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New Governance Principles for Sustainable Urban Transport

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Research Memorandum 1996-51

November 1996

vrije Universiteit amsterdam

NEW GOVERNANCE PRINCIPLES FOR SUSTAINABLE URBAN TRANSPORT

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Paper presented at the Third Nectar Euroconference entitles "European Transport and Communications Networks: European Networks and Dynamics of Spatial Organisation", held in Mons, September 24-28, 1996

Abstract

The paper positions the communications and transport in the centre of a rejuvenation policy for a sustainable urban habitat, taking for granted the success of urban governance will depend on the professionality of local/regional policy-making governed by sound principles from business practice in corporate organizations.

NEW GOVERNANCE PRINCIPLES FOR SUSTAINABLE URBAN TRANSPORT

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1. The City: Pro and Contra

Human settlements are a spatial mapping of socio-economic and cultural political ramifications of society. In the past century, we have witnessed the emergence of large cities as a result of economies of density and scale. These forms of human settlement suffer often from environmental hazards and health risks posed by air, water and surface pollution, substandard housing, poor sanitation and in general, lack of basic services. These negative urban externalities are disproportionately distributed among urban inhabitants. Especially in Third World cities the poor tend to live in ecologically vulnerable areas and on marginal lands. Thus, large cities are often showing an unsustainable picture of economic efficiency, social equity and environmental decay. This tension will increase in the future, as the main part of the growth of world population will reside in urban areas, a trend which will likely be accelerated due to the liberalization of the world economy and the transition towards a global network society in which urban nodes will play a key role. A critical question is then whether urban management and local political leadership will be sufficiently strong and effective so as to implement a proper proactive urban policy in a multi-faceted field fraught with conflicts: traffic, pollution, waste, energy, congestion, infrastructure, sanitation, or public services.

The above rather pessimistic view on the city is even aggravated, if one introduces the notion of the so-called 'footprint of cities', by which is meant the total land use which would be necessary to supply a given city with sufficient food or timber, as well as the total area of growing vegetation which would be needed to absorb the CO_2 emission of that city. Such calculations lead usually to excessively high estimates of the indirect spatial requirements for the survival of cities. They contribute to a view on the modern city that is characterized by threat and decay, but fail to assess the direct and indirect spatial demands of alternative patterns of human settlements (e.g., deconcentrated ways of living). More in particular, many publications on modern city life seem to forget that the city has more opportunities to cope with negative externalities than any other way of living. Furthermore, it should be noted that the urban environment does not only concern pollution and waste, but also the cultural heritage and the built environment which offer massive positive externalities to both citizens and visitors (cf. Coccossis and Nijkamp, 1995). Thus, a reflection on the urban environment comprises many aspects of urban life. We may refer here to Lynch, 1981, who asserted: "So that settlement is a good which enhances the continuity of culture and the survival of its people, increases a sense of connection in time and space, and permits or spurs individual growth: development, within continuity, via openness and connection" (p.117).

The critical role of a city in an industrialized society appears to turn increasingly into a centripetal role in a modern network society; cities are becoming 'local networks in networks of cities'. In their setting we focus on the central role of transport and communications systems which offer many economic opportunities and social advantages (i.e., social benefits), but also many threats in terms of environmental decay, traffic insecurity and congestion. This requires a careful tuning of various types of policies to transport policy, guided by the idea that free readership has to be penalized and - following sound economic principles - social costs of transport have to be charged to the sources of negative externalities.

The quality of the urban habitat will at the same time decisively be determined by its accessibility by means of both physical and non-physical network infrastructure. This means that transportation and communication are in principle vehicles for urban sustainability, provided all social costs (and benefits) involved are charged to all users in such a way that a socially acceptable and equitable market result

emerges. The recent popularity of market-based policy principles for sustainable urban development (e.g., tradeable area licensing schemes, or tradeable car emission permits as experimented at present in e.g., Mexico City) illustrated that creative policies are necessary in order to ensure that cities are - and remain - the 'home of man'.

2. The Modern City as a Node in the New Network Society

Cities are increasingly playing a central role in our modern society, due to their threefold nature of "gateways" in the internationalisation of their regional setting, of "nodes" in international information and communication networks, and of "places" bearing an economic and demographic weight, a specificity and a "vocation".

2.1. Cities as gateways to internationalization, multinationalization and globalization

As a result of the presence of dynamic agglomeration economies, cities have always been recognized as the loci of modernization and technological innovation and as the engines of economic growth and social transformation. In this respect, they have always developed or attracted the most advanced, economically rewarding and politically crucial functions (Braudel, 1979; Nijkamp, 1986). Traditionally, all this developed for a long time into multiple forms of territorial control and economic hierarchization, but has also given rise to opposite processes of diffusion of know-how and economic activities, in a never ending cyclical process of concentration and diffusion.

More recently, in presence of an acceleration in the process of international integration due to political, economic and institutional backgrounds, cities are taking up a novel crucial role: the role of gateways in the internationalization process of their surrounding regions.

We may distinguish three different processes within the general international integration of the different economies (Gordon, 1994):

- internationalization, which refers to international trade and increasing market integration;
- multinationalization, which refers to integration in the production sphere, through foreign investment and the selective location decisions of multinational corporations;
- globalization, which refers to integration in know-how and innovative activities, through transnational cooperation agreements and strategic alliances.

When these processes refer to specific regions, their territorial connection takes place through those guideposts or gateways we call cities. On the one hand, external firms interested in the control of new regional markets, in off-shore branch-plant location or in potential technological joint-ventures establish their guideposts in the economic barycenter of the different regions; on the other hand, regional activities dispersed throughout the territory find in the big city the competences, the tools and the channels for their international projection. It is not incidental, for example, that the economic upswing determined in Europe by the launching of the Single Market Project in 1985 coincided with the relaunching of almost all big cities in the countries of the European Union (Camagni, 1991).

2.2. Cities as nodes in the city-network

The capability of the city of connecting economic activities throughout the world derives from its nature of a node in international communication and information networks. In all times, efficient links (relative to the existing technological level) connected cities with one another; today, airplanes, high-

speed trains, fiber-optics cables annihilate physical distances and simplify the geography of centres by the dychotomy "to be or not to be in the network".

Against this statement, one could argue that some networks are nowadays extremely diffused on the relevant territory (like the telephone network), and that other communication technologies, using the ether as a medium, overcome not just space but also physical networks and nodes, reaching whatever place the receiver is located. In this picture, nodality seems to lose importance.

The counterargument may be straightforward: it is certainly true that each economic unit might act and might be considered as a node in the information network, but what really matters is the co-existence of different networks in a single node, or, using an increasingly popular terminology in transportation research, their interconnection. In consequence, if nodality still matters for some kinds of networks (like transportation networks), nodality still matters for the interconnection among them.

While in the past the rank of a city was determined by the number of functions that concentrated in that city, nowadays its rank is more and more determined by the number of networks it allows to interconnect: financial networks, technological networks, headquarter networks, cultural and leisure networks, high-speed trains networks and so on.

As a consequence of these evolutions, cities (as nodes) link up with other cities and nodes in ways that cannot be analysed and understood with the traditional tools of urban geography. The traditional models of city-systems considered only one class of city-networks: hierarchical networks, where each city interacted only with smaller urban units situated inside its regional hinterland. These types of relationships remain important, but are complemented by other more important relationships, that give rise to three kinds of city networks (Camagni, 1993):

- complementarity networks, linking cities performing different roles within the spatial division of labour (e.g.: the cities of the Randstad Holland, relatively specialized in different functions);
- synergy networks, linking cities performing similar roles and allowing the integration of the local markets (e.g., the international financial centres acting on a unique virtual worldwide market; art cities linked within tourist itineraries);
- innovation networks, linking cities cooperating on common projects (e.g., airports, railways, etc.).

In all these cases, two complementary elements are necessary at the same time: efficient physical networks and a specific function played by the city within the network. The existence of efficient physical networks is a conditio sine qua non for the development of high order functions and the internationalization of the city; the existance of an actual role of a strategy to build it up is a condition for the effectiveness of the investments in the networks.

