policies for urban systems. Through the stydy and the analysis of urban development over the past one hundred years it is certainly possible to be able to identify some behavioural patterns which could show some interesting indications for eventual future trends[17]. The identification of driving forces which directed socio-economical, demographical and cultural factors in cities and their impact on the urban stucture and function could help defining and developing scenarios. Common city planning approaches are still rather 'short sighted' and may fail to identify major long-term problems which could be usefully considered in present-time policy planning.

b) The definition of future scenarios for possible urban development should be given primary importance in order to provide alternative choice for decision-makers and implement careful policy planning. Possible urban 'change' patterns should be, this way, identified.

c) The identification of consequences of action should be taken in high consideration; the new urban complexity makes it an ever increasing necessity to approach planning issues with a sort of aprioristic forecast of the induced effects of proposed steps to be undertaken. The outcomes of this preliminary analytical phase should act as an input to the actual plannig momentum in a 'circulatory' way.

d) A widespread action of monitoring and of data collection on different aspect of urban metabolism and of urban functions should be activated within every significant urban entity. A form of standardized information data base on urban systems may act as a tool of co-operation between cities. An exchange of information on how to tackle with specific problems which may be common to different realities should be made possible, and cities may learn from each other how successful innovative methods and policies have proved in specific situations and how they could be applied globally [18].

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[17] If we consider the past two centuries of human development it is possible to notice recurrent trends which may eventually turn up regularly with quite wide intervals. A good example is given by the so called 'Kondratiev Cycle' which is referred to in paragraph 3.5. Figure 19, page 54 shows instead how urban growth closely follows economic growth. It would be interesting to develop similar methods to study also other aspects of urban dynamics.

[18] Under this point of view what is proposed with the Kobe Protocols appears to be pointing towards this direction (see paragraph 1.2.)

e) Central governments should help the development of the new information technologies; regional development policies must be stiffened in order to mantain a certain balance between eventual disparities between regions and cities. Certain regions or cities could be threathened by the fact of finding themselves in less favourable geographical locations or by lower levels of technological development. These policies should then be implemented by Local Authorities (regional bodies, city administrations, intermediate organizations) who should have a major role in introducing and supervising the new information technologies. They could encourage firms producing or using new information technologies to locate in their area. Besides, and this is a particularly important point, they can use the new information technologies themselves to manage municipal public services.

f) A re-organization of city departments within municipal administrations should be considered. Traditionally, and still in most cases, each single department or section copes with different aspects of urban activities with little interaction - or in any case quite complex forms of interaction - among each other. Specific areas are very often under the jurisdiction of several departments each one of them responsible for single 'parts' of the management function. This often proves very slow and inefficient. Most administration - just to make an example - have (or at least should have) nowadays a section which deals with environmental protection. The field of action of such a section is quite broad and affects almost every sector of the municipal administrative function. In this case the idea of creating some sorts of environmental units within each section or department, which could be liked to each other and act as a cross-sectional task-force, could be worth consideration.

g) A new approach to town planning is an obvious consequence to the development and the widespread application of the new information technologies. Town planners must take into consideration the new urban complexity and start accepting new planning rules. The set of principles contained in the New Charter of Town Planning described in paragraph 2.1. is a good example to be considered for further development. Among possible concrete action in the actual practice of town planning, the need to foresee the setting of teleports or of specialized high-tech functional areas within the city could be mentioned.
Besides, the possibility of organizing the city according to the fractal model discussed in paragraph 1.3. and 2.2. is also worth consideration.

h) Training and education play also a very important role. Architects an town planners should be trained now to be able to tackle with the city of the future. New specialized subjects dealing with the use and application of the new information technologies should be thaught in universities and professional schools. A new generation of professionals who can make effective use of the new possibilities available should be trained, in order to plan and manage the re-organization of urban functions. The same is necessary for public servants and technical personnel working in public administations. It would be useless to have offices and services equipped with highly sophisticated technological devices without people having the necessary know-how to use them.
Education at the school level is also very important to make children aware of changes taking place in this era of informational revolution. Technological development is nowadays so fast that the future inhabitants of this Earth should develop a sensibility for change dynamics and be aware of of what to expect.

3. A GLOBAL BACKGROUND SURVEY: HOW FAR ARE WE FROM CATASTROPHE?

In order to better identify the issues discussed so far in a global perspective it appears important to devote now attention to some general demographical, economical, social, energetic and environmental aspects.

3.1. Urban population: some facts and figures

Doxiadis' Ecumenopolis:

According to most recent statistical projections and studies on urban issues there is a widely recognized tendency for global urban growth.

Twenty years ago the Greek architect and planner Constaninos Doxiadis (1974) was forecasting the transition to *Ecumenopolis* [19] for the year 2100, with a total urban population of almost 19 billions and a level of urbanization of 94 percent (see tables 2 and 3, and figure 7). Doxiadis' projections and scenarios, also based on data available at that time [20], may appear a little drastic but even if the rate of population growth seems to have somewhat slowed down to date, our expectations for the future can not be too optimistic.

Table 2: Global population projections, 1950-2225

	S-20	F-20	S-35	S-50	F-35	F-50
1950	2.486	2.486	2.486	2.486	2.486	2.486
1960	2.982	2.982	2.982	2.982	2.982	2.982
1975	4.000	4.000	4.000	4.000	4.000	4.000
1995						
2000	6.420	6.430	6.400	6.440	6.490	6.500
2025	9.450	9.600	9.700	9.900	10.230	10.380
2050	12.730	13.500	13.850	14.650	15.700	16.300
2075	15.700	17.800	19.150	20.900	22.850	23.600
2100	17.900	20.000	25.250	28.600	30.650	34.600
2125	19.100	21.300	30.300	35.000	37.750	44.200
2150	20.000	22.600	33.100	37.800	43.400	50.000
2175	21.000	24.100	35.000	40.200	46.800	53.300
2200	22.000	25.600	36.800	42.700	50.000	56.600
2225	23.100	27.100	38.600	45.300	52.500	60.200

(population in billions)

Note: This table and the next one (table 3) are based on the long-range projections and on the six population models worked out at the Center of Ekistiks (see note 20).
Source: Doxiadis (1974)

[19] *Ecumenopolis*: The coming city that will, together with the corresponding open land which is indispensable for *Antrophos* (the uman being), cover the entire earth as a continuous system forming a universal settlement. It is derived from the greek words *ecumene*, that is, the total inhabitable area of the world. Term coined by C. A. Doxiadis and first used in the October 1961 issue of the magazine EKISTIKS (see Doxiadis 1974).

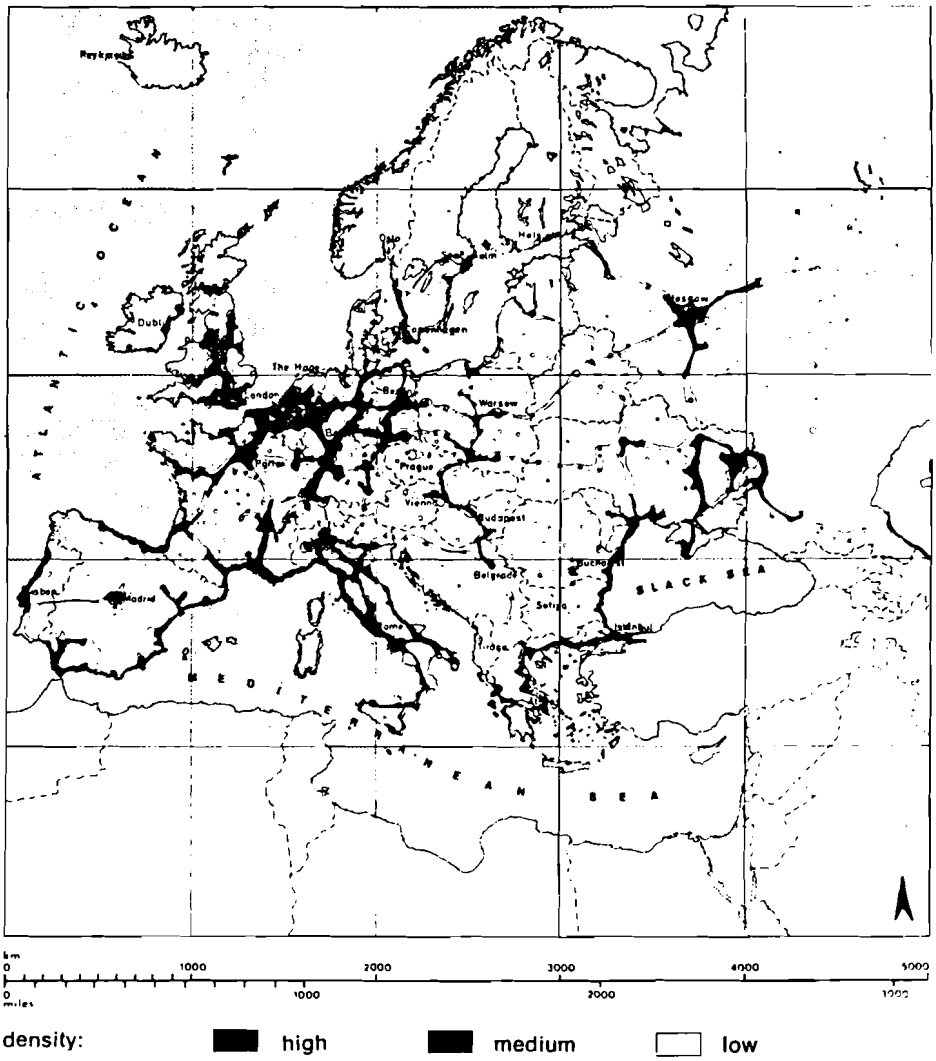
[20] A set of interconnected long-range projections, reaching into the period of the incipient Ecumenopolis, have been worked out in the early seventies at the Athens Center of Ekistics for various aspect of population, income and energy. Retaining a certain number of basic assumptions (six for population), an equal number of models was developed for each variable which give a coherent picture of its future evolution. The six population models refer to three "ultimate" values for world population at the time of incipient Ecumenopolis: 20, 35 and 50 billion, respectively, the lowest figure being regarded by far as the most probable and the other two as assumptions whose meaning we have to understand. Two types of evolutionary curves leading to these "ultimate" figures were chosen: one "Fast" model (F) and one "Slow" model (S), the slow one leading to the same "ultimate" figure as the fast one, but 50 years later. The six models are: F-20, F-35, F-50; and S-20, S-35, S-50. These data are therefore based on assumptions and may differ from those of the UN.

Table 3: Urban population according to assumption F-20

year	total urban population (billions)	% urban of total global population	% annual growth rate of urban population (average within period)
1960	1.335	44.7	3.70
1975	2.300	57.5	2.81
1995			
2000	4.601	71.5	2.21
2025	7.940	82.8	1.67
2050	11.991	88.9	1.27
2075	16.454	92.5	0.55
Ecumenopolis starts 2100	18.796	94.0	0.29
2125	20.238	94.8	0.28
2150	21.649	95.9	0.27
2175	23.210	96.3	0.26
2200	24.750	96.7	0.25
2225	26.280	97.0	

Note: Data shown here may differ from those of the UN, and a definition of urban population is not available.
Source: Doxiadis (1974)

Figure 7: Ecumenopolis in Europa after 2100



Note: To have some idea of what Ecumenopolis will be like, the European part of Ecumenopolis is here shown. Its main centre will be London-Paris-Randstadt and a strong link will exist with other main centres of Ecumenopolis, especially with the Eastern seabord of the U.S.A. This is already - to a certain extent - a reality, and Doxiadis forcasted that such link could occur by sea and air and possibly means of tunnels. The possible future development of telecomunication technologies is however not considered in Doxiadis' global comunication network, where the ideal goal was to be able to physically commute within Ecumenopolis in one hour's time, according to possible technological development.
Source: Doxiadis (1974)

UN data

UN estimates indicate that at mid 1990 43 percent (almost 2.3 billion) of the world population lived in urban areas (see table 4). The level of urbanization is projected to cross the 50 percent mark in 2005 and reach 61 percent by 2025 (UN 1993).

Table 4: Urban population and percentage of population living in urban areas, 1970, 1990 and 2025

Region	Urban population (millions)			Urban share (percentage)		
	1970	1990	2025	1970	1990	2025
World	1 352	2 282	5 187	37	43	61
Less developed regions	654	1 401	4 011	25	34	57
Least developed countries	38	103	532	13	20	44
Other countries	615	1 298	3 479	26	36	59
More developed regions	698	881	1 177	67	73	84

Note: Less developed regions comprise Africa, Latin America, Asia, Melanesia, Micronesia and Polynesia. Within the less developed regions are a group of 47 countries that have been designated by the UN as "least developed" because of their particularly precarious economic situation.
More developed regions comprise Northern America, Japan, Europe, Australia - New Zealand, and the former Union of Soviet Socialist Republics.
Source: UN (1993)

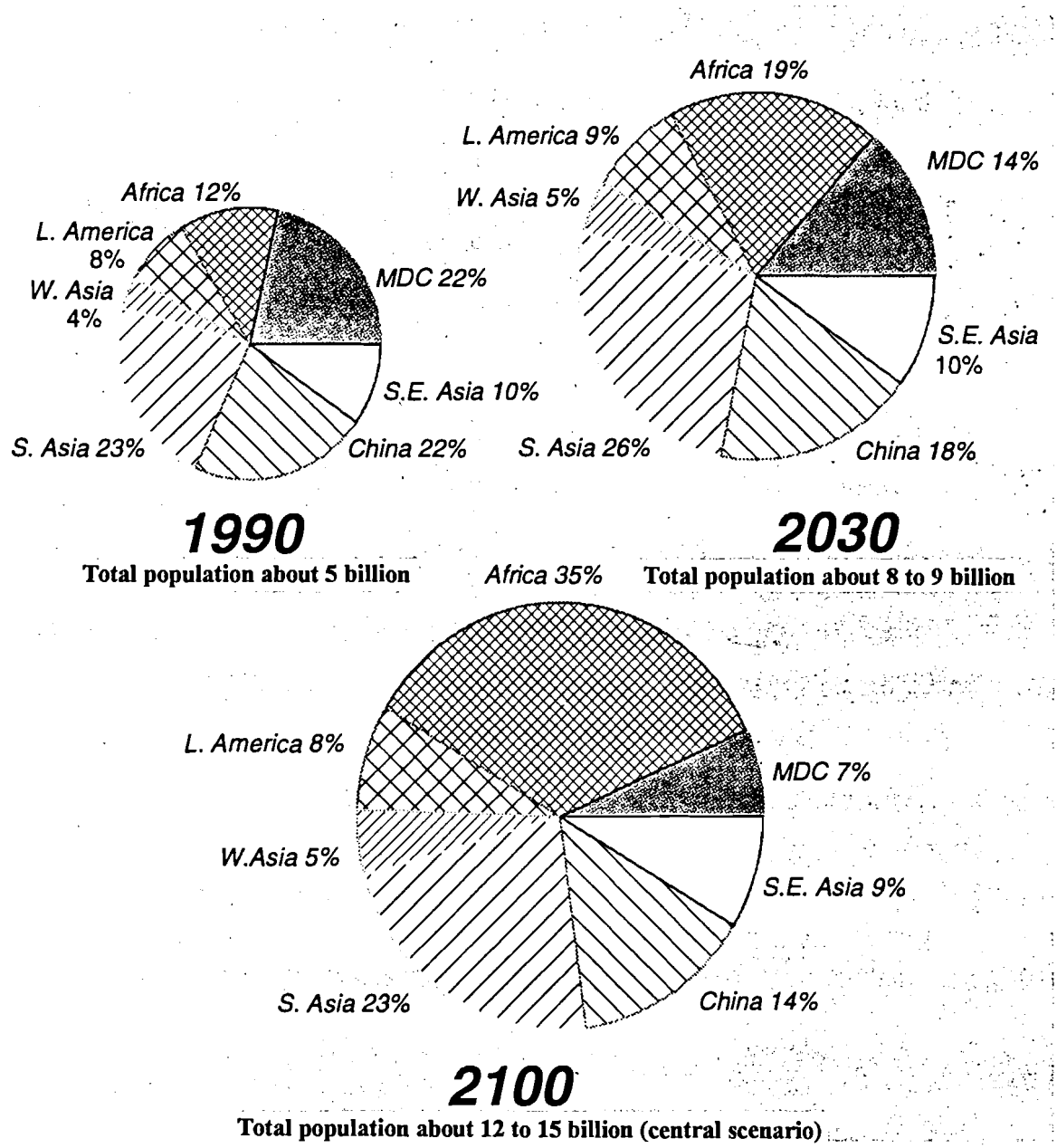
IIASA population projections

In 1990 our planet accommodated roughly 5 billion people, 78 percent of which living in less developed countries (see figures 8 and 9). By 2030 - 2040 the population will increase (under all scenarios) to at least 8 billion; by 2100, under high fertility / low mortality / low migration assumptions, the world population size could reach 35 billion, while in the very long run it may also decline to 1990 level (5 billion) under low fertility / high mortality / high migration assumptions (Lutz *et al.* 1993).[21] Doxiadis, using one model considered to be the most probable one out of six, was actually forecasting (for 2100) a world population of 20 billions, only 13 percent of which (ca. 2.6 billion) living in Europe and North America. How far are we from that?