2.3. Cities as places

This last element brings us to the consideration of the third nature of cities: cities as places characterized by a physical dimension, an identity, an image. The use of the network metaphor in fact does not exhaust the multiform facets that characterize the city, and may even be misleading: the city cannot be interpreted as (and its image reduced to) an airport, a railway station or an electronic switch addressing telephone calls to the right direction. Cities bear a geographic, demographic, physical and economic dimension that nourish and determine its internal functioning and its role.

The functions performed are always biased towards tertiary and immaterial tasks, planning and control, contact and interaction; one in the modern city, towards internationalization. In order to host

and attract these functions the city has to supply efficient external accessibility through long distance networks and linkages, but also an efficiently managed internal territory allowing a good quality of life and an easy utilisation of space for internal movement and residential activities.

2.4. Nodes and places: an increasingly difficult integration

As we have seen above, the territorial and the network natures of the city are widely complementary, but may become conflicting with each other. On the one hand, the quality and quantity of the urban functions demand, and highly benefit from the supply of, external infrastructures; on its turn, infrastructure provision needs an actual and effective demand in order to be profitable. But on the other hand, highly efficient long-distance networks have to end up into specific sites within the city; they have to interconnect with each other; therefore they enter in a direct contact with the physical aspects of the city, with its traffic and congestion, with its costs. Users mainly branched on the air or fast train networks can less and less stand the inefficiency and the slow rythm of the central city, even though they need a wide CBD, a diversified local economy, an equilibrated blend of economic and leisure assets. The market, and in particular the urban land market, provides an initial answer to this possible conflict. The city selectively loses the activities and the functions that make a less efficient use of its assets (which are in general those activities which are less willing to pay its costs), through their suburbanization or disappearance. But at the same time a wide part of the adjustment process happens at the expense of the urban quality of life, the urban efficiency, and in the long run its sustainability.

An effective policy response is needed, especially in terms of proper urban form, internal transport infrastructure and effective interconnections among the different transport means inside the city. Many recent studies about international cities point out in fact that not only the internationalization of internal urban functions is needed, but also an efficient interconnection between the airport and the CBD, the high-speed trains station and the major highways (Bonneville, 1991; Bonnafous, 1993).

3. The New Emerging U rban Paradigm: The Multicentric Network-City

As we have seen, one of the possible answers to the problem of urban diseconomies of scale and to the increasing contradiction between the abstract node function of the city and its heavy physical realm consists in rethinking in an integrated way the general city form. The international debate on this issue is intense (see for example Breheny, 1992; Owens, 1992) and many international institutions have contributed to it (OECD, 1990 and 1995; CEC, 1990) launching a plea in favour of "compact" city forms. Arguments for and against this suggestion have multiplied recently, as, on the one hand, the compact, monocentric, big city has shown in the past a low "sustainability", due to excessive density of functions, congestion costs and slow pace of internal renewal, while, on the other hand, also the low-density, spread city, with its heavy dependence on private transport means and its high land consumption, has added new problems to the traditional ones.

Nevertheless, one general conclusion has come out in a sufficiently clear way. A possible land-use pattern that can avoid the limits of the two extreme patterns might be found in the munticentric network-city. This pattern in fact maintains the "urban effect" linked to the agglomeration of different functions in compact centres, avoiding at the same time the diseconomies coming from excessive size of the single centre through the multiplication of the centres. The necassary conditions for the effectiveness of this new (or better revisited) "paradigm" may be described as follows (Camagni and Gibelli, 1994):

a) the single centres have to bear a diversification of functions, possibly linked with each other "en filière" (intersectoral linkages, residence/leisure/production linkages, etc.), in order to contain inside the centre the widest possible share of trips. Under this respect, mono-functional centres should be avoided, as they maximize trip generation with respect to other centres;
b) the centres should be linked with each other through a network of effective transport links, organized both in a radia and an orbital way with respect to the major city-centre;
c) each centre shoud keep or develop its specific image and character, in order to work as a magnet (with respect to both trips and locations) and not as a repeller (emphasizing spread trends).

Northern European countries such as Holland and Denmark have since long oriented their land-use planning towards integrated systems of medium-sized, compact centres, and this pattern is increasingly seen as a policy benchmark and an effective solution in many big cities around the world (Table 1) (OECD, 1995).

In policy term, the new paradigm implies first of all, a deep integration between transportation and land use planning, and secondly, an anticipatory policy intervention with respect to actual development processes. It may also be implemented at different spatial scales:

- at the regional scale, distributing high order functions (e.g., in the public administration and government activities) among different centres;
- at the metropolitan scale, maintaining the urban fringe as a continuous and compact area and concentrating development in newly developed centres, spatially separated and linked among each other;
- at the urban scale, trying to re-concentrate and push some polarization effects in the already urbanized, middle-density urban peripheries, through the selection of what French planners call some "lieux magiques", bearing a symbolic meaning for local population, and recreating around them an "urban atmosphere".

Table 1. Policy Impacts in Case-Study Cities

Objective	Metropolises (10 to 30m)	Large cities (1.5-5m)	Medium cities (0.5-1.5m)
Planning			
Constrain main city's growth	+	.	.
Promote multi-centric structure	+++	++	.
Make city more attractive	+	+	++
Bring homes and jobs closer	-	.	.
Promote cycling and walking	.	+	.
Restrain out-of-town facilities	+	.	+
Transport			
Improve mobility	+	++	++
Reduce congestion	-	.	.
Improve parking	+	+	+
Improve safety	+	.	.
Improve public transport	++	+++	+++
Encourage modal shift to transit	.	+	++
Reduce financial burden of transit	.	-	.
Reduce dependence on car	-	-	.
Reduce need for mechanised travel	-	--	--
Environment			
Reduce noise levels	-	.	.
Reduce pollution levels	-	.	+
Reduce CO_2 emissions	--	-	--

Key: + to +++ indicates the strength of the impact positively
- to --- indicates the strength of the impact negatively
. denotes no effect or not tried

Source: OECD, 1995

A major question involved in designing a new paradigm for the city concerns the transportation and communications function. This has a direct impact on urban sustainability, and will be discussed in the next sections.

4. The Role of Transport and Communication in The Modern Economy

During the eighties much attention has been devoted to the structural changes taking place in modern economies. During those years, the rapid rise of the service sector - not only for domestic but also for international activities - mirrors the fact that the western world is increasingly marked by a wide variety of communication and interaction patterns ranging from a local up to a global scale. This tendency is reinforced by the rapid and deep technological changes taking place in the transport and communications sector, which have been regarded as the driving forces pushing modern society into the so-called "Information Economy"; this term refers to an economy where a large share of all economic activities is associated with the production, distribution and consumption of information.

The pioneering study of Machlup (1962), followed by Porat (1977), was the first one to stress the significance of a "knowledge-based" economy in those years when Bell (1973) was signalling the emergence of a "services-dominated economy in post-industrial society". From these early works, a series of theoretical and empirical analyses have followed, strengthening the development of an economy governed by different rules and dependent upon different strategic resources. Jonscher (1983) described the emergence of the "Information Economy" by classfying economic activities into two classes, viz. "production tasks", i.e. tasks associated with the manufacturing and delivery of products and services, and "information tasks", i.e. tasks associated with the coordination and manipulation of production activities. The major source of added value appeared to shift from production tasks to information tasks.

All these studies witness the emergence of an information economy, characterised by a growth and intensification of activities (both investment and employment) associated with the collection, manipulation, storage and transfer of information. *Knowledge-based* and *information-based* activities were becoming important strategic resources upon which the competitiveness of firms and comparative advantages of regions would increasingly depend (Bar et al., 1989; Capello et al., 1990; Gillespie et al., 1989; Gillespie and Williams, 1988). Thus, a modern economy tends to go through a period of transformation, marked by the move from "*capital-intensive*" production systems to "*information-intensive*" production systems (Willinger and Zuscovitch, 1988), where information and knowledge are inextricably linked strategic resources for economic development. The emergence of the "Information Economy" is seen to be highly dependent upon the widespread diffusion and adoption of new communications technologies, originating from the interaction of computers and telecommunications, which give rise to new ways of storing, manipulating, organising and transmitting information.

It is evident that a delay in the adoption and exploitation of modern transport and communication technologies will imply a loss of opportunities and hence cause significant costs. This is true for developed countries and developed cities, which define their competitive edge on the basis of the speed of adoption of these new technologies. This is even more true for developing countries, and developing cities; for them new transport and communications technologies represent a new threat which their economic systems have to face in the near future. The lack of adequate transport and telecommunications infrastructure may imply that local economic systems (i.e. regions and cities) may become isolated from development processes and from integration processes characterising modern economies.

By the same token, a great attention was given in the same years to transport infrastructures and communications services as tools for urban economic development and competitiveness. There are strong commonalities between the two sectors which can better explain why they are always analysed together, also in the case of urban sustainability studies:

- accessibility to an urban area depends on the existence (and efficiency) of transport and communications systems (Banister and Button, 1993; Banister et al, 1995);
- in the last two decades, a radical technological revolution has taken place in both sectors, allowing a revolutionary upgrading of all technologies. In the words of Freeman (1987), radical innovations have taken place in the two sectors, which are now followed by numerous incremental innovations, opening the way to a new techno-economic paradigm;
- both transport and communications systems impact on the spatial organisation of economic and social activities, and can thus have a very important role on sustainability. The extremely high potentialities of these two sectors to reshape the spatial organisation of industrial and social activities represent an important opportunity for creating more sustainable urban forms, at least in the long run (Capello and Gillespie, 1993);
- in the light of what has just been said, transport and communications are the physical carriers of the new "city-network" paradigm which seems to emerge in modern economies. As was shown before, this paradigm implies the development of non-hierarchical relationships among specialised centres, providing externalities from complementarity/vertical integration or from cooperation among centres.

However, transport technologies do not offer only advantages. As they imply mobility, energy consumption, noise, and, when overexploited, congestion costs, they have huge negative environmental impacts, especially in the case of cities. Mobility of commodities and people plays a conflicting role in the development of any economy (Nijkamp, 1994a): on the one hand it enhances the productivity of the capital stock and the welfare of the population, but on the other it causes high costs of affecting the urban quality of life and the structure of the urban environment and by eroding the stock of natural resources.

The negative feedbacks of transport activities are not irrelevant in modern societies, and risk to become even greater if efficient intervention policies in favour of environmental protection are not put in place.

The list of costs is a long one: air and water pollution, noise and vibration, road casualties, are just some of the examples. If we look at some data, the picture is quite dramatic. According to Swedish studies, urban air pollution causes between 300 to 2000 new cases of cancer annually. Traffic accounts for 70 per cent of the emissions of carcinogenic substances that may affect the genes of people living in urban areas. In Switzerland, concentration of NO_x regularly exceeds the standards for cities laid down in 1985 Order for the Protection of air. The costs of local air pollution, although rather difficult to calculate, have been estimated at about 0.3 per cent of GDP in OECD countries; for the European Union, a figure of 0.3 per cent to 0.4 per cent of GDP, with 90 per cent of the costs attributed to road transport, is quoted in the EU Green Paper (OECD, 1995). All these data witness the severity of the problem, which becomes even greater if one thinks that transport infrastructures are vital for economic development and daily life. At a first glance, it seems a paradox without a solution.

A way out to this impasse may be found at a higher level of abstraction of the problem, with the introduction of two different concepts: *accessibility, defined as the potential interaction among sites based on ease of contact/flows* (i.e. travel time, capacity of links) and *mobility, defined as the actual interaction based on the ease of contacts/flows and* ***costs***.

Accessibility represents the real value of transport infrastructure, as it embodies all the advantages of spatial interaction: exchange of goods, information, know-how and experience. Mobility, on its turn, is the way by which the advantages of accessibility are realised, but it creates social costs and, through congestion of the network, impinges on accessibility itself. A possible solution for the preceding paradox is to conceive policies that reduce mobility without limiting accessibility, acting on mobility costs (e.g. by internalising its social costs) rather than on circulation restrictions. If similar policies are successfully implemented, one can reach the positive effects:

- reduce mobility costs and congestion costs;
- anticipate the effects of congestion on mobility without jeopardising accessibility;
- increase public financial resources, that can be mobilised for improving public transport infrastructure.

An interesting aspect to draw attention to is the relationship between accessibility, economic development and sustainability. The logic characterising the relationship is different in cities located in developing and developed countries. For what concerns *developed countries*, the virtual circle is depicted in Figure 1. The mechanism is put in place by an exogenous factors; policies supplying transport infrastructure and services have an immediate positive impact on urban accessibility. After this first pushing effect, a double cycle is activated:

- *a virtuous cycle*, as improved *accessibility* means improved *sustainability* of urban development via reduced congestion and better air quality. The improved *sustainability has a positive effect on development*. Urban quality becomes a strategic locational factor, and thus a discriminating feature in the competitiveness of urban systems. The city becomes an ideal location for managerial and residential activities, and for high quality social interaction. The case of the Swiss cities is an example in this respect, where natural quality, economic efficiency and pleasant social life are mixed together and guarantee an increase in economic welfare;
- *a vicious cycle*, as *development generates more mobility* and *more mobility has a negative impact on accessibility*. The elasticity of mobility to income has been estimated around 1.2 in OECD countries (OECD, 1995). Moreover, it has been proved that the increase in income has a positive effect on car ownership, which is increasing in all European countries. Even in USA, where 58 per cent of households own two or more cars and 20 per cent have three or more, there is little sign of saturation, as one would expect (OECD, 1995); and the upward trend of car ownerships is expected to continue in all countries. The rising trend is even more problematic, if data on travel choice mode are analysed. Car represents the mode by which more between 30 to 50 per cent of urban trips are made in European cities (see Table 2), and the one which generates the highest external costs (Table 3). On the other hand, the increase in congestion generated by more mobility has an economic cost, in terms of loss of economic activities within the city and of loss of efficiency of the economic system as a whole. OECD data report that using the definition of "additional time spent travelling compared with free-flowing travel", congestion is estimated to cost the equivalent of about 2 per cent of GDP (Quinet, 1994, as quoted in OECD, 1995).

It is on the negative feedbacks of the "circle" that appropriate transport policies play a crucial role. Appropriate policies should be able to move along a difficult "razor edge" path, increasing accessibility of cities (the real value of transport) and at the same time keeping the negative social costs of transport activities under control.

As far as cities in *developing countries* are concerned, the virtuous circle does not look the same as before (Figure 2). Also in this case, the mechanism is activated with supply driven policies which develop transport infrastructures in cities. The first impact on accessibility is the same as in the case of developing countries, but then:

Table 2 . Travel Modes for the Journey to Work in Cities of Different Densities, 1980 .