If we consider global regional demographic trends, what appears to be important is that the population in today's less developed countries (LDCs) will increase under all scenarios by at least 70 percent (or 1.3 percent annually) by 2030, while in the more developed countries (MDCs) the population size will most probably start to decline soon after the turn of the century (under low migration, low mortality and low fertility assumptions). Figures 8 and 9 show that today Europe accommodates more people than Africa, but in the long run only a tiny fraction of the world population would live in European countries. Africa will increase its share from 12 percent in 1990 to 19 percent by 2030 and to 35 percent by 2100 (Lutz *et al.* 1993)

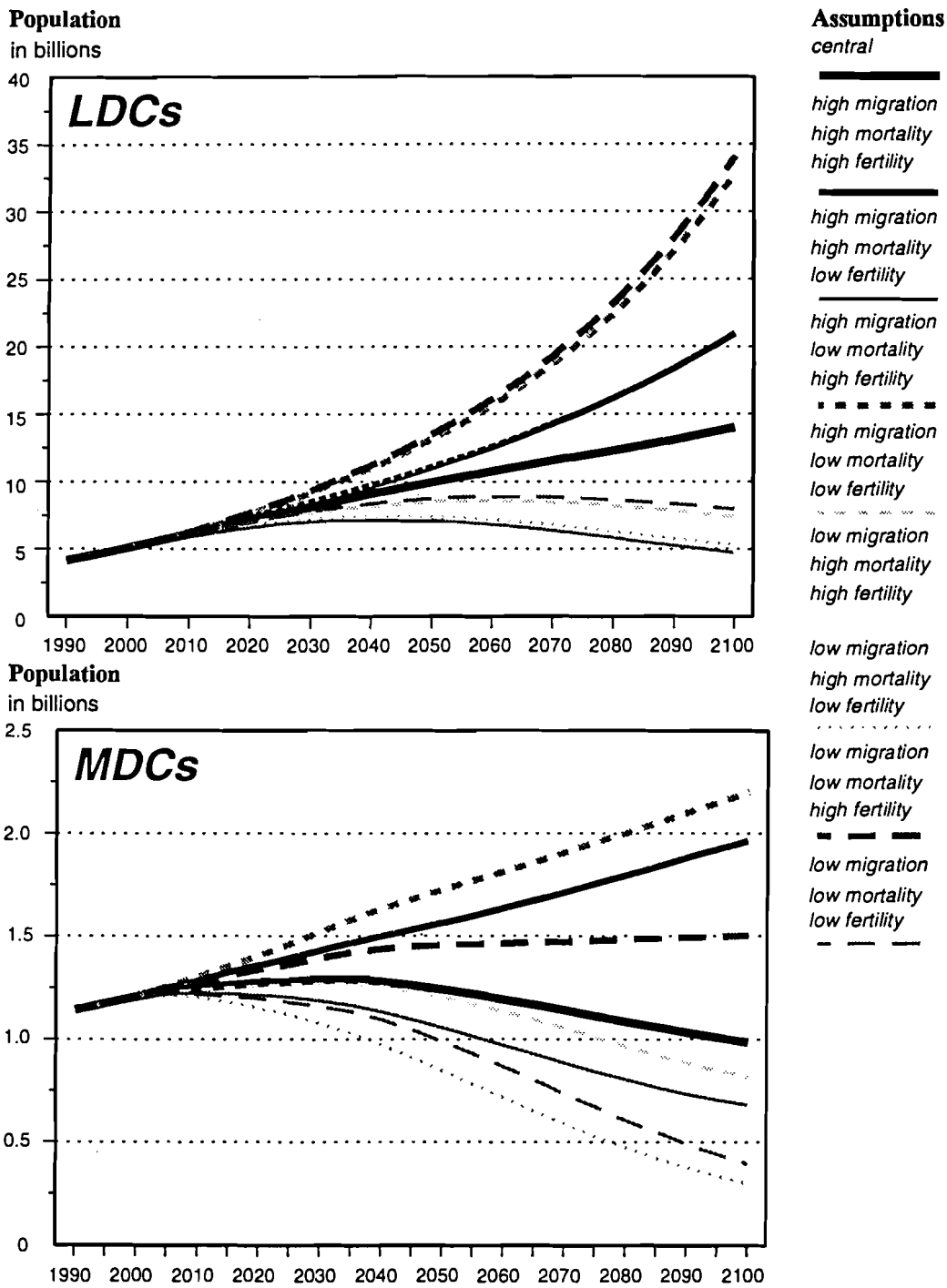
[21] The Population Project at IIASA has recently completed a study on global population scenarios. Their approach has been to assume high and low extremes for each of the three components of population change (fertility, mortality, migration) and to consolidate them into eight scenarios plus one central scenario that combines the three averages. The time horizon is 2030. Extensions are given to 2100. The calculations are given for twelve world regions and also for 20 larger European countries separately. Data have been compared with the ones available from the UN and the World Bank (see Lutz 1994; 1994a).

Figure 8: Regional distribution of world population under IIASA population projections' central scenario



Note: MDC comprise Northern America, Japan, Australia - New Zealand, Western Europe, Eastern Europe (including Albania, the former Yugoslavian Republics and the 7 European Republics of the former USSR). LDC comprise Africa, Latin America, Asia (including the 8 Asian Republics of the former USSR), Oceania (excl. Australia - New Zealand).
Source: Lutz (1993)

Figure 9: Future population size in LDCs and MDCs, 1990-2100

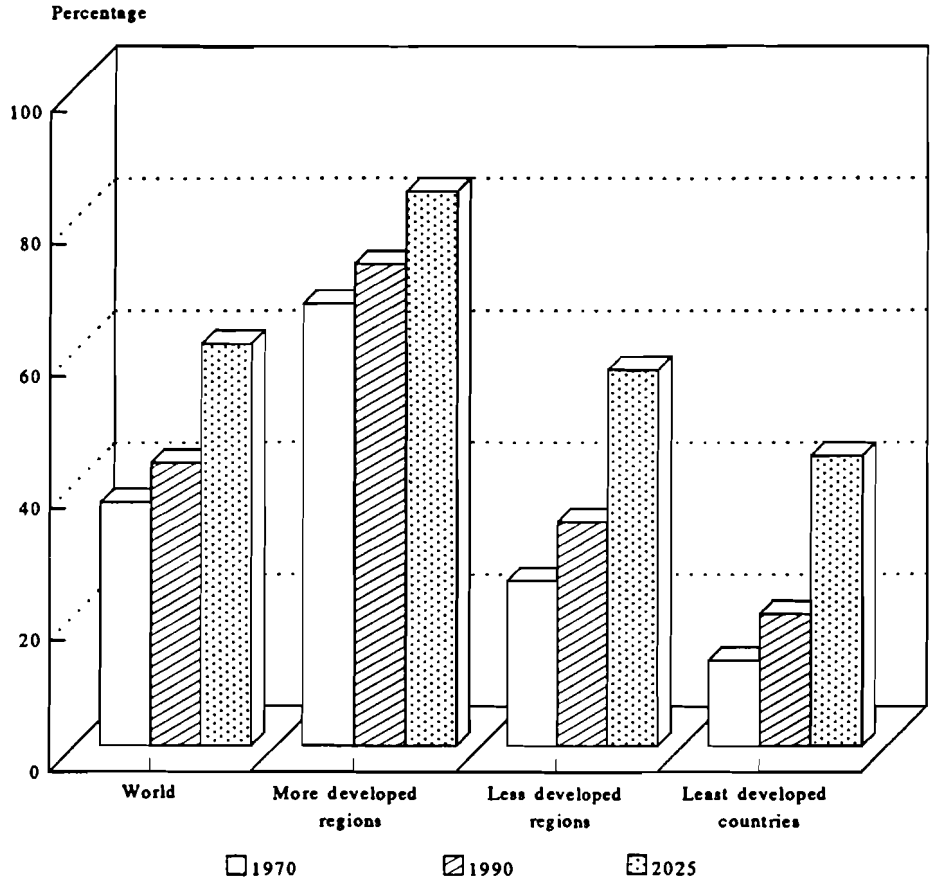


Note: LDC, MDC: see note to Fig. 8.
Source: Lutz (1993)

Economic development

So as to better understand the dynamic process taking place in urban areas great attention should be given therefore to regional aspects but also to the economical development process.
If we look at the so called more developed regions and countries we see a definite slow down - and in some cases even a shift to negative rates - in the urban growth process taking place at first in North America since the mid seventies and later also in Western Europe, Australia and to some extent in Japan. There is today, however, some evidence that this counter-urbanization phenomenon may yet be over but confirmation must await further data.
An interesting example of a european city which shows a recent reversal of trend and is growing again is the one of Vienna (see appendix, paragraph 5.1.)
On the other hand a real city boom has been taking place in the least developed regions with tropical Africa (today one of the least urbanized region in the world) on the first line, followed by Asia (which houses the world's highest urban population) and Oceania (which has the lowest absolute urban population) (see figure 10 and tables 5 and 6).

Figure 10: Percentage of total population living in urban areas, 1970, 1990, and 2025



Note: More developed regions, less developed regions, least developed countries: see note to Table 4.
Source: UN (1993)

Table 5: Urban population and percentage urban in the less developed regions, 1970, 1990 and 2025

Region	Urban population (millions)			Urban share (percentage)		
	1970	1990	2025	1970	1990	2025
Less developed regions	654	1 401	4 011	25	34	57
Africa	83	206	857	23	32	54
Asia (excluding Japan)	407	879	2 556	20	29	54
Latin America	162	315	592	57	72	84
Oceania (excluding Australia-New Zealand)	0.7	1.5	5.3	18	24	45

Note: Less developed regions: see note to Table 4.
Source: UN (1993)

Table 6: Urban population and percentage urban in the more developed regions, 1970, 1990 and 2025

Region	Urban population (millions)			Urban share (percentage)		
	1970	1990	2025	1970	1990	2025
More developed regions	698	881	1 177	67	73	84
Australia-New Zealand	13	17	27	84	85	90
Europe	311	373	458	67	73	85
Japan	74	95	109	71	77	86
Northern America	167	209	307	74	75	85
USSR (former)	133	186	277	57	66	80

Note: More developed regions: see note to Table 4.
Source: UN (1993)

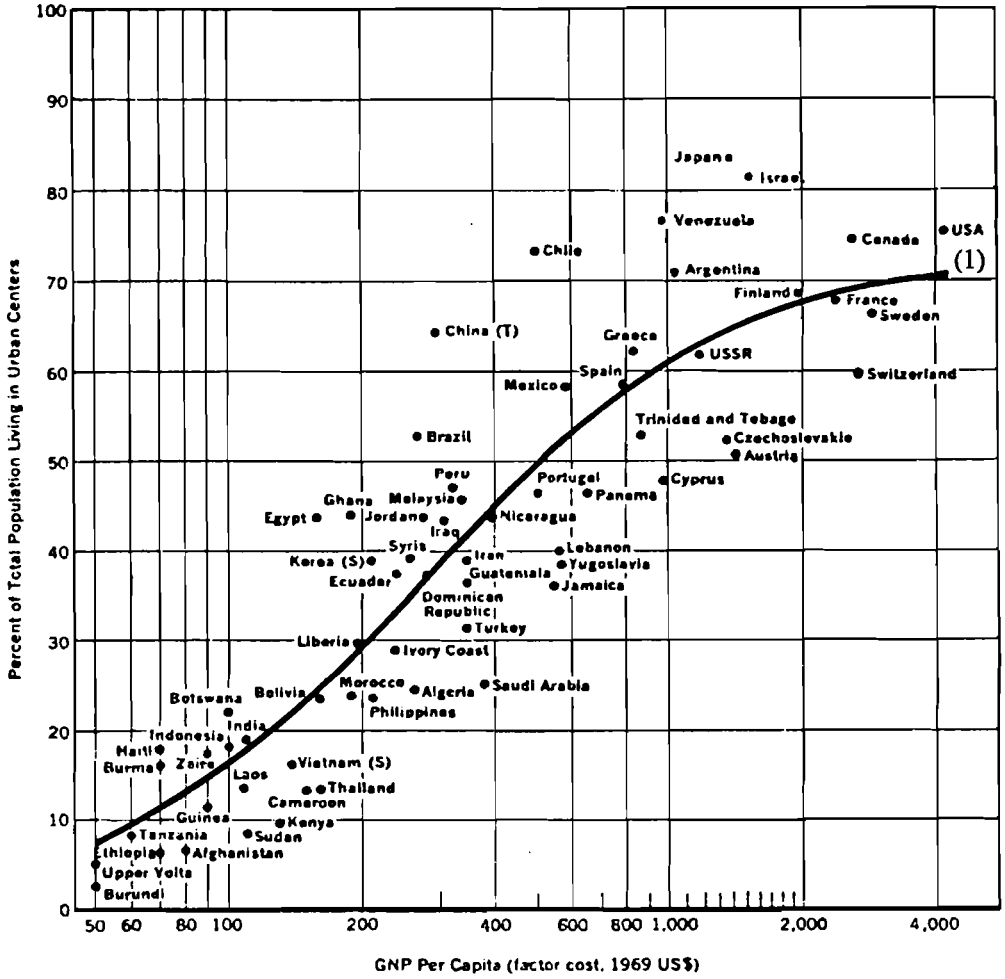
The more developed regions of Latin America and North and South Africa occupy somehow a position in between with decreasing but still quite high urbanization growth rates. The countries of eastern Europe should also be considered separately, even if - generally - the recent political and social changes occurring in the region do not seem to have strongly influenced the urban dynamics process by now, at least in demographical terms [22].

Economic development is actually closely linked to urban change, both on national and regional scales [23] (see also figures 11 and 12).

[22] The political, social and economical change occurred in Eastern Europe has produced indeed a transormation of the economical structure of cities which determined, in turn, a new land-use pattern (see Lichtenberger 1993 and Faßman, Lichtenberger 1994).

[23] The fact that economic development is linked to urbanization can also be seen from the following data which relate to four groups of cities belonging to different stages of economic development in LDCs and MDCs. The first group comprise tropical Africa and Asia, the second Northern Africa and Latin America, the third Eastern Europe and finally, the fourth, Western Europe and Northern America:
the cities of Dacca, Lagos, Bombay are currently experiencing annual growth rates of respectively 5.89, 5.68 and 4.22, while Sao Paulo, Cairo and Mexico City in turn 2.61, 2.23 and 0.61; Moscow has a rate of 0.81 while New York, Paris, London respectively 0.34, 0.25 and 0.00 (UN 1993).

Figure 11: Degree of urbanization on a national scale compared with GNP per capita.