	Degree of land utilisation	Choice of transport type for travelling to work		
	(Housing and places of work per hectare)	Private automobile	Public transport	Foot and bicyc
Phoenix	13	93	3	3
Perth	15	84	12	4
Washington	21	81	14	5
Sydney	25	65	30	5
Toronto	59	63	31	6
Hamburg	66	44	42	15
Amsterdam	74	58	Id	28
Stockholm	85	34	46	20
Munich	91	38	42	20
Vienna	111	40	45	15
Tokyo	171	16	59	25
Hong Kong	403	3	62	35

Source: Kenworthy and Newman, 1989

Table 3 . Social Casts in Relation to Transport Modalities (by percentage)

Social costs	Air	Rail	Inland waterways	Road	Total
Air pollution	2	4	3	91	100
Noise pollution	26	10	0	M	100
Land coverage	1	7	I	91	100
Construction/ maintenance	2	37	5	56	100
Accidents/ casualties	1	1	0	98	100
Total in billion DM/year	3	14	2	68–77	86–95

Source: Whitelegg, 1988

Figure 1

Positive and negative feedbacks of transport activities in developed cities

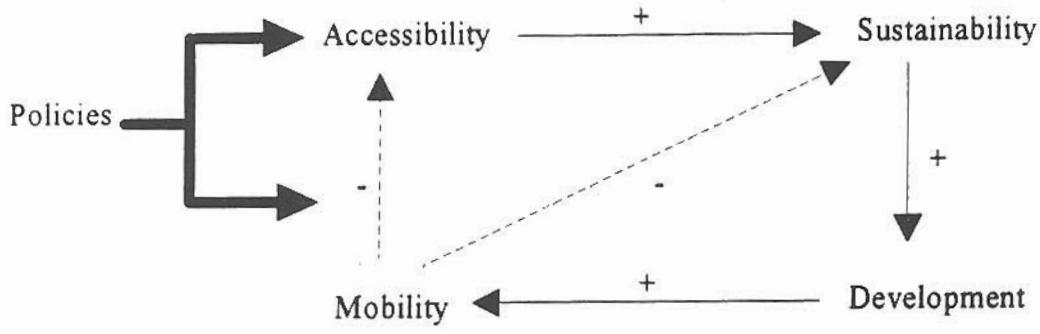
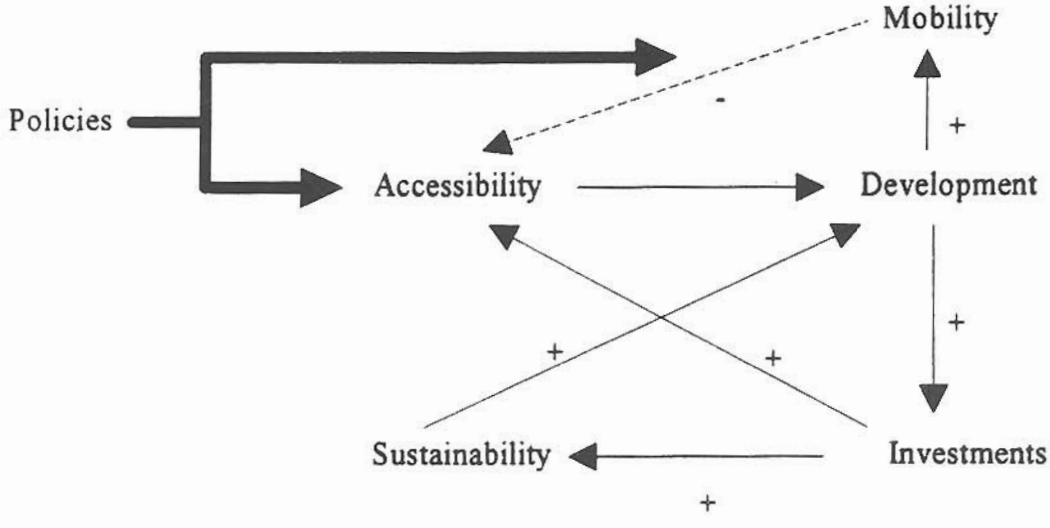


Figure 2

Positive and negative feedbacks of transport activities in developing cities



Legend:

Natural positive feedbacks

Natural negative feedbacks

Policy interventions

- *more accessibility generates more development*, as new activities are attracted or generated (transport infrastructure is a direct precondition for development); *more development has two kinds of effects: from one side it acts on sustainability* through more investments in the quality of social services sewerage systems and sanitary infrastructures, at present very low in developing cities (Lea and Courtney, 1986). All this has a positive impact on the quality of life in urban areas, and thus on sustainability. *From the other side, economic and social development has a positive effect on mobility* of people and commodities, as in the previous case. Studies on the effects of per capita income growth in developing countries have underlined the fast rise by the consumption of non-durable goods such as cars and electric appliances, usually second-hand, high energy-consuming ones. What is even more worrying is the fact that forecasts on the number of car ownerships in developing countries estimate a substantial increase by the year 2025 (see Button, 1992);
- as is the case for developed cities, in the long run more *mobility generates more congestion and thus less accessibility*. Most of developing cities are in fact already affected by congestion on urban roads, which is the result of an increase in car trips and a very poor quality of transport infrastructures (roads and public transport services). Bangkog is a clear example of a highly congested city, with severe traffic problems: overall, Bangkok's public transport carries only 33 per cent of of total annual passenger kilometers in the city, compared to an average of 64 per cent in Singapore, Tokjo and Hong Kong. At the same time, Bangkok has 51 per cent of daily trips by private transport, and is recognised to be the most severely congested city in the world (Poboon and Kenworthy, 1995).

An important message stems from these considerations; there is a need that appropriate policies are formulated in the transport field, which lead to a cut in costs caused by mobility and to the protection of the real value of transport, i.e. accessibility. The main problem is that such a strategy has thus for never been implemented, as we will show in the next section.

5. Transport and Urban Sustainability

The relationship between transport systems design and use on the one hand and urban sustainability on the other hand is an intricate one, as both positive and negative externalities can be observed. In addition, this complex relationship is varying in the course of history of cities. In an interesting paper, Hall (1994) has identified and distinguished various crises in the interface of transport and the city. The related characteristic stages will concisely be described here.

Before the middle of the last century, most cities did hardly have an organized intra-city transport system. Such cities were dense and small, as can be seen from excavations in ancient cities such as Jericho of Acco. This stage may be coined the *pre-public-transport* era of cities.

After the 1850s most cities were breaking out of their narrow boundaries as a result of industrialisation and demographic growth. The response was the invention and introduction of the horse tram and later on commuter railways, which led to the first wave of urban sprawl. Such *early-public-transport* cities were characterized by small-distance sub-urbanisation and commuting to central urban industrial districts.

By the turn of the last century more sophisticated transport technologies were introduced, viz. electrified trains and commuter trains, followed by underground electric railways. This generated a new wave of suburban development, reinforced by the need to solve the emerging social housing problem. The result of this development was the emergence of *late-public-transport cities* (e.g., London, Paris, Berlin, New York).

After the First World War a new wave of urban transport technologies emerged, viz. the penetration of the private automobile. In the conflict between private motorization and collective transport systems several cities made an explicit choice pro the private car, with as a result a low density individualized urban sprawl. (e.g., Los Angeles, Dallas). This led to so-called *auto-oriented cities*, in which public transport was bound to decline.

Other cities however, adopted a different urban transport systems model and tried to cope with the new wave of urban industrialisation by developing more appropriate public transit systems (e.g., Paris, London, Tokyo, New York). Such cities developed into *strong centre cities*, largely depending on public railway transport for the functioning of their CBD.

Later on, when other cities started to grow (e.g., Brussels, Frankfurt, Milano, Rotterdam, San Francisco), they adopted a hybrid policy by choosing for both private and public transport. Although a significant part of urban transport in the centre is served by public transport, the share of private transport in suburban areas is as high as in Los Angeles. Such *weak centre cities* have a mixture of various modes of public transport.

In view of the high social costs of congested urban centres, a new phenomenon has in more recent years emerged, viz. the polycentric or *edge city*, which means also a concentrated suburbanization of offices and shops towards suburban areas, which are either car-dependent (e.g., Milano, Munich, Toronto) or public transport dependent (e.g., Tokyo, Amsterdam, Zurich).

The above brief historical sketch has shown that communication and transportation is a sine qua non for a flourishing urban economy. Ancient cities already regarded infrastructure as a necessary condition for industrial, commercial and residential activities. It is plausible to state that accessibility is almost an indicator for urban economic performance. Clearly, the costs of accessibility -reflected in the costs of infrastructure and in the costs of transportation - may be significant (see Button, 1992; Desai, 1990; Dimitriou, 1990; ESCAP, 1990). In most countries, for instance, the energy share of the transportation sector exceeds 25 per cent of total energy use. Also the amount of public resources in infrastructure construction, environmental decay and traffic insecurity is significant. Although there is a wide spectrum of various transport modes (cars, trains, buses, undergrounds, trams, bicycles, airplanes, ferries etc.), it turns out that - despite urban poverty - in almost all cities private surface transport is becoming the dominant mode (see Button and Ngoe, 1991). Although this is conceivable in light of the obvious advantages of the latter mode, it also means that the most polluting mode has become the most popular. This social trap can only be remedied if all social costs are properly charged to all transport users. If this is not done, urban accessibility - which is a critical success factor for economic success - is under serious threat. Thus ways would have to be found that ensure urban sustainability through market based policies.