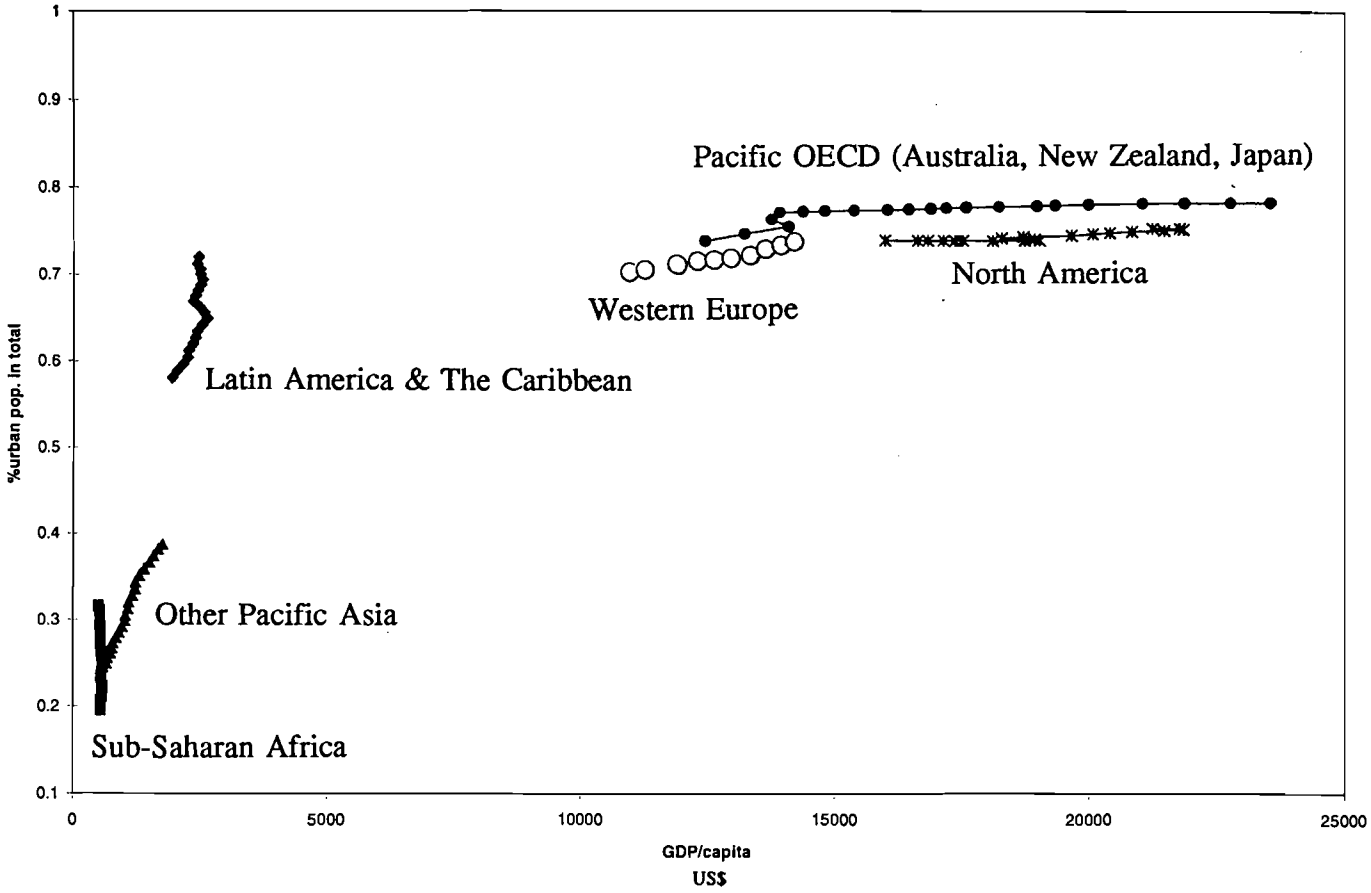


Note: GNP = Gross National Product (see note 2, page2).

(1) Curve fitted to type $y = \frac{a}{1 + be^{-c\,(\log GNP)}}$

Source: International Bank for Reconstruction and Development, *World bank Operations: Sectoral Programs & Policies,* Baltimore, John Hopkins University Press, 1972.

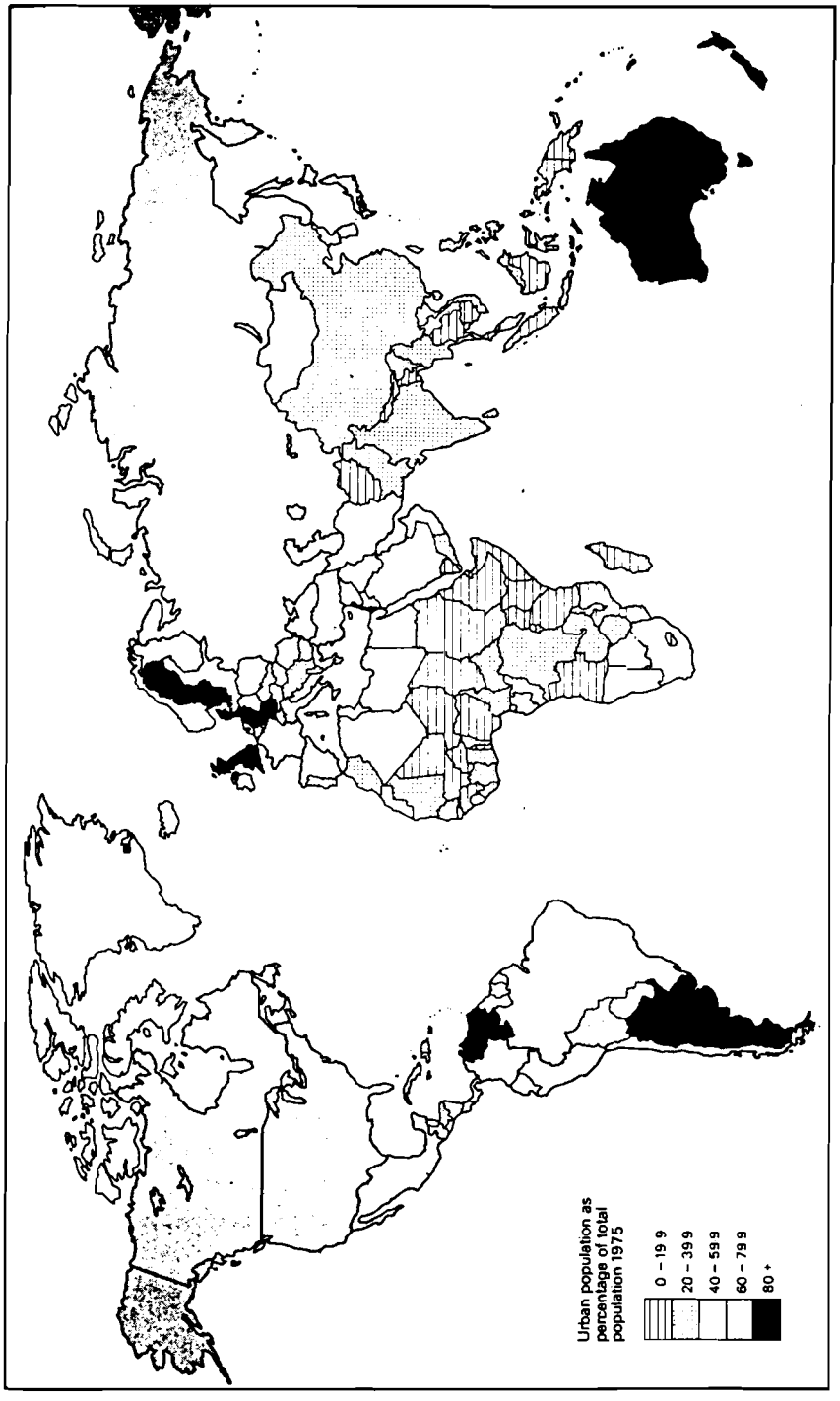
Figure 12: Degree of urbanization on a regional scale compared with GDP per capita



Note: GDP = Gross Domestic Product (see note 2, page 2).
North America comprises Canada, USA, Puerto Rico, Virgin Islands and Guam; Latin America and the Caribbean comprise the rest of America; Western Europe comprises also Greenland, Malta and Cyprus; Sub Saharan Africa comprises the whole of Africa except Morocco, Algeria, Tunisia, Libya and Egypt; Other Pacific Asia comprises all Pacific states except Cambodia, Hong Kong, Lao (PDR), Vietnam, China, Korea (DPR), Maldives, Pakistan, Bangladesh, India, Sri Lanka, Japan, Australia and New Zealand.
Eastern Europe, former Soviet Union, centrally planned Asia and China, Middle East and North Africa are not considered.
Data: World Bank; Diagram: Malvani

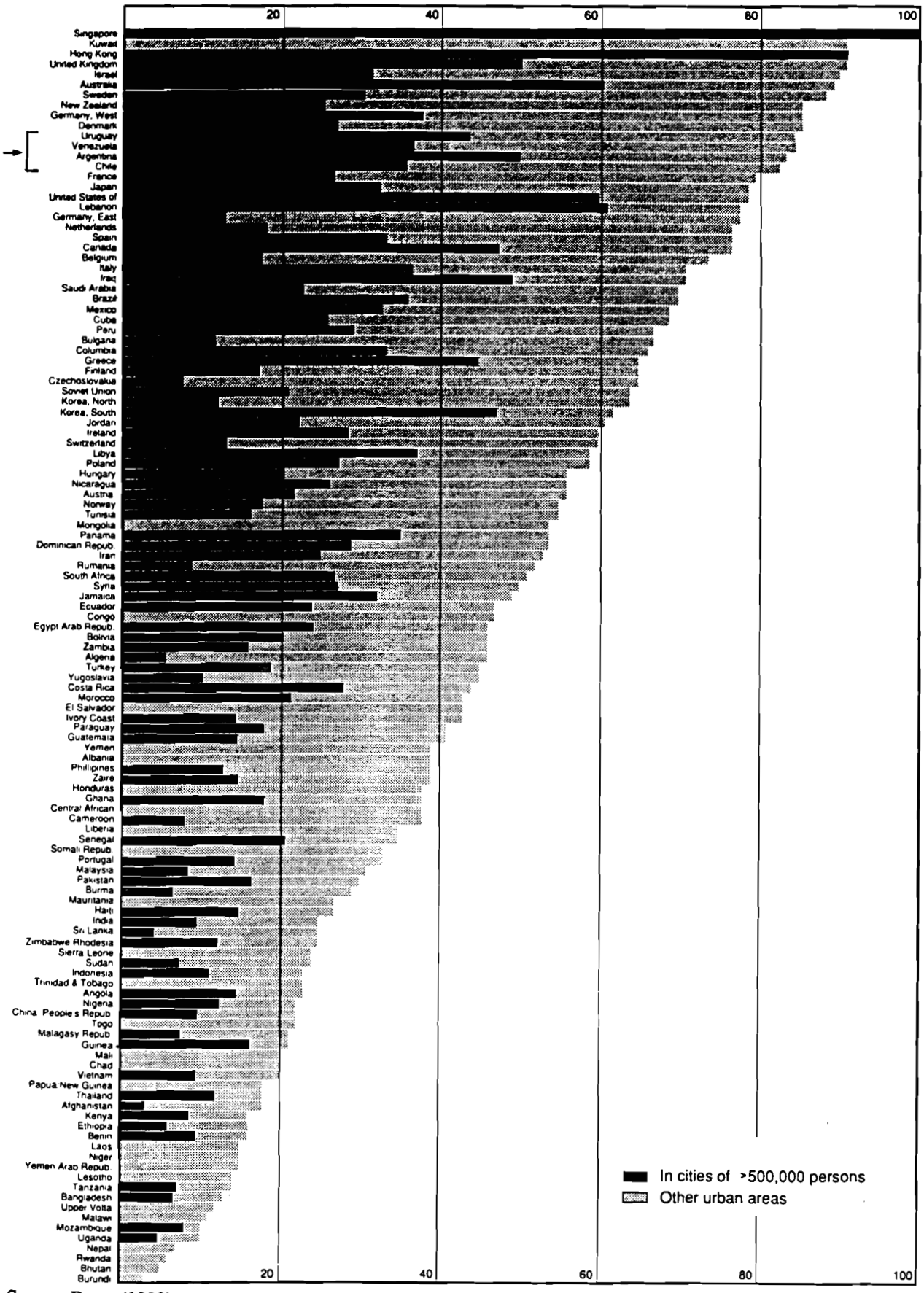
Throughout the world there is in fact a broad correlation between levels of urbanization and levels of economic development: the more developed regions account for the highest rates of urban residents while some of the least developed ones always showed a large rural population. Latin America, which can be considered - with some exceptions - one of the 'more developed' regions of the LDCs has been facing a regular decline of urban growth rates since 1955, with an average rate of 0.75 to date, compared with the 0.44 of Europe and 0.26 of North America. Latin America is today the most urbanized major area of the LDCs (see figures 13 and 14).
North and South Africa display a rate of respectively 0.94 and 0.80 compared with the much higher rates of the Eastern and Western areas of the continent (respectively 2.5 and 2.16). Africa, as already stated, is today the least urbanized major area of the LDCs and of the world. Eastern Europe shows an average rate of urban change of 0.82 with peaks of 1.00 in Hungary. Russia has a rate of 0.59 (UN 1993).

Figure 13: Urban population as percentage of total population



Source: Gilbert & Gugler (1990)

Figure 14: World urbanization levels in 1995



Source: Berry (1990)

Within major areas or regions enormous variation in urban growth rate is nevertheless apparent. Interesting examples occur if we compare data from Haiti to the ones of Argentina or data from Japan, Hong Kong to those of China. The same can be said for Netherlands and Portugal or for Australia and the Solomon Islands (see table 7).

Table 7: Urban growth: disparities within major areas

Annual urban growth rate (1990 - 1995)

Japan China	0,57% 4,50%	3,41 % average East Asia
Australia Solomon Islands	1,42% 6,49%	1,55 % average Oceania
Argentina Haiti	1,48% 4,00%	2,54 % average Latin America
Netherlands Portugal	0,79% 1,61%	0,80 % average Europe

Data: UN 1993; Diagram: Malvani

Globally, the rate of urban growth, which has been fluctuating between 2 and 3 percent since the early 1960s is expected to decline, reaching 2.5 percent at the turn of the century and dip below 2 percent by 2025. However, we have seen that absolute world population is still increasing, especially in the less developed regions. This means that for the next half century much of the world will keep on facing a process of population concentration in large urban areas (see table 8, 9 and figure15). The number of mega-cities of 10 millions or more (13 in 1990) will double by 2010 and only 5 of them will be in the more developed countries [24].

Table 8: Number of urban agglomerations with population of 5 million or more, 1970, 1990 and 2010

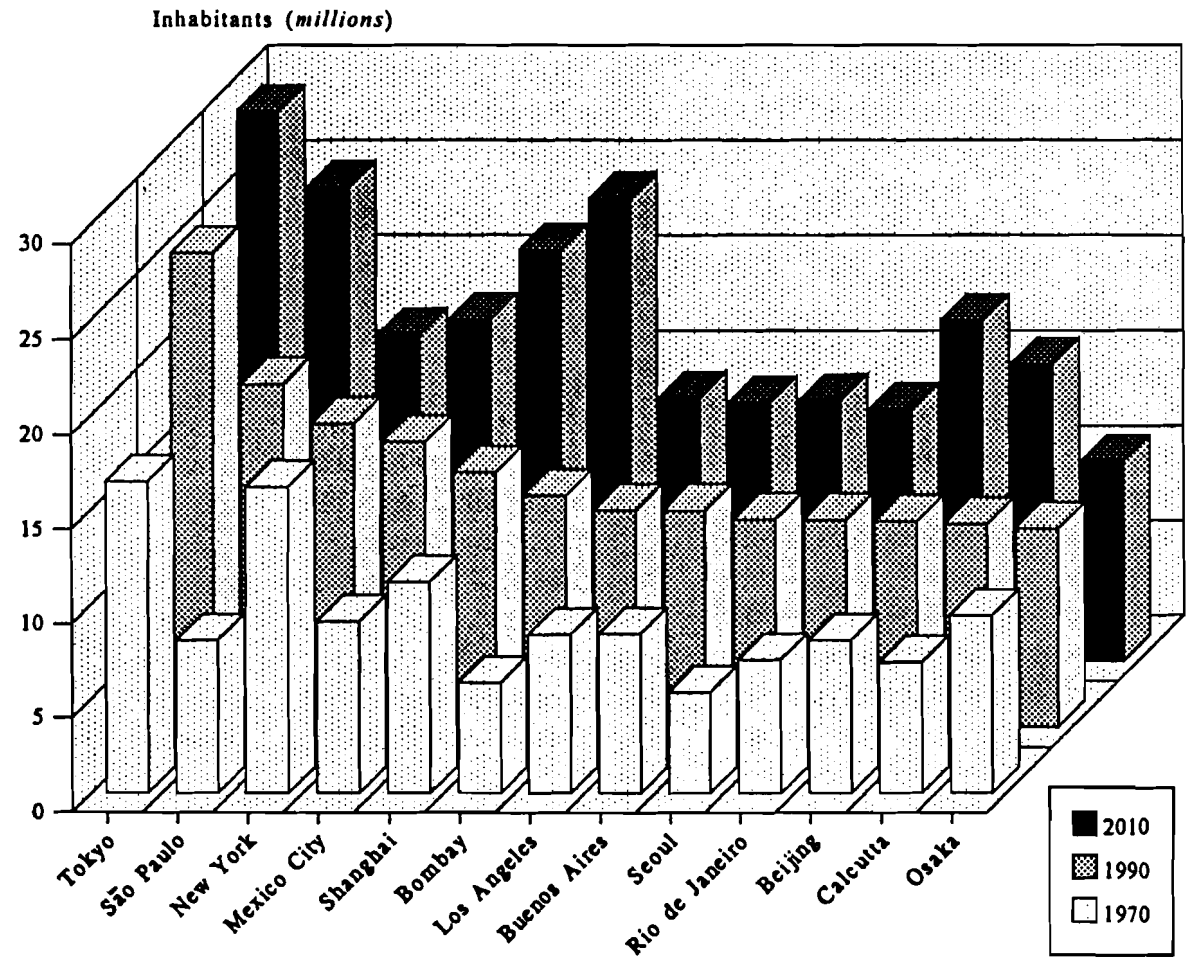
	10 million or more			*5-10 million*			*Total*		
Region	*1970*	*1990*	*2010*	*1970*	*1990*	*2010*	*1970*	*1990*	*2010*
World total	3	13	26	18	22	33	21	35	59
Less developed regions	1	9	21	10	14	26	11	23	47
Africa	0	0	2	1	2	6	1	2	8
Asia (excluding Japan)	1	5	14	5	11	17	6	16	31
Latin America	0	4	5	4	1	3	4	5	8
More developed regions	2	4	5	8	8	7	10	12	12
Europe	0	0	0	4	5	5	4	5	5
Japan	1	2	2	1	0	0	2	2	2
Northern America	1	2	2	2	1	1	3	3	3
Russian Federation	0	0	1	1	2	1	1	2	2

Note: Less developed regions, more developed regions, see note to table 4.
It is interesting to notice that in 2010 out of 26 mega-cities worldwide only 5 are in the more developed regions whereas as much as 21 will be in the less developed regions (see also note 24).
Source: UN (1993)

[24] According to UN estimates the following 5 cities of MDCs will have more than 10 million inhab. in 2010: Tokyo 28.9 Millions, New York 17.2 Millions, Osaka 10.6 Millions, Los Angeles 13.9 Millions, Moskow 10.4 Millions. Paris, instead, will reach 9.6 million (UN 1993). Compare also with figure 15 and table 9.

We also have to take into account the various differences between data sources and population projections, as well as the actual difference between official data and reality, especially for fast-growing cities with large 'illegal' settlements. If we consider for instance the Mediterranean model of urbanization two good examples can be pointed out: Istanbul, 6.5 million in 1990 with an average annual growth rate of 3.65 (UN 1993) is actually estimated at 11.5 million with a real annual growth rate of 4.8 percent; Genoa, over one million in 1990 with an average annual growth rate of 0.17 (UN 1993) has instead 675,000 inhabitants and a negative growth rate. Misunderstandings and differences may of course also originate from the actual definition for urban agglomeration which is considered; generally, in the UN prospects this normally refers to the population contained within the contours of a contiguous territory inhabited at urban levels without regards to administrative boundaries. However, some countries do not define localities with this concept and use instead that of metropolitan area or city proper.

Figure 15: The largest urban agglomerations in the world (10 millions or more inhabitants in 1990)



Source: UN (1993)

Table 9: The 10 largest urban agglomerations in the world, ranked by population size, 1950 - 2010

(Millions)

Rank	*Agglomeration*	*Country*	*1950*	*Agglomeration*	*Country*	*1960*
1	New York	United States of America	12.3	New York	United States of America	14.2
2	London	United Kingdom	8.7	Tokyo	Japan	11.0
3	Tokyo	Japan	6.9	London	United Kingdom	9.1
4	Paris	France	5.4	Shanghai	China	8.8
5	Moscow	USSR (former)	5.4	Paris	France	7.2
6	Shanghai	China	5.3	Buenos Aires	Argentina	6.8
7	Essen	Germany	5.3	Los Angeles	United States of America	6.5
8	Buenos Aires	Argentina	5.0	Essen	Germany	6.4
9	Chicago	United States of America	4.9	Beijing	China	6.3
10	Calcutta	India	4.4	Osaka	Japan	6.2

Rank	*Agglomeration*	*Country*	*1970*	*Agglomeration*	*Country*	*1980*
1	Tokyo	Japan	16.5	Tokyo	Japan	21.9
2	New York	United States of America	16.2	New York	United States of America	15.6
3	Shanghai	China	11.2	Mexico City	Mexico	13.9
4	Osaka	Japan	9.4	São Paulo	Brazil	12.1
5	Mexico City	Mexico	9.1	Shanghai	China	11.7
6	London	United Kingdom	8.6	Osaka	Japan	10.0
7	Paris	France	8.5	Buenos Aires	Argentina	9.9
8	Buenos Aires	Argentina	8.4	Los Angeles	United States of America	9.5
9	Los Angeles	United States of America	8.4	Calcutta	India	9.0
10	Beijing	China	8.1	Beijing	China	9.0

Rank	*Agglomeration*	*Country*	*1990*	*Agglomeration*	*Country*	*2000*
1	Tokyo	Japan	25.0	Tokyo	Japan	28.0
2	São Paulo	Brazil	18.1	São Paulo	Brazil	22.6
3	New York	United States of America	16.1	Bombay	India	18.1
4	Mexico City	Mexico	15.1	Shanghai	China	17.4
5	Shanghai	China	13.4	New York	United States of America	16.6
6	Bombay	India	12.2	Mexico City	Mexico	16.2
7	Los Angeles	United States of America	11.5	Beijing	China	14.4
8	Buenos Aires	Argentina	11.4	Lagos	Nigeria	13.5
9	Seoul	Republic of Korea	11.0	Jakarta	Indonesia	13.4
10	Rio De Janeiro	Brazil	10.9	Los Angeles	United States of America	13.2

Rank	*Agglomeration*	*Country*	*2010*
1	Tokyo	Japan	28.9
2	São Paulo	Brazil	25.0
3	Bombay	India	24.4
4	Shanghai	China	21.7
5	Lagos	Nigeria	21.1
6	Mexico City	Mexico	18.0
7	Beijing	China	18.0
8	Dacca	Bangladesh	17.6
9	New York	United States of America	17.2
10	Jakarta	Indonesia	17.2

Source: UN (1993)

3.2. Physical city growth

Up to this point we have been considering urban growth mostly in terms of demographic an economic change. But what happens to the city in spatial and formal terms? In other words, how does urban growth physically occur?

Among the most serious problems linked to urban change are certainly the impacts on human social condition and behaviour as well as sanitary and environmental decay.
On one side we experience a *physical expansion* of the city which is consuming always more and more land in spite of green areas inside and outside the previous city boundaries. On the other hand we also witness a growing concentration of population and activities within the city which result in a *higher urban density*. This means a higher density of population for square kilometre but also higher densities of energy consumption and of soil, water and air pollution in terms of flows and emissions.
If urban expansion is wisely planned it can lead to the creation of new suburbs organically connected to the city or to the completion and welding of existing parts of the urban system. Without effective planning measures the way is clearly open to a proliferation of 'illegal' settlements with little or no infrastrucure and poor sanitary and social conditions.
Analogously if urban concentration processes are preceded by plans and projects they can lead to the implementation of urban upgrading, urban renewal or rehabilitation programs. If this doesn't occur the only outcome of a higher concentration in the existing city is to raise the level of physical and social decay.

The urban planning process needs appropriate structures and know-how, and should be actually integrated in larger scale development programs at national or regional levels. There is no need to explain how these conditions may differ from case to case according to the geographical location or to the effective economical level of the country or city considered. When the proportion of urban dynamic change is merely out of scale and takes place too fast like in many of the Third World mega-cities, it can easily be argued that the result and outcome of any planning policy is, to a certain extent, very little effective when not non influent at all. In societies where a large percentage of the population may have to struggle for the daily survival it can be a difficult task to succeed in implementing effective planned urban settlement programs.
If this can not be taken as an excuse for the eventual lack or insufficient development of sensible planning policies it may nevertheless help understanding the problem.
The situation is of course different in more developed countries where planned urban rehabilitation measures have definitely contributed to the upgrading and resettlement of low standard central city quarters over the last twenty years. Generally, former industrial sites have been relocated in outer areas and the urban voids which so originated were gradually transformed into valuable residential/commercial opportunities close to the city center. We may for instance just think of the redevelopment of the Docklands in London or Rotterdam as major significant examples of implemented large scale projects.
The planning process should take into account, nevertheless, also long-wave trends and not only concentrate on immediate short-term results.

Responding to the opportunities offered by the new telecommunication technologies, the foreseeable onward counterurbanization trend in the MDCs will nevertheless most probably occur with a dispersed pattern which will bring to concentration in urbanized metropolitan areas but not necessarily in the mega-city form. Some have argued that what is emerging are *urban civilizations without cities*. Unlike the Third World where urban dwellers are attracted to the city mostly by the availability of a great demand of handwork manpower, the big cities

of the North have assumed mostly the form of business centres which are home to corporate headquarters connected with another. In other words the productive function of the cities is being taken over by services. If this configuration may enable the possibility of thinking to a sustainable city development, the situation in LDCs is inevitably bound to serious environmental problems.

3.3. Energetic and environmental impacts and implications

We already stated that urban growth is closely linked to economic development (this is true especially for developed countries). But growing cities are also, clearly enough, characterized by a growth in the needs of their populations that need satisfying: work, housing, health, transport, comfort, safety and leisure needs, and so on. These needs translate directly or indirectly into energy needs and have major repercussions on the environment.

Energy

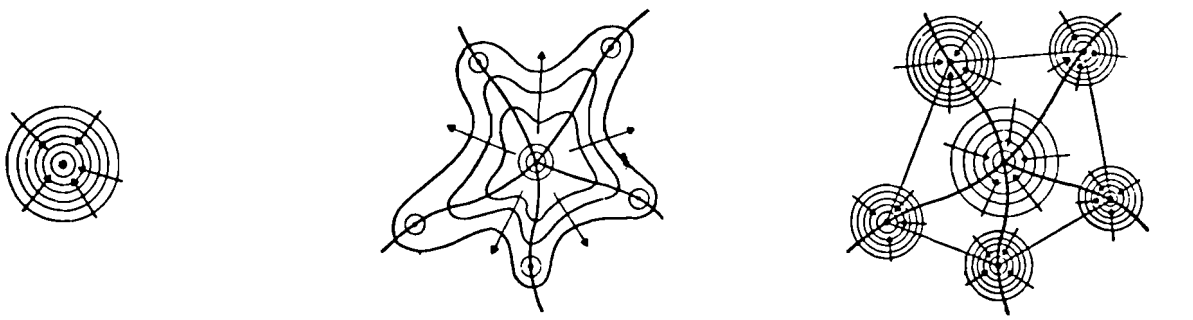
Up to not very long ago energy appeared to be inexhaustive and cheap and encouraged a certain urban development which could take place without any constraint. Energy considerations were mostly ignored in the planning and development process.

The urban spatial structure became therefore more energy intensive and has been characterized by an urban sprawl in the form of decreasing density of facilities and physical separation of activities. Heating was provided individually and inefficently. Unfortunately, as we can see today, in most cases this 'freedom' has not led to quality in town-planning.

Then, the succession of energy crises since 1973 showed that energy could no longer be consumed wrongly or rashly and that urgent steps needed to be taken, namely in form of energy consumption control policies. The spatial and functional organization of the built environment had therefore to respond to energy constraints.

S. Owens (1986;1987) has deeply analyzed the possible spatial responses to energy constraints and concludes that the longer term effect is likely to be a closer integration of different activities which could eventually lead to greater autonomy in urban subcentres or a to a form of *'decentralized concentration'* (see figure 16).

Figure 16: Stages in the development of the city



First stage (pre World War II)

Second stage (post World War II to the present)

Third stage (suggested further development)

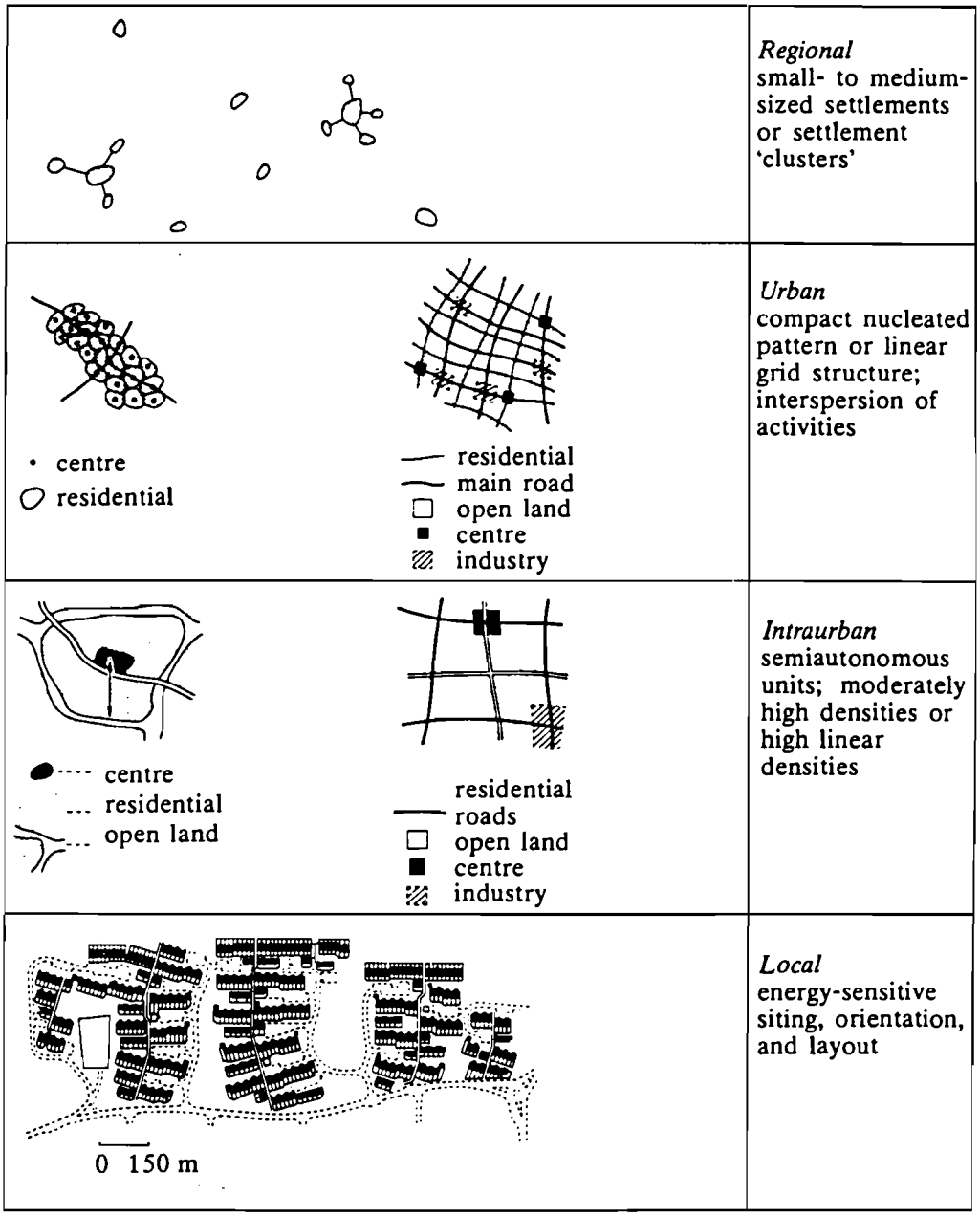
Source: Romanos (1978)

Empirical evidence shows, however, that in the short to medium term people will respond to energy constraints in ways which will result in less energy consumption and will have little significant impact on spatial structure. As a matter of fact higher energy prices induced the discovery of new oil fields and to double the fuel efficiency of automobiles (at least in the

USA). Susan Owens also clearly states (and we agree) that energy factors can *permit* or *constrain* urban change, but they do not cause it. Energy constraints taken alone could not lead to any simple reversal of consolidated urban trends.