It is also worth noting that there is a close connection between transport needs and land use (see Wegener, 1995). If there is no strict physical planning which addresses also explicitly the transportation needs of new residential, industrial or commercial areas, urban sustainability is not likely to emerge. Thus a strict coordination between urban transport policy and urban land use policy is badly needed, a strategy in which also public transportation would have to play a critical role. Distortion of the urban transport market via subsidies, infeasible regulatory measures or unpriced externalities will no doubt aggregate environmental quality conditions in the city. It seems a wiser policy to adhere to economic principles which would pave the road to sustainable urban development (see also OECD, 1994).

It goes without saying that the dynamics of urban transport technologies runs parallel to that of the urban morphology. Various types of cities have emerged and each arche-type results in specific urban energy use patters, environmental quality conditions, safety and congestion patterns, and land

use patterns (see also Banister and Banister, 1995; Breheny, 1992; Newman and Kenworthy, 1989; Rickaby, 1991 and Warren, 1993). An interesting overview of indicative effects of various types of urban morphology - from the viewpoint of transportation - can be found in Verroen and Hilbers (1994). They distinguish four types of development patterns of a city, viz. the compact city, new towns, edge cities and uncontrolled development.

The implications of diverse patterns of urban transport and urban morphology for urban sustainability are not entirely clear at the outset, as each city is facing site-specific physical conditions and behaviour-specific responses of citizens, which makes it difficult to make unambiguous statements on the consequences of transport and land use in the city for the urban sustainability. However, in light of the dynamic evolution of both phenomena it seems plausible to suggest that in new urban land use development the notion of urban sustainability - in terms of economic efficiency, social equity and environmental quality - is taken as an explicit starting point for urban policy (cf. Hay and Trinder, 1991). Market-based policy measures may then be developed to make sure that future mobility patterns contribute to a reinforcement of urban sustainability. This message is particularly important for Third World cities, which are threatened by a "mobility avalanche". Without a mobility policy driven by market principles, Third World cities will not turn into islands of locational opportunities, but rather into pollution havens. Traffic restraint policies, road pricing and land use policies need to be developed in a proper combination to pave the road to urban sustainability. Needless to say that this requires a strong urban management based on business-oriented guidelines, coupled with environmental-friendly land use planning.

A few examples may help to clarify the above notions. In a recent paper, Goddard (1995) has proposed for Mexico City demand side management policies for making urban areas sustainably viable by managing vehicle use as part of a cost-effective programme for controlling vehicle emissions and congestion. The allocation system for achieving this result is based on a tradeable permit system for vehicles which combines the objectives of efficiency, equity and environmental quality, at the expense, however, of very high transaction costs for users. In another study area licensing schemes are proposed in order to reach an environmentally-benign transportation system (see Ramjerdi, 1992a). This approach is based on the maximization of user benefits, taking into consideration time preferences of users and marginal utilities of incomes of users. The analysis was applied for new transport policy schemes in Stockholm. The same author (Ramjerdi, 1992b) has also extensively studied the road pricing (essentially a cordon toll system) developed in the city of Oslo.

It may be concluded that there is not a single uniform market solution for transport policy in a sustainable city. There are various options and - depending on site-specific considerations - a choice has to be made. Recent experiences provide testimony of the fact that the use of economic principles in urban transport policy is necessary for ensuring accessibility and thus urban sustainability.

A convincing support for the above mentioned need for a client-oriented and market-instigated transport policy and infrastructure provision is found in the World Development Report 1994 published by the World Bank (1994a) which was entirely devoted to 'infrastructure for development'. According to this study, infrastructure can generate significant benefits in economic growth, poverty alleviation, and environmental sustainability, provided it delivers services that respond to effective demand and does so efficiently. Thus infrastructure policy has to be instrumental in fulfilling market needs. Therefore, infrastructure policy must be seen as a service industry, driven by commercial management, competition and stakeholder involvement. As a consequence, the following guidelines are formulated by the World Bank (1994a):

- manage infrastructure like a business, not a bureaucracy.
- introduce competition - directly if feasible, indirectly if not.
- give users and other stakeholders and strong voice and real responsibility.

Clearly, there should be much more scope for private-public partnerships in the provision and financing of infrastructure. One thing is clear: governments will have a definite - though changed - role in infrastructure, especially in setting up efficient policy and regulatory frameworks safeguarding the interests of economically deprived people and the interest of the environment and in developing initiatives that induce private involvement in the provision of infrastructure services.

If we accept the idea that a positive relationship can exist between transport development and sustainability, given appropriate policies to overcome social costs, urban policies which limit transport development do not seem the most appropriate. At least two aspects act against these kinds of policies:

- the *high costs implied by limiting the emerging strong social behaviours*. In fact, many structural phenomena cause the role of transport to rise rather than to decline. Examples of such phenomena are: at a micro level, increased female labour force participation, increase in leasure time and income, and at a macro level, the rise of a global economy (Nijkamp, 1994b). Policies oriented towards the reduction of transport activities would hamper these structural socio-economic trends but in the long run it will not prevent them from taking place, exhacerbating congestion and environmental damages;
- the *high economic costs involved in such policies*. The risk is that in the short period an increase in pure environmental values is achieved, but at the expense of economic competitiveness and growth. In the long run, the weak economic position would lead cities to invest less in environmental quality.

6. The Role of Telecommunications Technologies on Urban Sustainability

New information and communications technologies represent a great opportunity for both developed and developing cities, since they can act as countervailing powers to environmental decay caused by transport activities. In principle, these technologies may play a double role in leading cities in terms of sustainability:

- they act on *accessibility*, without genereting the negative environmental feedbacks caused by transport systems. In this way, they act on development without the negative effects of mobility;
- they act as *policy tools to solve some negative aspects of transport activities*, through an increase of their efficiency. Examples of these potentialities are multimodal transport systems aiming at optimising the performance of the transport systems as a whole, telematics amining at optimising drivers' behaviour through the provision of real time information, fleet control serving to reduce transport cost.

In the last two decades there has been a wide spectrum of technological upgrading in telecommnications systems, particularly computer networks and data systems, fax machines and electronic mail, whose effect has been to increase accessibility, by shrinking time and distance. All these technological opportunities have dramatically widened the locational choice for many workers, allowing them to work whenever these tools are available, including the home; this means a high potential reduction of mobility for journey to work trips within cities. In the United States, for example, the share of people working at home, for at least part of the time, is estimated to be as high as 30 per cent of the labour force. An estimated two million of these people are full-time employees, who would otherwise commute daily to an office or on other work place. Estimates on telecommuters in the United States achieve the number between 7.5 and 15 million by 2002 (OECD, 1995).

Telecommuting can be an effective component of travel demand management and can contribute to reducing traffic congestion, air pollution, road casualties and energy consumption. In developing countries the application of telecommuting would only be possible for high qualified jobs and high level trained employees, which represent a very low percentage of daily commuters. The impact on travel demand is then likely to be lower than in developed cities. Other advanced telecommunications technologies, like teleshopping, home-banking, videoconference are expected to have an impact on transport mobility, but even in developed countries the rate of adoption is still very low and the forseable effect will be limited.

A more promising area in which telematic applications will ultimately represent an effective policy tool for reducing road congestions is the implementation of information technologies on road transport and public services (see for an extensive discussion Nijkamp et al, 1996). Traffic management will benefit from integrated systems incorporating real-time, adaptive computer programmes that will optimise traffic-signal timings and give bus priorities, making use of information from accidents to congestion detector systems. It has been estimated that traffic management measures, which remove much of the "stop-go" from urban driving, coupled with congestion pricing, could reduce NO_x emissions from trucks by up to 70 per cent, apart from any savings in fuel consumption (OECD, 1995).