The uncertain energy future does not enable us to make clear projections for forthcoming urban structure trends but what appears important is the opportunity to act with flexible normative planning bound to ensure energy-efficient and energy-flexible environments. It is today generally recognized that there is a growing awareness of the necessity of implementing ways to reduce energy consumption levels and that the city of the future has to become more energy-efficient than the megalopolis of the mid-twentieth century. Figure 17 shows energy-efficient spatial structures at different scales (Owens 1986).

Figure 17: Energy-efficient spatial structures at different scales



Source: Owens (1986)

To a certain extent the idea of increasing densities of facilities and activities within the city could be a possible way towards energy-efficient structures, and in this framework a pattern of '*decentralized concentration*' certainly appears more appealing and human than compact cities with high-rise / high-density developments which - in fact - require the use of highly energy-intensive construction materials, which also greatly increase the 'energy investment' in infrastructure [25].

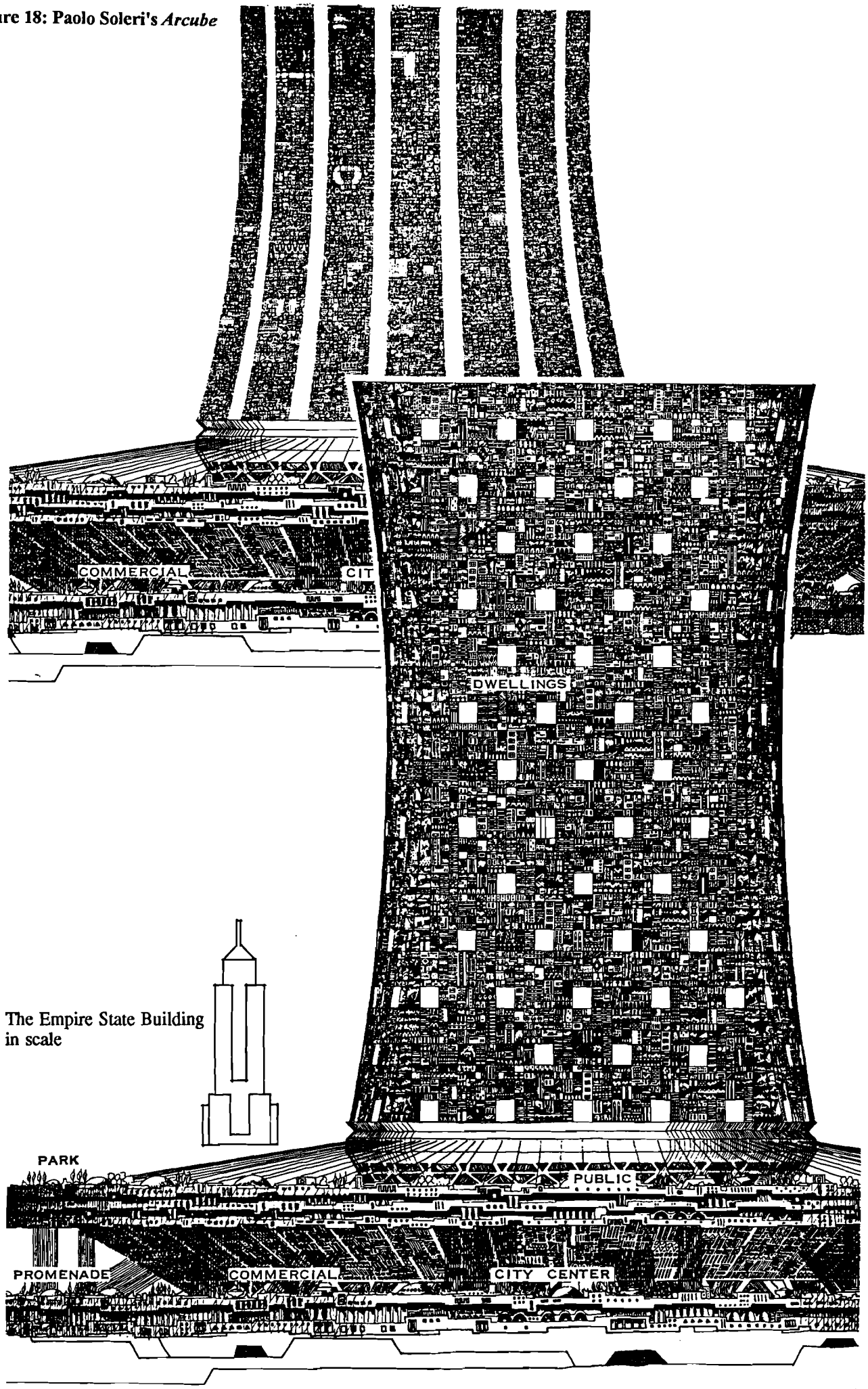
Energy density

Density factors, therefore, should also be taken into consideration both for their implications on the land use patterns and also for energetical reasons.

Generally, it can easily be stated that there is a clear relation between population densities and energy consumption in the territory. Greater concentrations of energy consumption are infact reached in the more central parts of metropolitan areas although there is evidence that average energy consumption densities in small towns of a few thousands inhabitants are comparable with the large metropolitan areas, at least in developed countries. The reason appears to be that recreational and agricultural areas are not incorporated into the town as they are in metropolitan areas, because a direct access to the surrounding natural environment is still possible (see Häfele *et al.* 1981). In developing countries, this same study shows that already in 1971, on a pro capita basis, the urban population of India used ten times more energy than its rural population. When compared to data from developed countries (in this case the FRG), the energy consumption density of conurbations in India (on an area basis) shows much higher levels, although the pro capita consumption is definitely lower. We have to take into account the much higher urban population density rates in LDC's.

[25] The possible advantages of a decentralized concentration have already been discussed in chapter 1 (see The Fractal City). For further reference see also Owens (1986).
Dantzig and Saaty (1973) made an interesting nontechnical introductory study about the feasibility of building a city that makes more effective use of the vertical dimension and the time dimension (through around-the-clock use of facilities) than present cities. According to the authors the plan for a compact city arrangement, presented to demonstrate that it is possible to have a spacious, effectively low-density city that would be low cost and would bypass many of the problems connected with urban overgrowth: smog, traffic jams, longcommutes, delays, noise pollution, accidents, high consumption of energy and natural resources, inaccessible central facilities and recreational areas, destruction of the ecosystem and the countryside, and future slums. Marchetti (1977; 1979) while arguing the actual possibility of a real carrying capacity of the Earth for 10^{12} people also shows some examples of compact cities, among which the models of Craven and Soleri (see figure 18).

Figure 18: Paolo Soleri's *Arcube*



Note: this vertical city (height 1,500 metres) for 400,000 is a good example of utopic compact cities.
Source: Marchetti 1977;1979)

Even though the global energy consumption of LDC's is relatively low, it is increasing very rapidly. In these countries there is a generally quite bad distribution of energy with growing numbers of urban and industrial areas where energy is wasted (and where considerable savings could be made) as well as rural areas where hundreds of millions of human beings lack the vital 'minimum' of energy. Decentralized systems combined with weak consumer systems and equipment could bring energy to these areas where it is needed. All this needs of course rigorous policies on local, national and international levels.

In MDC's the highest rates of energy consumption are determined by urban and interurban mobility. In the U.S.A. transportation accounted for 28% of primary energy consumption in 1987 and for 63% of petroleum consumption. If we consider the complete cycle of activities connected with the transportation sector (including the manufacture of transport equipment, the production of fuels and the building of infrastructures) about one third of the nations primary energy was devoted to it. Highway transportation in the U.S. is projected to double in 2020 and air traffic to increase by 60% by 2000. Up to 32% of the nation's CO2 emissions (1987) have been attributed to transportation figures (see Rayner 1993).

Environment

It is no wonder that the increase of traffic flows has devastating effects on the environment. Especially for what concerns intra-urban transportation, mobility occurs mostly through private or public polluting motor vehicles. Air pollution, noise and high costs of energy consumption are among the more immediate outcomes. Also extra-urban mobility occurs to a large extent through road transport. Air transport is developing fast but, as to noise, energy consumption and hazardous gas emission into the atmosphere, this doesn't solve any problem. Some interesting studies and applications are being made on experimental projects for the use of maglev (magnetic levitation) trains both for intra-urban and extra-urban mobility [26].

Private mobility is closely connected to our century's lifestyle and can be considered an indicator of quality of life; besides, we shouldn't forget that a private car in many cases represents an important status symbol. Even if faced with energy constraints or high emission taxes it seems unlikely that people will easily renounce to that. This is certainly true for the large suburban areas of urban sprawl planned for a car-centered culture, but also for cases where public transportation could actually be made competitive with private mobility in terms of costs, travel time and efficiency.

Urban concentration associated with population increase will consequently bring to a modification of the environment, besides to a change in the intensity of the supply and demand of energy. This can occur at three geographical scales: locally, regionally and globally (see also Berry 1990).

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[26] Maglev trains are today still undergoing a phase of further technological developmet before they can effectively be introduced for commercial purposes. To date an experimental test track is already in function in the german Emsland region, while a first commercial line is being planned between the cities of Hamburg and Berlin for the year 2005. It will then be possible to cover the distance between the two cities in little more than one hour.
For further reading on Maglevs see also: Alscher, H. *et al.* (1984) "Propelling Passengers Faster than a Speeding Bullet", *IEEE SPECTRUM,* August; Nenadovic, V., Riches, E.E. (1985) "Maglevs at Birmingham Airport from System Concept to Successful Operation", *GEC REVIEW, Vol. 1, No. 1*; Stix, G. (1992) "Air Trains", *Scientific American*, August; Marchetti, C. (1992) *On Mobility*, First Status Report Contr. No. 4672-92-03 ED ISP A, IIASA, Laxenburg.

On a first stage there is an actual alteration of the mere surface of the Earth with the replacement of soil, grass and trees with tar, brick, concrete, glass, and metal at different levels above the ground. Both the newly acquired roughness of the surface and the different nature of the reflecting and radiating surfaces alterate the heath exchange with the atmosphere. On a regional scale this implies also the generation of large amounts of artificial heath and the alteration of the composition of the atmosphere with the emission of gaseous and solid pollutants, due to highly concentrated energy consumption. Globally, heath islands may serve as a trap for pollutants and contribute to the greenhouse effect and to global warming. Sea level changes are among other possible outcomes.

A recent study on urban warming and energy consumption in Tokyo (Saitoh 1993) provides a good illustration of the phenomenon of urban heath islands. Over the Past century the temperature of the Earth has increased about one degree Celsius but Tokyo's temperature has increased at the rate of almost 7 degrees per century. Its points of high heath are now as much as about 8 degrees higher than the surrounding rural areas. According to a simulation model which has been developed, if this trend continues summer central city ground temperatures could reach higher than 40 degree Celsius by 2030. In Japan research is being done on how tree planting or the development of new technologies to store heat in the ground, as well as the development of new and cleaner forms of energy, can help to alleviate this problem. Japanese scientists are collaborating with other scientists throughout the world to use new technologies of satellite remote sensing to measure urban heat islands.

Growing cities and the growing needs of their populations will necessarily bring to ever growing pollution rates if drastic measures are not taken. There are some examples of 'ecological' settlements where renewable energies are being used and where almost everything is recycled, enabling people to live in a better balance with the environment. Once again, however, we have to recall that our great concern is now towards the problems of the megacities, with their extremely great concentration of population, activities and material flows. A global approach to the question is therefore required and it is unlikely that pilot experimental projects for isolated settlements could solve the problem on the long run.

Growing urban densities bring moreover to always greater concentrations of urban discard (in form of solid, liquid and gaseous waste) which has to be processed and somehow dispersed into the environment. The metaphor of urban metabolism considered in paragraph 1.2. can be seen as an interesting way to approach the sudy of material flows within the city.

3.4. Quality of life in the city, city functions and 'city power'

To assess quality of life in cities (and the changes in it) is an extremely difficult task. Quality of life is very subjective and has many dimensions (many of which actually defy measurement) which cannot be aggregated. Moreover, we do not have an index of the 'quality of life' in cities similar to the measures available to assess economic output. For this reason we will have to rely mostly on personal judgment and common sense.

A simple index of economic well being such as the GNP pro capita is obviously unsatisfactory; the measurement of quality of life by income or consumption or any combination of economic criteria alone is insufficient because it leaves out important personal, social and environmental conditions, such as for instance the state of health or quality of the neighborhoods.

Research work in the field of social indicators reflecting different aspects of the quality of life has developed with the aim of defining it at some middle ground between the extremes of the

transcendental or intimately personal values on the one hand, and one dimensional economic factor on the other [27].

Today the image of the megacity, as it is now *organized*, is commonly associated with the idea of an alienating place in which its inhabitants are constantly faced with the danger of a loss of the human scale if not of the very basic values of human life and dignity.

The situation is particularly critical in the big urban conglomerations of the South of the world. The very high speed of urbanization which has generally determined high densities of population with very scarce or insufficient infrastructure, has caused a mixture of economical and social problems. 'Illegal' or 'informal' settlements, better referred to as 'shanty-towns' or 'slums' are the place of human segregation, of urban poverty, of growing criminality and of a general deterioration of the quality of life. In many Third World cities nearly half of the population is living in slum and squatter settlements and more than a quarter of the inhabitants of most large cities are estimated to be living in absolute poverty (see table 10).

Table 10: Proportion of population living in slums and informal settlements in selected cities (%).

City	%	City	%
Addis Ababa (1980)	85	Manila (1980)	40
Cairo* (1984)	84	Mexico City (1980)	40
Dar es Salaam (1980)	60	Nairobi (1986)	34
Lagos (1981)	58	Rio de Janeiro (1980)	34
Bombay (1988)	57	Sao Paulo (1980)	32
Delhi (1981)	50	Seoul (1988)	12
Calcutta (1980)	40		

Note: * Informal housing (without licence).
Source: Oberai (1993)

Public investment often misses the urban poor and inadequate attention is paid to water, sanitation, hygiene, nutrition, maternal and child care, family planning and health needs of the poor, with new roads, hospitals and other infrastructure tending to bypass the slums. The lack of these services leads to higher fertility accompanied by high levels of infant mortality amongst the urban poor, particularly amongst slums dwellers (Oberai 1993).

In the more developed countries of the North, where economic development enabled a better development of infrastructures and services and where the percentage of urban poverty and marginal settlements is in no term comparable to the situation in the developing countries, the way in which the urban functions are organized in the megalopolis is, nevertheless, not optimal either (see also par. 2.2.).

Globally, the rapid growth of the city during the past century has not occurred according to the basic rules of social organization considered under anthropological and psychological

[27] For further reading on the quality of life, see also Terlecky, J. (1977), Slottje *et al.* (1991), Gallopin, G.C. and Öberg, S. (1992). In the attempt of broadening Economic Development to include also other indicators of development, the United Nations Development Program's "Human Development Index" (HDI) combines measures of sub-goals (literacy, life expectancy and GNP) to provide an index of relative achievement, i.e. a score which is defined in terms of a country's position relative to other countries (see UNDP 1993).

values. The spatial and social dimension of the natural city was broken: the optimal equilibrium between the functions that a city has to provide to exist and the anthropological constants which have to be granted so that the system could last in time had been drastically altered.

Generations of often wrong planning policies based on monofunctional zoning have determined a lack of diversity of urban functions within the city together with a difficult accessibility of urban facilities. Transport infrastructure in systems where urban mobility is made essential have not developed adequately and are still obsolete. Public transportation, in spite of all efforts, has never succeeded in being competitive with private transport and public facility location and distribution within the city seems not to have been thought keeping in mind that cities exist for human beings and not the opposite. As the overall dimensions of the city grow, the inevitable and consequent growing need for always faster mobility can not be satisfied in optimal ways. The outcome is congestion and stress and the urban dwellers begin to realize themselves the consequences of the loss of the spatial dimension of the village where everything necessary for daily life is accessible on foot within a half hour. Recent policies common to most urban centers in developed regions directed to render parts of the existing city fully or partly pedestrian simply don't work because they are merely superimposed to a structure which has developed in the culture of the motor car.

We have to reckon, however, that not everything is negative about the city, otherwise we wouldn't be able to understand why people like to live in cities also when they do not necessarily have to. Of course every city is different and the factor of attraction can differ quite a lot.

Typical of the city is the typical ambivalence between the two opposite feelings of fascination and scare inspired from it. The city is indeed the place of the difference and of the social and cultural mix. It enables the contrast and co-existence of different people, races, ideas, activities, lifestyles. It is the place where creativity flourishes, of the arts, of technological innovation, of the intellectual and political movements and of the new trends. In short, city life implies a gain of human scale. The fluidity of use and choice among city people underlies most city centered activities and attracts enterprises of all kind which can draw skills, materials, customers or clienteles from a great pool and in extraordinary varieties. The possibility of communicating and exchanging opinions increase, in turn, the choices available to city people for jobs, goods, entertainments, ideas, contacts and services. People are infact attracted to big cities from the big possibilities which the functional hierarchies in which they are organized give them to utilize their various talents and to insert the individual in a broad social scale.

Looking back in history we see that before the industrial revolution cities where primarily centres of commerce or of political power, but since industrialization cities have developed essentially as centres of production. Technological innovation increase which has always been a major vehicle for productivity, always occurred in cities. This is one of the reasons why labor productivity is higher in cities. Theoretically, if we can correlate this to city size, the larger a city, the higher the productivity of the people who live in it could be. Labor productivity is therefore higher in cities and incomes are also higher. This is also another reason which attracts people to cities. Large cities subsidize the rest of the country. And this is not only true for developed countries.

In the case of Mexico City (see Oberai 1993), in 1980 as much as 20,8 per cent of the nation's population lived in the capital but generated 34,3 per cent of the country's GDP (see table 11).

Table 11: Cities' share in national population and GDP

City	Percentage of national	
	Population	GDP
Seoul (1988)	24.6	26.5
Mexico City (1980)	20.8	34.3
Cairo (1986)	12.5	17.8
Rio de Janeiro (1987)	4.1	10.6
Lagos (1981)	2.9	3.4
Bombay (1985)	1.2	3.4
Shanghai (1987)	1.2	4.8

Source: Oberai (1993)

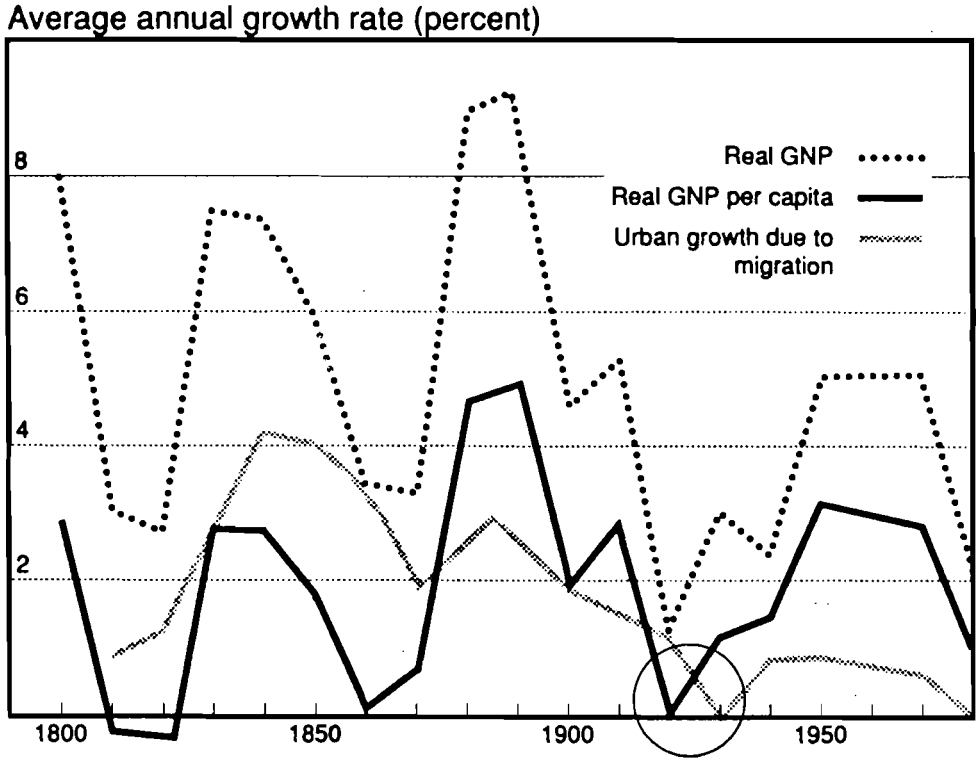
Santos-Burgoa (1993) in, comparison, states that in 1990 less than one fifth of Mexico's population lived in the capital which generated 36 per cent of the GNP (and consumed 17 per cent of the nation's energy) and also points out that Mexico City hosted in that year 68 per cent of the nation's post graduate programmes, and generated 72 per cent of the nation's registered health research. This means that, compared to the rest of the country, its inhabitants produced twice as many goods and services, three times as much AIDS research and four times the total health research. This of course shows a strong centralization but also a necessity for a developing nation to better use its scarce resources.
Similar figures can be shown for Rio de Janeiro which accounted for 4.1 per cent of Brazil's population in 1987 and 10.6 per cent of the nation's GDP, or for Shangai (1987) with 4.8 per cent of GDP but only 1.2 per cent of China's population (Oberai 1993).

3.5. Cycles, trends, perspectives, theories on urban change

If we consider the urbanization patterns which have been occurring globally over the last 2 centuries it is possible to find a path of long-wave rhythmicity in urban growth clearly linked with the long swings of economic growth which were first pointed out by the soviet economist Nikolai Kondratiev (see Kondratiev 1935 and also Schumpeter 1934).

Brian Berry (1990) argues that, according to the 55-year cycle pattern of Kondratiev, since 1792 each growth upswing quickened urban migration; each slowdown was followed by a lower rate of urban growth. If this is true for what concerns urbanward migration, the same can not be stated so easily, however, for natural population increase (see figure 19).

Figure 19: Long waves of economic growth and urbanward migration in the United states, 1790-1980

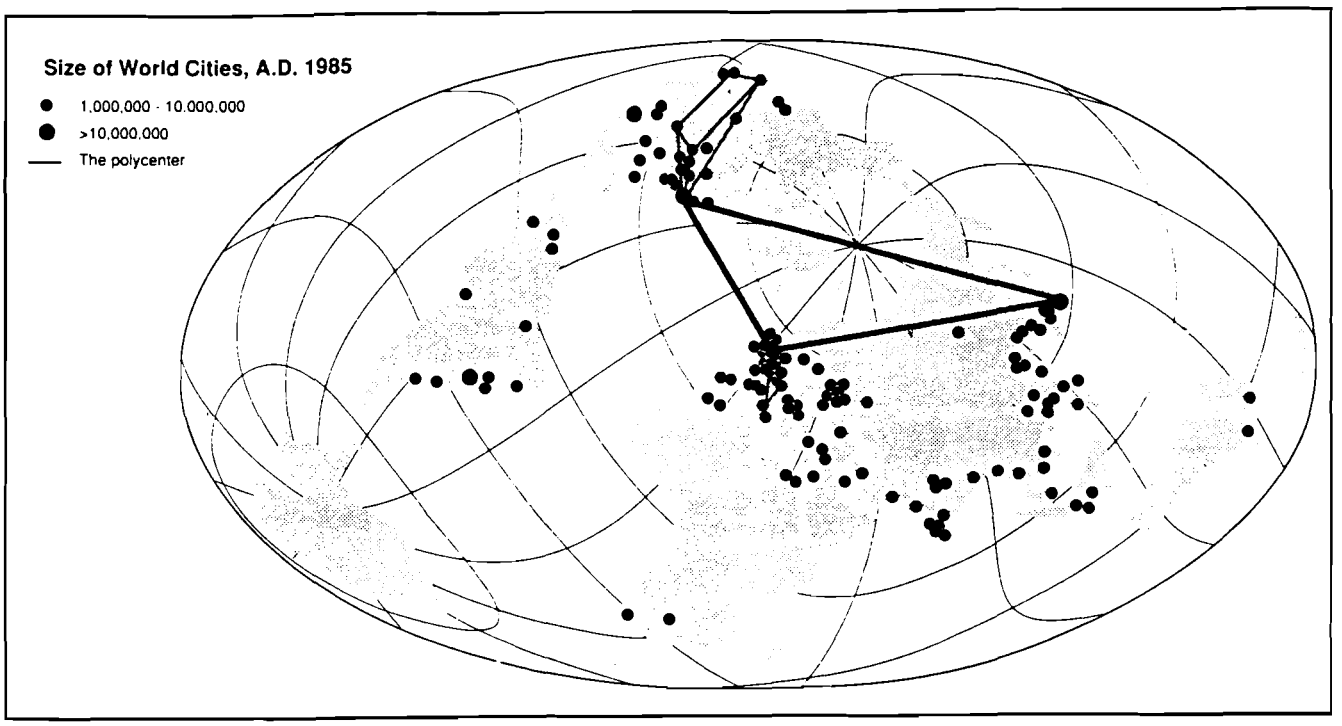


Note: GNP = Gross National Product
As a good example, it can be seen here how the crisis of 1929 determined a halt in the economic growth which was followed by a gradual but steady fall of urbanward migration over the next ten years.
Source: Berry (1990)

Berry also reports that the theory of long waves centres on the role of key innovations that become the leading sectors in growth. These innovations produce accelerated expansion until markets are saturated and recession occurs. Acceleration turns to deceleration and then to stagnation and collapse which eventually leads to depression. Venture capitalists then look for new sources of profit, investing in new technologies which become the leaders for the next wave of growth.
According to this theory we should be right now approaching the lowest peak of the depression swing if not finding ourselves already there. Having being living a real information revolution in the last twenty years the question which immediately arises could be: what role will the new fast developing technological innovations occupy in a foreseeable future economic growth wave? What can be said of the new telecommunication technologies? And

how will these technologies affect the physical setting and life behaviour trends in the world mega-cities? These points have been already partly discussed more in detail in the previous chapters.
Looking at the future Berry (1990) suggests for instance that during the next Kondratiev (1995-2050) the world will be faced with two different realities: on one hand the technological change already occurring in the field of telecommunications and information technologies will lead to a dispersed pattern of city growth in the world's advanced economies which will constitute the *'polycenter of the global urban network'*; besides, in the *world periphery* beyond the *polycenter* there will be a growing list of very large cities in which the process of population concentration, accompanied by local- and regional-scale environmental modification will be repeated (see figure 20).

Figure 20: The *polycenter* and the *periphery*, A.D. 1985



Source: Berry (1990)

Van den Berg *et al.* (1982), instead, developed an interesting theory of urban life cycles and stages of development whose hypotheses were empirically tested by means of macro data on 14 European countries. The analysis is mainly on population and employment figures. Urban development stages can be identified by the evolution of the two discrete urban zones (core and ring) considered, in terms of their growth (or decline) rates. On this basis the following phases of urban development are distinguished: urbanization, suburbanization, deurbanization and reurbanization. If this is true, does it necessarily mean that after what occurred in the fifties, sixties and seventies/eighties the European cities will face a reurbanization trend?
This behavioural theory seems however not sufficiently empirically validated and the role of innovation in urban development is not included.
Jane Jacobs (1965), who was probably one of the first to criticize the effects induced by zoning policies in town planning, had identified the diversity of urban functions in the city (for instance, living, working, shopping, recreation) as the real essence of urban life and as the cause of urban cyclical processes. The concept of *'optimal urban diversity'* is introduced,

characterized by a variety of functions, a stratified age structure of buildings, an accessibility of urban facilities, and a sufficient concentration of urban population. The optimal mix of all those characteristics guarantees an optimal use of urban facilities. At the same time, a lack of diversity may lead to a downward movement of cities. On the other hand, in the case of too many attractive functions of a city, a self-destruction of diversity may take place leading to congestion, land-use competition and environmental decay. What can we say today about the quality of life in the cities and of the impact of the prevailing urban planning rules?
The question of urban functions and of a possible re-organization of them has been partly considered and developed in chapter 2.

3.6. Concluding remarks

The important considerations being made in this chapter clearly show the implications of urban dynamics issues in a global perspective.
The background overview information provided under demographical, social, environmental and energetical standpoints reminds the gravity of dangers involved in a *'laissez faire'* attitude towards the global situation and how important it is for joint action to be taken even at local level.
Considerations on lifestyles and quality of life in the city are meant to show how meaningful city life may be for the human being and for development. Improving the natural, built and cultural environments of cities at neighborhood and regional levels, while acting in ways which support strategies bound to a global sustainable development appears therefore as one of the main priorities for the next century.
Finally, it is hoped that in the framework of this work, this concise concluding overview may be of some contribution for launching an appeal to policy makers and for stimulating further constructive research work in this field.

4. CONCLUSIONS

To this point it has become increasingly clear that the ideal picture which could be imagined for future urban settings is that of a techno-city on a man scale where special attention is being granted to ecological and environmental issues; a combination of technological, socio-antropological and environmental factors should therefore be taken into consideration. The structure should be functional, resource and energy efficient, democratic, appeal to esthetical values and grant a continuity between past and future. All citizens should be given free access to services and facilities and should be able to pursue increasing higher levels of the quality of life. The need for a certain flexibility in the urban management is also to be taken into consideration, so as not to render the city a sclerotic system of rules and regulations on what one is or isn't allowed to do.

4.1. Perspectives for future research

This present work constitutes a preliminary more theoretical part of a broader project.
On one hand the scientific research work carried so far implies a necessary applied phase. The importance of focusing into detail the issues which have been discussed throughout the study has been clearly mentioned. Up to this point all considerations (with the exception of the presentation of some specific examples) have been on a global perspective. As shown so far urban change and the outcome of the implementation of planning policies on single situations have, as a whole, implications on the global environment. It is therefore important to promote action at the single city scale, beeing aware of the global implications.
Therefore, in order to better understand some of the principles which emerged from this study it appears important to focus the attention on the re-organization of an urban function within a specific urban reality at a local level, taking into consideration all possible concrete possibilities and constraints. This implies the co-operation and the involvement of several public and private institutions, as well as the necessary support of the municipal administration of the city concerned. Some hints for future applied case studies is presented in the appendix to the present work (case study, Vienna).

On another hand it has to be admitted that the subject considered in the present study is actually very broad and manifold. The complexity of problems and issues involved in the anaysis of urban systems is so wide that even if a specific approach has been followed in order to somehow reduce the field, many questions remain still open and unexplored. This means that it has not been possible to devote enough time and space to the deeper and more scientifical analyses of some specific points which have been considered, however, very important.

Even if almost every one of the different aspects related to urban systems which has been so far considered would require - maybe - a more detailed research, it appears important to focus on some specific ones, especially in view of a possible future implication of IIASA.
This relates, on a first stage, to the systematic analysis of the type of structural urban organization suggested for the city of the future. The re-organization of the city according to a pattern of de-centralized concentration based on a self-similarity structure and described as the Fractal City could be further studied with a more scientific approach.
This requires the possible implication of theories on location and spatial interaction. It is certainly possible to identify in detail a set of driving forces in the urban system dynamics which can affect its spatial organization; specific modelling work may therefore be developed.
This would mean the possibility of defining some actual urban trends (also applied to concrete case-studies) and to verify the change pattern foreseen in the form of alternative scenarios.

In this paper it has been mentioned how transport and above all communication infrastructure can reduce the distance between geographically separated locations (e.g. between cities or parts of a same metropolitan area) by decreasing the *'friction of space'*.
The objective of investigating the possibility of re-locating and re-organizing vital urban functions within the territory of the city employing modern telecommunication (or information) technologies could be studied with gravity models of spatial interaction (see Abler, Adams and Gould 1971).
An important issue to be verified is, for instance, wether the actual reduction of problems determined by 'separation' in terms of interaction time and space in the new city organizational pattern may have an effect of 'barrier removal'.
The technological change which occurs in the wired city can be effective also as a development steering device and can be seen as a way of improving service efficiency.