Telematics applications have also an important role to play in public transport operation.

Despite all positive aspects related to telecommunications technologies described in the previous section, it would be too simplistic to affirm that these technologies represent the perfect solution to the problem of negative external costs associated to transport activities. Many barriers and limits exist which may hamper their widespread adoption and exploitation:

- limits to the adoption;
- limits on the expected positive effects.

The limits to the adoption stem from the often "taken for granted" idea that telecommunications and transport techologies are perfect substitutes, and thus that telecommuting, teleshopping, videoconference will soon achieve a high penetration level.

Some theoretical considerations may be offered here. Both transport and communication systems enter a production function, and present a certain degree of substitution, given the fact that both reply to the accessibility needs of firms. But this degree is very low, as substitution between the two technologies is an *imperfect one*, since it depends on (Camagni and Capello, 1991; Capello and Williams, 1992; Capello, 1994a and 1994b);

a) habits of individuals and economic actors;
b) organisational factors at industrial and urban level;
c) learning processes related to the use and exploitation of these new technologies, especially in the case of telecommunications technologies.

As a consequence, a change in the relative prices of the two inputs (e.g. an increase in the transport costs due to congestion) does not drive directly towards substitution, as is suggested by the traditional neoclassical equilibrium model. Other external conditions must be present, either exogenous to the economic system (like the Gulf war in 1991 responsible for the rise of the videoconference service and the drop of air transport demand), or endogenous to the economic systems. In this latter case we refer to policies encouraging telecommunications demand, not in terms of financial support to adoption, but especially in terms of specific measures to overcome the three above mentioned critical aspects explaining imperfect substitution. These telecommunications related policies become, in a more

general framework, urban sustainability policies aiming at increasing the degree of substitution between transport and telecommunications systems.

The expectations related to the positive side effects of the use of telematics applications in reducing the negative impacts of transport on the environment are usually very high; it is instead worth mentioning that, even if positive effects are envisaged as a consequence of the introduction of transport-substituting activities like telecommuting and teleshopping, in the long run these advantages may be eroded if newly-generated traffic is not restrained. In fact, telecommuting will certainly bring about changes in travel patterns. Whether the total travel will decrease or not is not clear at this stage, but there will be considerable redistribution of travel in time and space. Telecommunting might stimulate urban sprawl and have other adverse effects on land use and public transport use, if suitable conter measures are not taken (OECD, 1995).

The above limits and barriers to an efficient telecommunications policy for urban environmental quality stem mainly from the *demand side*. It is worth mentioning that also at *the supply side* there are aspects which are strongly related to the potential effects generated by these policies. There are two main areas which deserve particular attention when telecommunications policies are implemented:

- the "*appropriateness*" of these technologies, which guarantees the best exploitation of the technological potentialities, and;
- the "*vintage of the technology*", which in the long run has an impact on both the efficiency of the technology itself and on environmental quality.

summary

7. Transport Policies for Sustainable Urban Development Strategies

7.1. Foreseable trends and the need for appropriate sustainability policies

Before addressing the issue of the appropriate policy strategies for sustainable urban development focusing on transport and communications, a brief scenario of the foreable trends in urban transport demand looks necessary.

Extrapolating recent trends, international institutions like the OECD forecast a doubling of urban private traffic for both cars and goods vehicles in the next 30 to 40 years (OECD, 1995). We can subscribe to this forecast as far as demand elements are concerned; but in front of increasing bottlenecks and contradictions arising on the mobility supply side, aggregate growth will probably slow down or find other territorial patterns of expantion (growth of new centres, flow of activities in developing countries, substitutions among transport modes and between transport and communications modes).

Moreover, these forecasts do not take into account the countervailing effects of transportation and land-use policies implemented by local and national government, preoccupied by the evident non-sustainability of the aggregate scenario and willing to anticipate the disruptive effects of spontaneous trends (on local wellbeing and global sustainability) and feed-backs (potential crisis of existing cities and spread of activities on the entire regional territory with disastrous long-term effects). Demand forecasts have nevertheless the advantage of clearly showing the contradictions of spontaneous trends, if the present situation in which social costs of urban mobility are not but partially internalised by private activities is going to continue.

The forecasts of a rapidly increasing urban travel demand derives from the evidence of an aggregate elasticity with respect to income higher than one, and of the continuing success of an urban

environment to provide the information and contact assets that are requested by modern economies and to reduce the uncertainty embedded in a more and more turbolent and innovative economic environment (Camagni, 1996).

In developed countries, cities will not probably grow in terms of population and jobs, but in terms of income controlled and produced and in terms of physical space utilised. The decentralisation of population will continue, albeit at slower rates than in the past, as a consequence of increasing land prices in the centre and of increasing congestion. Edge-city shopping malls and leisure centres, decentralised headquarters and science-parks will flourish, especially in those countries where they have remained rare phenomena up to now.

The average tri-lenghts will increase, as a consequence of the widening of the "bassins de vie" of the households, of the widening of the urban labour market to which individuals address themselves as long as income levels, professionality and personal specialisation increase. The increase in women participation rates and consequently two-income families reduce the possibility of optimisation of the household location with respect to journey-to-work length.

Even if technological improvements will reduce the toxic emissions of cars, the problems of noise and CO_2 emissions will remain, and will remain also the problem of increasing use of urban land for roads and increasing use of roads for private parking.

Trends in energy use, toxic emissions, congestion and traffic domination in cities will probably be exacerbated. This will especially show up in new industrial and developing countries where a wider space for rural-to-urban migration exists and the urban hierarchy is widely biased in favour of primate cities. The attractiveness of cities as pleasant places to live and efficient places to work will be jeopardised.

The forecasted trends are preoccupying also from the point of view of global sustainability. Transport is not the major source of CO_2 emissions but the fastest growing one: the case for a precautionary intervention strategy to limit private mobility in cities is evident.

7.2. The main policy goals

Given the preceding worrysome scenarios referring to urban travel demand, the main general goals of a transport policy for sustainable urban development may be summarised as follows:

a) maintaining for cities thier character of efficient forms of organisation of human societies, a character that they have always maintained in history and that is more and more threatened by the contradictions issued from increased size, sub-optimal city form, growing urban travel demand, increased use of the private car. In fact, their role as nodes of interaction, engines of economic growth, triggers of modernisation and change, instruments of social wellbeing and cultural upgrading might be jeopardised by the increase of the abovementioned environmental diseconomies;
b) avoiding diseconomies of large scale through appropriate urban forms, stimulated and realised through an appropriate blending of anticipatory intervention, land-use regulations and effective orientation of market forces;
c) avoiding traffic domination in the urban landscape without reducing accessibility of the different parts of the city, including the more congested ones like the city-centre;
d) encouraging a more environmentally sensitive use of the vehicles stocks, in terms of a more selective use, better maintenance, better energy-efficiency;
e) increasing the efficiency and attractiveness of public transport;

f) stimulating the communication substitution for person, paper and goods mobility.

7.3. Policy principles and policy styles

The complexity of the system we present to control the multiplicity of the goals of an urban sustainability policy, the lack of really successful policy experiences to which to refer, are all elements that suggest that the resource to a single and simple policy principle would not be possible or sufficient: an eclectic approach would prove more effective. But even in an eclectic approach some principles emerge as the most relevant and appropriate. The first principle under this respect should be the resource to market forces whenever it is possible.

In fact, when the behaviour of a host of individuals is under scrutiny, the market proves to be a much more efficient, flexible and equitable instrument of resources allocation than governmental regulations. On the other hand these latter have often proved costly, easy to contour, inflexible, open to negative side effects and incapable of dealing with the complexity of urban phenomena.

Or course, the market we are speaking about is often a corrected market, integrated by a system of environmental taxes in order to take into account all the costs implied by individual behaviour and to deliver more correct signals (as in the case of the resource to a "polluter pays" principle, addressed to the internalisation of social costs and negative externalities), or created voluntarily in order to allow an easier adaptation of the private system to the environmental benchmarks which look necessary (this is notably the case of the transferable emission rights).