4.1.1. Contact institutions

Several institutions and organizations have been contacted during the research work which conducted to the present study, both for what concerns the first more theoretical part and also for the case study shown in the appendix. Some of these can be considered as references and as eventual sources for further information; other just represent institutions which are active in the sector but which have not jet been contacted [28].

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[28] **List of contact institutions**:

(according to the different subjects treated in the text)

1. Urban metabolism - Kobe Protocols

Population-Environment Dynamics Project, Director: Prof. Gayl D. Ness, University of Michigan, Ann Arbor, Mi 48109-2029 USA, Phone: (313) 747-0222, Fax: (313) 747-4947

The Asian Urban Information Center of Kobe (AUICK), (> joint research program with the University of Michigan), 6th Floor, Edo machi SK Building, 92 Edo-machi, Chuo-ku, Kobe 650, Japan, Phone: (078) 334-1681, Fax: (078) 334-1683

IUCN - The World Conservation Union, Prof. Gayl D. Ness, Rue Mauverney 28, CH-1196 Gland, Phone: (22) 999 0001 / 999 0280 (direct), Fax: (22) 999 0002

Prof. Richard Berk, Department of Sociology, UCLA, Los Angeles, CA. 90024, Phone: (310) 206 95 44, Fax: (310) 206 56 51

2. General and interdisciplinary studies on urban issues

CNRS - PIRVILLE, Programme interdisciplinaire de recherche sur la ville, Directeur: M. Gabriel Dupuy, Communication, relations exterieures: M. Jean-Marc Rennes, 3, rue Michel-Ange, 75016 Paris, France, Phone: (01) 44 96 47 07

IIED (International Institute for Environment and Development), Office for Latin America, Presidente: Jorge Enrique Hardoy Corrientes 2835, cuerpo A, 6. B, Buenos Aires, Argentina, Fax: (...) 961 2332

IIED - Europe, Director: Richard Sandbrook, 4 Endsleigh Street, London, United Kingdom, Fax: (...) 388 2826

OECD (Organization for Economic Co-operation and Development), Environment Directorate, Urban Affairs Division, Head: Mr. Ariel Alexandre, 2, rue André-Pascal, 75755 Paris Cedex 16, France, Phone: (01) 45 24 82 00 (direct: 97 47), Fax: (01) 45 24 78 76

OEIL (Observatoire de l'Economie et des Institutions Locales), Directeur: Prof. Rémy Prud'homme IUP - Univérsité de Paris XII - 94000 CRETEIL CEDEX, Phone: (01) 45 17 11 54, Fax: (01) 45 17 11 55

URBAN MANAGEMENT PROGRAMME, UNDP/UNCHS (Habitat)/World Bank, Josef Leitmann, Brit Saksvig, The World Bank, 1818 H Street, N.W., Washington, D.C. 20433, Phone: (202) 473-1245, Fax: (202) 522-3224

3. Urban systems - models

Universita' degli Studi di Torino, Dipartimento di Scienze e Tecniche per i Processi di Insediamento, Director: Prof. C.S. Bertuglia, viale Mattioli 39, 10125 Torino, Italy

4. The wired city - modern technologies for monitoring

Universita' degli Studi di Napoli "Federico II", Dipartimento di Pianificazione e Scienza del Territorio, Director: Prof. Corrado Beguinot, Piazzale Tecchio 80, 80125 Napoli, Italy, Phone: (081) 768 2307, Fax:(081) 768 2309

Consiglio Nazionale delle Ricerche, Istituto di Pianificazione e Gestione del Territorio, Director: Prof. Urbano Cardarelli, via P. Castellino 111, 80131 Napoli, Italy, Phone: (081) 546 3488 / 3903 / 3904, Fax: (081) 770 1918

5. The Fractal city

Dr. Cesare Marchetti, IIASA - 2361 Laxenburg, Austria, Phone: (02236) 715 21-0* (ext. -276), Fax: (02236) 713 13 / 731 47

International Competition "The City of the 21st Century", Participating group from Vienna, c/o Dipl. Ing. Michael Hetzl, Johannesgasse, 1010 Wien, Austria, Phone: (0222) 513 7781

Dr. Herbert Klima, Byophisiker, Atominstitut der österreischischen Universitäten, Schüttelstrasse 115, 1020 Wien, Phone: (0222) 727 01-0* (ext. -258), Fax: (0222) 728 9220

Politecnico Di Milano, Dipartimento di Ingegneria dei Sistemi Edilizi e Territoriali - Ingegneria Urbanistica, Prof. Arch. Giovanni Rabino, Piazza Leonardo da Vinci 32, 20133 Milano, Phone: (02) 23 99 - 4102, Fax: (02) 23 99 - 4105

Prof. Roger White, Memorial University, St. John's, Newfoundland, Canada, and Research Institute for Knowledge Systems, Maastricht, Netherlands

6. Sustainable City Development - The Ecological City

Österreichisches Institut fur Baubiologie und -ökologie, President: Arch. Mag. Ing. Helmut Deubner, Landstrasser Hauptstrasse 67/1, 1030 Wien, Austria, Phone: (0222) 713 3793-0*, Fax: (0222) 712 0997

CSD (United Nations Commission on Sustainable Development) - Human Settlements, c/o DPCDS, United Nations, New York, NY 10017 USA, Phone: (212) 963 1234, Fax: (212) 758 2718

Centre for Our Common Future, Executive Director: W.H. Lindner, 52, rue des Paquis, 1201 Geneve, Switzerland, Phone: (022) 7327117, Fax: (022) 738 5046

Global Forum '94, Eastgate, Castle Street, Castlefield, Manchester, M3 4LZ, UK, Phone: (61) 234 3741, Fax: (61) 234 3743

IIED - Jorge Enrique Hardoy

Prof. Michael Breheny, Department of Geography, University of Reading

7. Case studies

Magistrat der Stadt Wien - Stadtplannung Wien:
- Planungsstadtrat: Dr. Hannes Swoboda, A-1082 Wien, Rathaus, Phone: (1) 4000-81145
- MD - Stadtbaudirektion Gruppe Planung, Planungsdirektor: Dipl.Ing. Dr. Arnold Klotz, A-1082 Wien, Rathaus, Phone: (1) 4000-82638
- Magistratdirektion der Stadt Wien - Automatische Datenverarbeitung, A- 1082 Rathausstrasse 1, Phone: (1) 40 133/396, Fax: (1) 40 133/484
- M.A. 18, 19, 21, 22, 24, 27, 46, 64, 66
- Dezernat 2 - Stadterneurung und Bauvorbereitung der Stadt Wien, Leiter SR DI Horst Berger

WBSF (Wiener Bodenbereitstellungs und Stadterneuerungsfonds) - Dr. Forster, A-1082 Wien, 1 Bartensteinsgasse 16

Technische Universitat Wien:
- Institut fur Verkehrsplanung und Verkherstechnik
- FODOK (Forschungsdokumentationszentrum des Ausseninstitutes)

Prof. Elisabeth Lichtenberger, Department of Geography, University of Vienna, Universitätstrasse 7, 1010 Wien

Institut für Stadt- und Regionalforschung der Österreichischen Akademie der Wissenschaften, Direktor: Univ. Doz. Heinz Faßmann, Postgasse 7, 1010 Wien

Prof. M.M. Fischer, Institut für Geographie, Wirtschaftsuniversität Wien, Augasse, 1020 Wien, Phone: (1) 313 36-0*

Bundesministerium fur Öffentliche Witschaft und Werkher, Gen. Dir. fur die Post- und Telegraphenverwaltung

Fernmeldebetriebsamt Wien

Telekabel Wien GES.m.b.h., A- 1101 Wien, Erlachgasse 116, Phone: (1) 170171

Vienna International Conference on the Future, c/o UTEC Vienna, P.O. Box 285, Turkenstr. 25, 1092 Vienna, Phone: (1) 310 6896-0*

Wiener Akademie für Zukunftsfragen, A-1090 Wien, Porzellangasse 35, Phone: (1) 319 9871, Fax: (1) 319 9878

Istanbul Buyuk Sehir Belediyesi (Municipality of Istanbul), Prof. Mete Tapan, Sarachane, Istanbul, Turkey, Phone: (212) 5229102

Prof. Michel Grenon, Blue Plan Regional Activity Centre, Place Sophie Laffitte, Sophia Antipolis, 06560 Valbonne, France

5. APPENDIX. A CASE STUDY: VIENNA

5.1. The Vienna Metropolitan Area [29]

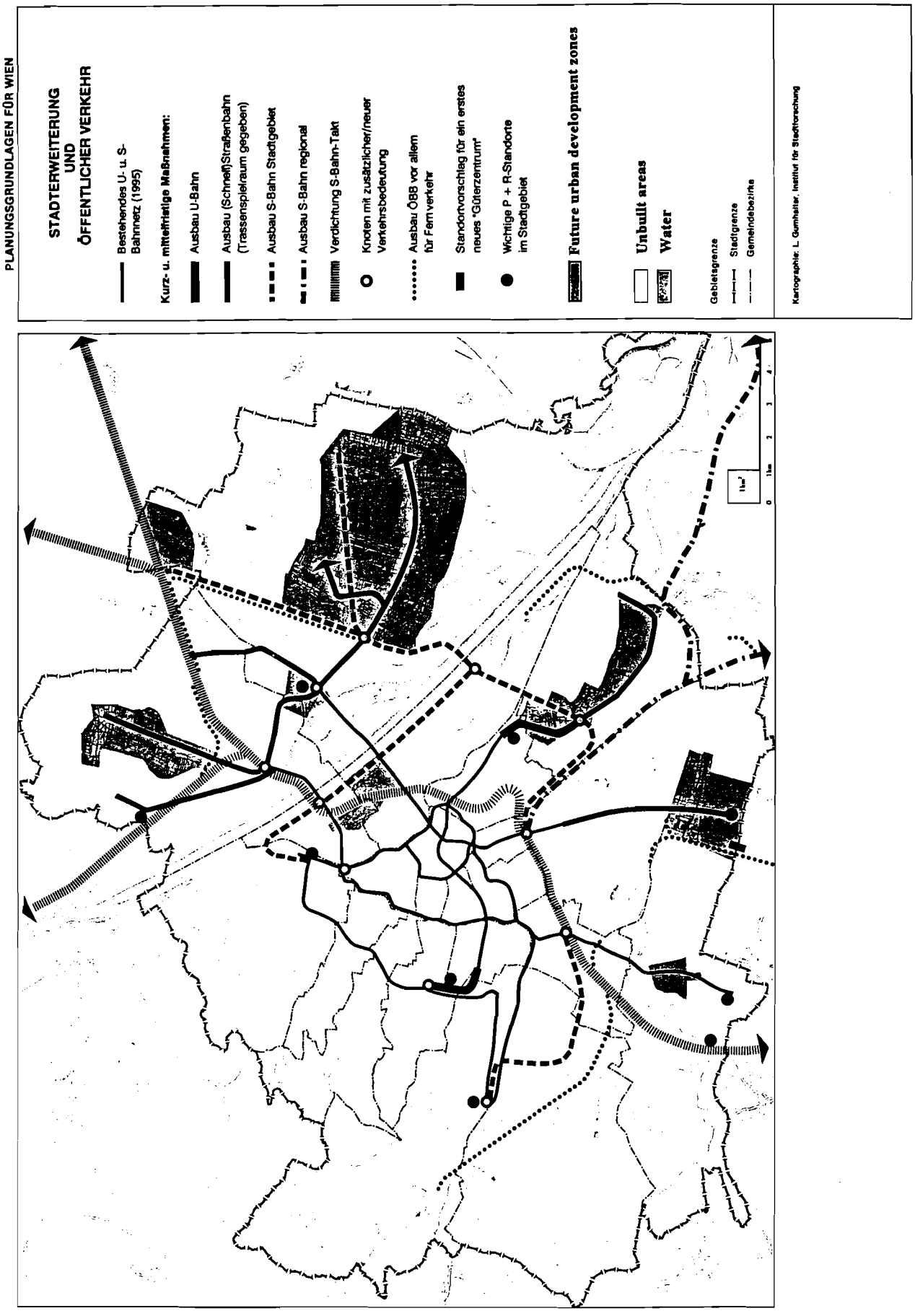
The case of Vienna presents more than one points of particular interest.
First of all the relative limited dimension of the urban system makes it possible to have ready-at-hand and manageable data which ensure the advantantage of defining a clear metodology of research. Secondly, the case study itself appears very interesting for its peculiarities and for the potential it offers.
Over the last ten years the city of Vienna has been interested by a process of transformation and development which resulted at first in a sort of re-wakening after a 'long sleep'.
Especially after the recent changes occurred in Eastern Europe Vienna has now confirmed its central geographical position in the European context. This means also a new special role for communication as well as for economic, politic and cultural exchange.
The City Development Plan of 1984 (STEP 84) was forecasting a constant decline of the population. A new revision was needed, mostly because of a fast growing reurbanization trend which started occurring in the past few years. The causes of this urban growth lie mostly on national and, above all, international migration flows. The City Development Plan of 1994 (STEP 1994) takes into account this new reality and, among others, confirms the setting of new urban development areas within the city (see figure 21).
Vienna is today one of the few european capital cities which is actually growing: a couple of hundreds of tousands more hinnabitants are expected for the next 10 to 20 years. A need of approximately 120,000 new dwellings is therefore foreseen by the municipal authorities.
The traditional and very effective policy of public housing, which since 1923 provided the city with more than 220,000 public-owned dwellings, has reacted quite steadily to this challenge. According to municipal sources in 1994, up to 10,000 new dwellings per year are being planned (the total cost of which amounts at 22% of the city's budget), in addition to the implementation of an extensive action of municipally aided rehabilitation of historic tenements, bound to raise the housing quality [30].
Altogether, better living quality for over 250,000 people will be ensured over the next five years. The highest percentage of sub-standard dwellings in Vienna is located mostly in the South-Western part of the city, beyond the *Gürtel* (see figure 22), in the densely built up areas of the 19th Century, the period of the so called *Gründerzeit.*
Increases in the price of rents and growing demand for new space for private and public buildings and facilities, as well as for green areas for leisure, are among the problems involved.

Vienna has a certain potential which is determined on one hand from the high level of the quality of life. This is granted, among others, from:
a) The accessibility and relative good development of functional public services (including the ones related to the two city-functions of culture and free-time leisure);
b) A traditional culture of environmental protection which, associated with optimal climatic and topographical conditions, also ensures special low levels of air pollution;

[29] Reference to metropolitan area is made to clarify that not only the city proper should be considered in this case study. As for Vienna the concept of metropolitan area gives however ground to different interpretations. For this reason a clear definition of the urbanized area to be considered needs to be made before pointing to any further development stage of the case study which is here outlined.

[30] To these figures the activity of the private and the co-operative sectors (i.e. *Genossenschaftswohnungen*) should also be added.

Figure 21: Planned urban development and public transportation in Vienna



Source: Magistrat der Stadt Wien, Magistrat Abteilung 18 - Stadtstrukturplanung, *Stadtentwicklung Wien. Bausteine für die Fortschreibung des Stadtentwicklungsplanes*, Beiträge zum Stadtforschung, Stadtentwicklung und Stadtgestaltung, Band 29, Wien 1991.

Figure 22: Dwellings of "D" category in Vienna (up to 60 sq.m.) built between 1870 and 1919

Kategorie-D-Wohnungsanteil (<60 m2) Gründerzeit (GZ)

1km²

0 1 km 2 3 4 5

Typ 1: über 50% *gründerzeitlich*

Typ 2: 25 <= 50% *gründerzeitlich*

Typ 3: 20 <= 25% *Mischzone*

Typ 4: 5 <= 20% *nicht gründerzeitlich*

Typ 5: unter 5% *nicht gründerzeitlich*

Sonderflächen

Institut für Stadt- und Regionalforschung, ÖAW. Daten: ÖSTAT, HWZ 1991. *Graphik: A. Andiel*

Note: This figure shows the distribution of dwellings in poor conditions, which have been built during the period of the german industrial revolution (*Gründerzeit*), at 1991. The Austrian rent regulation Law identifies 4 different classes of dwellings (A to D), according to the standard of living conditions. To the D category belong dwellings where sanitary services are either non-functioning or missing.