A relevant part of the excessive mobility demand we are facing in cities stems from a traditional policy of cheap transport cost that for decades was implicitly or explicitly implemented, in the persuasion that mobility is a value per se, eligible for government support, and transport a powerful development factor. Transport-intensive mobility patterns and organisational methods (like for example just-in-time organisation) were consequently implemented in a condition where (private) transport inputs were not paid their full investment costs, operational costs and social negative externalities. Today it is time to restore a sounder equilibrium in this respect, allowing the market to adjust to more reasonable prices for this production or consumption input. And this can be achieved through fuel taxes, carbon taxes or road pricing (or congestion pricing). But a purely market principle should be complemented by other forms of intervention in a number of theoretically relevant cases:

a) first of all, when the market requires long run reference frameworks, as in the case of land-use regulations on new urban expansions. With the externality case, this is another case of market failure, in presence of important benefits allowed by interindividual coordination and cooperation;
b) secondly, when the market, even corrected for externalities, does not allow the required protection of environmental conditions, like in the case of abnormally high pollution loads and emergency traffic conditions. It is generally agreed that in these cases the market mechanism would be accompanied by some forms of regulatory control over maximum pollution loads (Pezzey, 1988);
c) thirdly, when the resort to a market mechanism does not allow (or even jeopardises) the possibility of reaching a second goal in sustainable urban policies, namely that of environmental equity. A huge transport tax could easily prove to be a regressive fiscal device, as low income classes spend a much wider share of their income on transportation. Regulatory devices and traffic restrictions, applying to everybody, do not have this side effect and should accompany the former intervention strategy at least partially;

d) fourthly, when the mechanism of market correction or the creation of tradeable permits encounters huge transaction or control costs. It is the case, for example, of emission permits on car use in the city, as proposed by Haynes Goddard for Mexico City (1995), an instrument which looks sound from an abstract point of view, but that is going to rise multiple organisational problems in the implementation phase:
   - direct transaction costs for the user: the commodity traded is not in fact and homogeneous one, as the circulation permit has to refer to specific weeks and has in principle to be traded continuosly;
   - easy possibility of illegal permits emission, unless a costly control procedure is built (the *bona fide* holder is not going to be prosecuted);
   - the increase in intensity of car use that is going to be determined in the allowed days.

The most relevant point is of course the first, which refers to the necessity of giving the market the necessary long-term guidelines. It is widely accepted in fact that the market allows the most efficient adjustment to these guidelines, but cannot supply them. These guidelines should refer to:

- general environmental targets: types of gasoline allowed, maximum emissions of exhasted gases per car (control of the efficiency of mufflers, etc.)
- general expansion axes of the city and land-use guidelines; projected territorial pattern of the transport network architecture.

But a bridging mechanism should be conceived in order to integrate better the two principles and avoid negative reactions on the side of private activities. The regulations introduced should be in principle:

- addressed to clearly stated and easily perceivable collective goals;
- accepted by the public and the goals widely shared, through new forms of public debate and consensus building;
- effective with respect to both short term emergencies and long term issues;
- based on sound long term analyses and plans;
- delivered and marketed in a reliable way, in order to convey effective signals to the private decision making;
- shared from the beginning by the relevant interest groups whose behaviour the success of the public initiative widely depends on;
- politically acceptable, which means that they have to appear equitable, non penalising with respect to special categories of citizens, fiscally neutral (a new relevant tax should in principle be counterbalanced by the release of a previous one).

The policy style that all this implies is close to the one proposed by the new paradigm that is increasingly adopted in local policy management, namely "strategic planning" (Bryson and Einsweiler, 1988; Gibelli, 1993 and 1995). Policies in fact should refer to the building of a shared vision of the community future, merging traditional methods of long term land-use planning with socio-economic analyses of the viability (or sustainability) of the development trajectories envisaged and with strong involvement in consensus building, grass-roots participation, private/public partnership.

In developed countries, the same role of information dissemination, interest building in policy issues and involvement of local communities might be performed by NOGs, collaborating with local authorities and international organisations. In fact, they are already active in collecting the needs and concerns of local people and reflecting their perspectives in local project design and implementation (World Bank, 1994b).

A last element which is relevant in the discussion about market vs. regulation policy styles, regards the problem of guaranteeing an equal treatment of equal land proterty owners in case that planning regulations become increasingly selective in terms of development permits. In fact, once a territorial development axis is chosen for a "compact" urbanisation and surrounding areas are due to open to green spaces, a problem of equity is involved. In this case, the institute of transferable development rights guaranteeing the same potential building rights to all land parcels, but forcing the actual utilisation to particular sites through rights exchange - which is usually employed in case of inner city rehabilitation - could be used in the case of new urbanisation, as it guarantees a fair treatment of property rights and lowers the case for illegal practices[1].

7.4. Towards anticipatory and precautionary short term and long term policies

As was shown in the introductory part of this paper, territorial phenomena are subject to huge irreversibilities, given the long term persistence of social overhead capital and buildings, the cumulative effects linking transport infrastructures and location decisions, the forced outcomes in terms of transport use of the different land-use patterns and city-forms. The same irreversibilities shape the development trajectories of technologies (and transport technologies in our case), due to rapid learning effects that reinforce the profitability of early-developed technologies.

In this framework, the necessary short-term policies have to be complemented, developed together and even anticipated by far-looking, long-term policies, addressed to avoiding the previously mentioned irreversibilities.

Short term policies are by definition policies that assume the present state of technologies, private and social capital stock and land-use patterns, and are primarily addressed to the stimulation of more environmentally friendly use of the production functions through the substitution of high energy and natural resources-intensive inputs and the stimulation of the use of mass transit facilities. On the other hand, long term policies pursue the same goals through the orientation of technological change and the shaping of more sustainable urban forms (Camagni et al, 1996).

The latter policies have a crucial role in a sustainable urban development strategy, as the bulk of the negative externalities from transport demand and use unescapably derive from such structural elements as transport technologies, the architecture of transport infrastructure, the urban form and from their cumulative evolution.

Therefore, long-term policies should not be relegated among the package of those things whose implementation "would be so good but will never happen". They are the most important elements of a successful strategy of sustainable development.

Hopefully, many short-term measures are likely to have potential beneficiary effects on the long term trends (e.g. a tax on fuel consumption not only reduces car use but is likely to stimulate the orientation of both car demand and car technology towards more energy efficient products). But this is not true in all cases, in particular as far as land-use regulations are concerned, given the large degrees of freedom that a market response to land-use restrictions maintains; moreoever, the favourable long-term result is only possible, but not guaranteed.

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[1] This institutional tool is increasingly utilised in the U.S. for greenfield urbanisation; for its full operationality it requires high financial and planning skills by the local government and has to be used on areas of similar potential economic value (see Camagni, 1994; Jabobs, 1994).

7.5. Towards an integrated approach

The pure environmental issue to an urban sustainable development is in a way far too limiting to solve urban problems for at least two reasons: a) the city is a more complex reality, where three (economic/ environmental / social) subsystems interact and give rise to advantages and disadvantages on the quality of life in cities; b) urban sustainable development is a process of co-evolution of these positive interactive effects and cross-externalities which are generated by the three fields.

A wide variety of policies and measures is available to gorvenments at all levels to tackle the problems of transport and urban sustainability. However, in light of the approach used in this paper, it would be a contradiction in itself to suggest separated urban sustainable intervention policies in different fields, without taking into consideration the positive cross-externalities, feed-backs and co-evolution of the three different elements constituting the city.

For this reason, and in the light of the perspective followed in the all paper, the best way to approach environmental problems and all related negative externalities associated to transport and high mobility in urban areas, is to suggest *an integrated approach of policy interventions*, which should act exactly on the positive interaction effects and positive cross-externalities that the different fields which characterise an urban setting generate; at the same time, countervailing policies should be put in place to dominate the negative aspects and the social costs associated to these interaction effects.