Source: Andiel, A., Faßman, H., Ostermayer, J., *Was ist die Wohnlage wert? Das Mietrechtsgesetz und die Bestimmung des Lagezuschlags zum Richtwert,* Manuscript, Vienna 1994

c) A particular cosmopolitan and multi-cultural background and composition of the population;
d) The traditional historical organization of the city in quarters and districts which survived the radial monocentric development experienced in the 19th century.

On the other hand, Vienna is a city in constant balance between tradition and conservation on one side, and permanent transformation and innovation on the other.
Vienna has always been famous for its special flair of past splendour, on the glory of which the city always rested and successfully presented itself to the external world. The increasingly high number of foreign visitors per year and of touristic activities in general also rely on this major factor of attraction, which is well combined with the concentration of artistic and cultural interests in the city. When someone thinks of Vienna, the first images associated are the ones of music, of the viennese Secession, of the Habsburgs, maybe also of the 'Red Vienna' of municipal housing ...
But there is in Vienna also another important reality of a constant will for new experimentation which has often led to the actual implementation of projects beyond the mere theoretical discussion and proposal phase. And this aspect is probably less known of. For example, there is here an important and constant debate for new architectural models and forms which has not yet gone so much beyond national borders. And even in the field of urban safeguarding and rehabilitation, what has been achieved in the last twenty years may be less noticeable of what occurred for example in Bologna, Rotterdam or Berlin-Kreuzberg but is probably even more effective [31].

For the next appointment of 1995, which is so meaningful for the past and future of Vienna and Austria, the city wants to give itself a new image of a modern city of the future. The country is jet joining Europe (the EU) at round anniversaries since the declaration of independence and the proclamation of the 2nd Austrian Republic (1945), and since the 'liberation' of Vienna and Austria from foreign occupation, which also led to the signing of the State Treaty (1955).
The city can take the good opportunity to also prepare itself to host dynamically the celebrations foreseen for the millennium of the Austrian nation (the first record of the word *Ostarrichi* actually dates back to the year 996 a.D.).

This appears as a very special chance to identify the fascinating challenge involved in a re-consideration of the territory through the use of advanced technologies in such an important moment where urban change dynamics in the city is involved.

5.2. Proposed applied research (draft outline)

First of all the proposal regards a project of co-operation between the municipal administration of the city of Vienna and the research group *Technological innovation and territorial transformations for the city of the 21st century* of the University of Naples "Federico II" (Department of land-use science and planning).

The project may involve:
1) The re-organization of city departments within the municipal administration through the development and the use of the new information technologies

[31] The process of urban renewal and rehabilitation which has started in the mid 80s is projected to be a long-term one. Up to now, in the decade 1984-1994 investments from the public sector in this fioeld have reached 30 billion Austrian Schillings.

2) The diffusion and the implementation of the principles of the Charter of Megaride 94;
3) The 'intelligent' rehabilitation of historical city quarters.

At the time being part 1) of the project is still to be defined and agreed, and may in fact be part of a wider project involving also other European cities, with the support of the European Union.
A specific detailed research programme will be therefore separately developed.

For what concerns part 2) initial organizational work is already in the discussion phase among the institutions involved.
The idea is to organize a symposium/workshop on the the ways to implement the principles of the Charter in the viennese reality, within the frame of a suggested wider programme, like the one scheduled for next summer 1995 in Vienna.
The programme of this series of events, now in form of a first pilot project, that is a sort of 'Wiener Architektur Sommer' should be inspired on the model of similar initiatives already experimented in cities like Hamburg. Architects, town-planners, private and public contractors will have a special possibility to meet during a series of events (symposia, exhibits, conferences, wokshops ...) on the theme of architecture and town-planning for the 21st century. This would also mean a real possibility of grouping together several different initiatives on the future of the city, which may actually have a much stronger effect within the frame of a more general and organic programme, rather than isolated. The co-operation and support of public administrations, private firms and foundations, cultural and research institutions is of course of vital importance.
Within the framework of similar future initiative it may be worthwhile to plan activities inspired on the themes of the new Charter of town-planning. A workshop on the Charter of town-planning (Megaride 94) should include, for example, conferences and discussions held from professionals, researchers, civil servants and political leaders. This phase will focus on the analysis of the conditions and potentials of the city to implement some of the concepts contained in the ten principles of the document. A wide involvement of citizens should also be encouraged in some of these meetings.
A further phase of this workshop should involve young architects and students on the experimental application of some specific points wich could particulary well suit the viennese reality. This part could be organized on the model of the Viennese Seminars on Architecture (*'Wiener Architektur Seminare'*) which were successfully first launched in Vienna in 1990. Project groups should be organized with the guidance of architects and town-planners, and the results discussed in a final session. Among possible project fields for applied study are the re-organization of complex urban functions within the city.

Point 3) of this project of co-operation appears as a possible field of further research connected to the necessary applied follow-up to the present study "Urban Systems and Global Change". It regards the 'intelligent' urban rehabilitation of the historical city quarters of Vienna which date back to the period of the industrial revolution (*Gründerzeit*).
The co-operation of the different offices of the municipality of Vienna is very important especially for the concrete aspects involved, for background data collection and for the discussion of eventual future planning policies.
A specific detailed project description still has to be developed, and what follows is a brief overview of some crucial points which should be considered:

Vienna has the highest number in the world of dwellings with more than seventy years of service. More than 40% of the viennese houses have been built before 1919, and still today a relatively high number of them are even not equiped yet with sanitary services (see also figure

22). Under this last point of view the situation has greately improved during the last 10 years, mostly through the massive process of urban upgrading and renewal which has already been mentioned.
This situation represents an incredible opportunity for the planning and the implementation of an overall re-organization of the structure of the city.
Generally, although the serious involvement of the Municipality of this city successfully succeeded in guiding to the definition of important policy planning instruments, it has to be reckoned that there is in Vienna an absence of a real town-planning debate on the possible models to be followed for the development of the city. The many recent - and even quite large - projects and operations discussed and also the ones already into implementation appear mostly isolated from each other, resulting into a sort of fragmentary situation.
The development of the city is thus occurring with a pattern of dispersed islands rather than through wide omogeneous stratifications (as happened instead last century). Moreover, the innovative trends, the will for experimentation and the creative debate occurring at the mere architectural scale do not seem to happen at the urban scale, even if some of the architectural projects regard the development of entire new quarters. The result is that these projects, which are also very different from each others, do not seem to find their necessary integration in the urban periphery (which is also mostly badly structured), especially in the case of pre-existent historical settlements. The relation between the peripheral areas and these historic 'borougs' is already quite casual if not accidental.
Sometimes, important social assessment research is carried out only after the completion of large housing programmes. In the case of the urban expansion which is occurring over the Danube in the plain of the Marchfeld, one of the main actual dangers is to create new bedroom neighborhoods with little infrastructure which are almost totally dependent on the city centre. The centre, which has been made closer with the *U-Bahn* and which is subject to daily 'assault' from hords of tourists, is already under great pressure. A re-balance of the city should be actually thought of in a very careful way.
The development of a new centre on the Danube (the *Donaustadt*) will soon take place. This is the result of a political will which brought to a reconsideration of the big plans which had been made for the EXPO '95 in a new perspective, after the EXPO Project was turned down through a referendum. The implementation of the new project may show, however, the danger of creating a 'double' city, which may also result in a mere duplication of the amount of problems, in the long run.

Social analyses, previous to the planning phase, are considered essential also for the areas of urban rehabilitation and of a more general upgrading of the city. Who is going to live in the renewed dwellings? What kind of social and cultural structure does the population of these areas show? What are their real needs?
The importance to act with a global attitude based on long wave trends but centered on the scale of the city quarter is therefore important.
A series of 'a priori' socio-antropological analyses should be implemented before and during the actual planning phase. Therefore the necessity of granting more credit also to existing studies in this field, in the perspective of developing some scenario work.
It is for instance important to determine the points of 'magnetic' attraction within the existing city prior to intervention and how would the population react to change factors. The question is also to re-discover the urban values and the traces of memory of places within the planning process of urban upgading.
There is in Vienna a traditional organization of the city which follows the structure of historic quarters and districts (which still appear in old toponimes) to which the planned 'modern' monocentric radial growth pattern has been superimposed, and which still somehow survives. Rather than opposing old existing balances in the organization of the city it would be more

sensible to explore them in detail so as to well understand the phenomenon and succeed in guiding future development in the right way. The mixed-use structure of central areas should be reinforced and mantained; de-centralized work places should be created, for instance, in highly residential areas.
Practically, this means an attempt to re-organize the existing city of Vienna following the model of the Fractal city (see paragraphs 1.3. and 2.2. of the present study) and with a wisely planned use of modern information technologies. It is clear that the concept should be applied and developed according to the specific local conditions and constraints, and this requires of course time and a certain effort.

Such a project should also be seen in the framework of a wider stategy involving the re-organization and the re-balancing of the whole city, including the districts of the new expansion areas. The re-thinking of the transport and communication net (which now, with some exceptions, mostly determines a concentration of transit flows along a centripetal axes) should also be considered. New lines of a fast speed - high frequency computerized system developed also along other meaningful tangential itineraries should be planned.

Among possible study areas there are some specific zones which could be mentioned. Generally, the attention should be concentrated on those districts where physical and social decay appears worse. The districts between the *Ringstraße* and the *Gürtel* should be considered (i.e. districts 2 to 9) , but also the ones beyond the *Gürtel* (i.e. districts 12 to 20) where, especially on the south-western part of the city, we find the highest concentrations of foreigners and immigrants. Some connecting districts like for instance *Leopoldstadt* and *Erdberg* should also be given special attention. Under this point of view, for example projects like *Nordbahnhof* or the one around the area of the old *Gasometers* are well located.

Some considerations should, in conclusion, also be made on some extra-regional issues. A co-operation with the surrounding urban systems on a national and international scale is particularly important when thinking of the future role of the city of Vienna. This regards on one side the existig towns which are situated within a radius of ca. 50 to 70 kilometers from the capital. These include the new capital of Lower Austria, St. Pölten and the town of Krems, respectively to the West and North-West; Wiener Neustadt and Eisenstadt, respectively to the South and South-West, and finally Bratislava, the capital of Slovakia, to the East. There is today an intensive flow of commuters among these cities, and a sort of network 'galaxy' system of inter-connection should be actually thought of very carefully [32] (see figure 23).
On the other side we have to consider the fact that Budapest, the capital of neighbouring Hungary, will be most presumably connected to Vienna in the next coming future with a line of fast-speed trains which will reduce the actual 3 hour trip to just a ca. 1 hour ride. This will bring the two cities much closer than they are today, and common planning strategies should be thought of now.

5.3. Other related future case studies

Further enlarging the scale, the axis of possible future development which may connect the cities of Berlin-Prague-Vienna-Bratislava-Budapest should be considered. This may be the object of a possible future research (see Figure 24).

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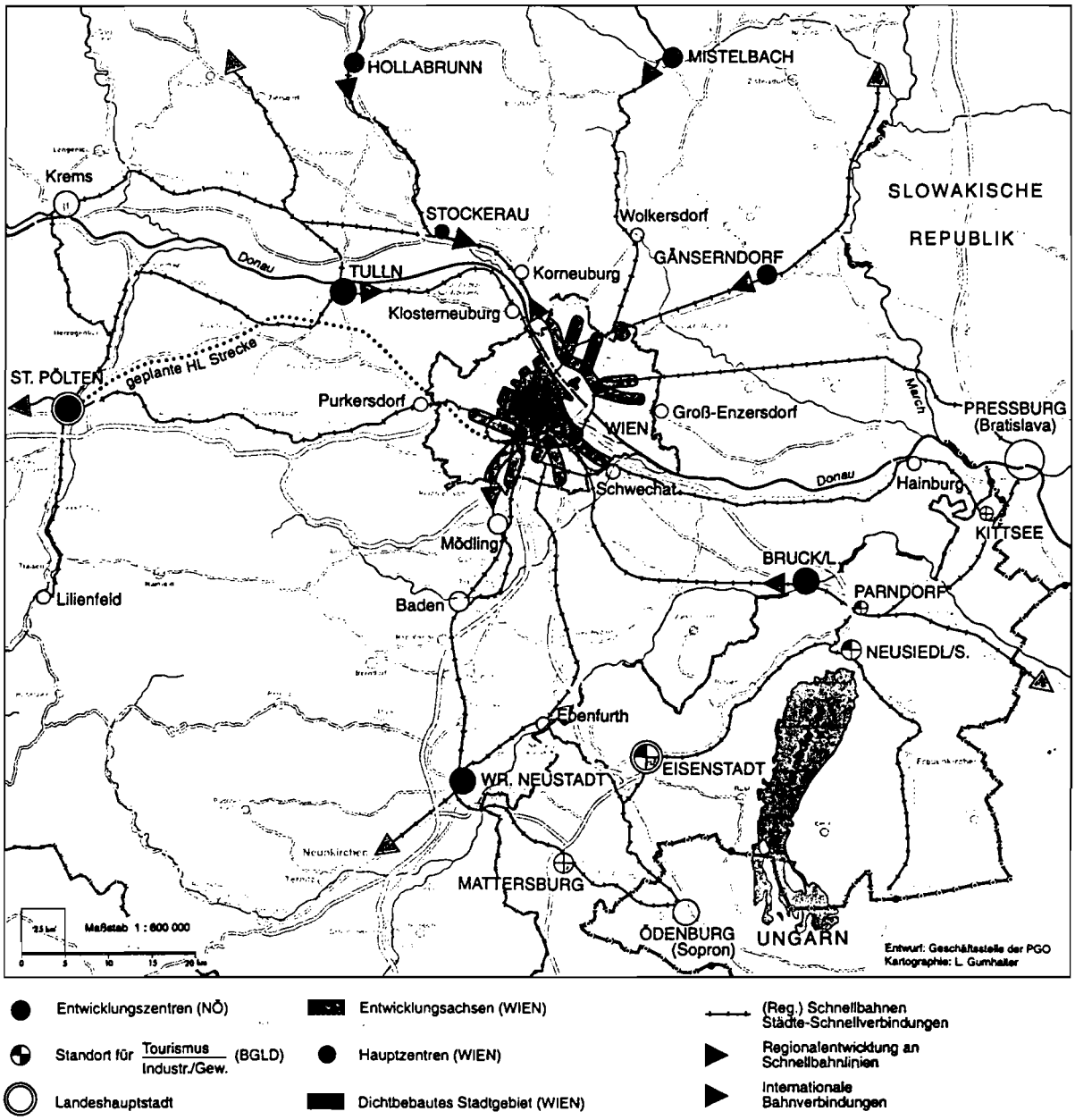
[32] Some meaningful activity in this sense is already shown by the *Planungsgemeinschaft Ost (PGO)* which will soon hold a Symposium (planned for November 1994) on the interactions among the regions (*Länder*) of Lower Austria, Burgenland and Vienna. A possible future development may even bring to the definition of a new European Region Vienna-Bratislava.

Figure 23: Development priorities in the Eastern *Länder* region



Source: Stadtplanung Wien, *Stadtentwicklungsplan für Wien (STEP)*, Beiträge zur Stadtforschung Stadtentwicklung und Stadtgestaltung, Band 53, Wien, 1994

Figure 24: Austria and Vienna in new Mitteleuropa: an axis of possible future development

Source: Malvani, adapted from STEP (1994)

Another case-study regards, instead, the mediterranean model of urbanization. This case-study is however not directly related to the previous ones, but is connected with the research project on the mediterranean city which originated a few years ago within the Institute of Land-use Planning and Management of the Italian National Council for Research in Naples (I.Pi.Ge.T. - C.N.R.).
Useful contacts have already been taken with the Tecnical University and the Municipal administration of the city of Istanbul (Turkey), which expressed their interest for common work. Similarly, a positive response also came from public institutions of the italian cities of Genova, Trieste and Naples.
A possible contact with the Blue Plan Regional Activity Centre of Sophia Antipolis, in France, is also foreseen, especially for what concerns a multi-disciplinary metodological approach to the problems of the mediterranean region. Under this last aspect, an involvement in the exchange programmes between European cities and the cities of the non-member countries of the Mediterranean can be foreseen. Such programme is co-ordinated and partly financed by the EU Commission through the so called MED-URBS project.

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