The major advantage of an integrated approach is that a careful combination of carefully-selected policies *reinforce* each other. Some policies blend naturally with other policies: for example the combination of restraint measures of private transport modes in city centres and improved public transport policy increase the effectiveness of the transit improvements. Moreover, integrated policies not only reinforce each other, but may have the great advantage to avoid, or in some cases to limit, the adverse side-effects of the policy. In the example given above, the restraint of private cars in city centres without an increase in public transport efficiency would have major deterior effects on the mobility of people, and thus would make the impact on car drivers less unpleasant.

Two issues come at this stage: if an integrated approach to intervention policies is envisaged as the most appropriate way of tackling urban transport policies, which are the phases of the intervention policies and the fields where integration is mostly favourable.

For what concerns the first issue, the integration of policies should take place at different stages of the decision making process. In particular:

- the design of the policy, in terms of intermediate and final objectives has to be developed by policy makers acting in these fields involved;
- the building of political consensus around the proposed policy;
- the decision concerning the timing of action.

Instead, the implementation stage has to be left to each responsible body in each field for two main reasons: a) it may very well be that tools and strategies need different time to be implemented, and the integration of the two could only postpone the implementation of short term interventions, although integrated policy actions should run parallel; b) specific know-how and experiences are required in different field, and thus each contributor acts with its own specialisations.

As far as the second aspect is concerned, four are the fields of action in which integrated policies have for sure a positive impact and generate cumulative positive cross-externalities (see Table 4):

Table 4, Short and long terms policies m different integrated fields of action

Policies / Fields of action	Short term	Long term
Integrated transport and land-use policies	Restraints on central city growth Request for private parking availability in newly built residential lots	Strategic land-use/transport planning Compact city and urban containment Multicentric city Mixed land-uses Designated growth areas and new towns Guiding the location of travel generating land-uses
Integrated transport and environment policies	Restraints on private traffic in particular areas Restrictions on heavy goods vehicles movements in the city New logistics of goods distribution in the city Enforcement of better performing catalytic converters and their frequent renewal	Investments in public transport service, infrastructure. management and image
Integrated transport and communications policies	Urban traffic management through telematic systems Improved control systems for public transport Telematic systems for bus/tramways priority Drivers' information via telematic networks	Incentives for telecommuting/tele-shopping infrastructures Incentives for telecommuting/tele-shopping use
Integrated transport and local public finance policies	Fuel taxes Congestion pricing, road pricing Selective tarifs of parking with decreasing distance from the city centre Enforces use of less polluting fuels Incentives to a faster renewal of car fleet	Incentives to design *energy* efficient engines Incentives to research on electric vehicles Incentives to reduce peak-hours travels

a) the first field is *transport and land-use planning*. This field of interaction has already been widely studied (see among others Banister et al, 1994; Breheny, 1992; Owens ,1992; Rickaby, 1991), and its relationship quite easy to foresee. Territorial dimensions, such as density, dimension, urban form, functional territorial organisation are all critical variable for environmental quality, especially in terms of energy consumption. The OECD has put much attention on the role that land-use planning may have on car use, and its use limit, through two main mechanisms: a) reducing the need to travel, ensuring reasonable proximity between places of residence, employment and other facilities; b) increasing the scope for non-motorised travel, such as cycling and walking, or by public transport modes (OECD, 1995);
b) the second field where integrated policies may be put in place with extremely positive results is between *transport and environmental policies*. The intervention policies in the field of transport, which may have positive effects on environmental policies cover a wide spectrum. All technological improvements in car emissions (i.e. catalytic converters), efficiency of fuel consumptions and fuel-substituting technologies (e.g. electric cars), have a major impact on air pollution in cities. In this field, the improvement of public transport services remains one of the leading intervention policies, not only in terms of infrastructure development, but also in terms of quality, reliability and attractiveness of the service, as we will see in one of the next sections;
c) the third field regards the integration of policies concerning *transport and telecommunications*. As we mentioned already in Section 5, in this area there is ample space for incentivating the use and exploitation of transport-substituting technologies, with the attention to avoid simplistic approaches which emphasise mainly the technological capabilities and overlook other organisational, managerial and cultural aspects crucial for adoption processes of telecommunications technologies and thus for the substitution effect to take place;
d) the last field of integrated intervention policies is between *transport and public finance*. Here, a large variety of economic levers exist, which may act on transport, both in terms of traffic management and of social costs involved, although some measures are more efficient than others. For example, it has extensively been recognised that the elasticity of fuel demand to prices is extremely inelastic and thus a tax on fuel in developed countries has unfortunately a very limited impact on the demand for car trips. OECD has estimated that an increase of 5 per cent above the rate of inflation every year, thus doubling the amount of duty paid after 14 years and trebling after 21 years is still less than the rate of increase which would be required to reduce CO_2 levels to the that recommended by the Intergovernmental Panel on Climate Change (OECD, 1995).

8. Concluding Remarks

Policies aiming at urban sustainability have to find a balance between economic efficiency, social equity and environmental equity. In particular the interfaces between these three major policy orientations have to be given due attention, as these shape the conditions for an equilibrated solution in a multi-faceted force field. In a long-term perspective one has to emphasize also the dynamics of interactive forces, as cumulative processes and irreversibilities are the rules in this field.

Transport and communications in the urban area are not necessarily a burden or threat, but rather they are vital for sustained economic development. It ought to be emphasized that cities in both the developed and the developing world will not favour urban sustainability by discouraging urban mobility through artificial, unflexible and generalised regulations. Mobility is a necessary consequence of the need for accessibility, which in turn offers the necessary conditions for vital cities as island of opportunities. Thus, the often assumed conflict between urban transport and the environment has to be looked at also from the viewpoint of dynamic positive externalities.

Clearly, the negative externalities of transport have to be coped with by devising proper policy measures, e.g., environmentally-benign transport technologies, traffic regulations and user charge

principles. Priority should be given to urban land use policies, as such physical planning instruments are able to influence urban transport patterns in a structural way. This requires in both developing and developed cities a strong and professional urban management. Such a business orientation towards urban policy does - in light of significant differences among cities - clearly not give a simple uniform remedy, but rather a policy guidance based on the viewpoint that cities are the driving forces for the national economy (in both the developed and the developing world). In a way similar to corporate firms, cities are (and have to be) networked with the rest of the world to be competitive and they should be aware of the need for globalisation at the local level.

Clearly, there is not a uniform pattern or position of cities: they differ in institutional, historical, cultural and economic respects. Furthermore, it is noteworthy that in developing countries there is generally a close dynamic interaction between urban and rural areas and it should be avoided that the expansion of the former were driven by the crisis of the latter rather than by their own development potential.

From an environmental viewpoint it would be noted that - despite similarities in various technologies - the vintage of these technologies is different (causing a higher ecological stress on developing countries). In this respect, there is still a long way to go for cities in developing countries, as the degree of introduction and acceptance of (tele) communication systems is still rather low. This may be detrimental for cities with a low penetration rate of network technologies, as such cities run the risk to be exploited by technologically more advanced cities in their own country. Therefore, policies should aim at a rapid introduction of and access to modern communication technologies in all cities. This seems to be a plausible strategy for enhancing the quality of urban life, to improve the urban habitat and to favour urban sustainability.

The urban economy creates scale advantages through synergy and proximity of all human activities, connected through networks inside and between cities. Sustainable urban development implies a maximization of synergy within strict social and environmental constraints (see CEC, 1990). The social fabric of the city is vulnerable and therefore it is a formidable challenge for urban governments to develop a management style which introduces economic principles for city governance while enhancing the quality of the environment and the human habitat under conditions of increasing social opportunities, defending historical heritage and promoting urban culture. In all these aspects, the design and maintenance of physical and immaterial infrastructure networks is a necessary condition. Networks open many opportunities for a varied and dense city life, for security and protection, for flexibility and participation.

The design of urban networks which manifest themselves in manifold configurations is a major task for city governments. Networks offer enabling opportunities, although it has to be emphasized that the use of networks incurs private and social costs which have to be borne by the user or actor. Active network policy is of strategic importance for a proper urban governance. This does not only require physical and immaterial transport and communication policy but also science networks, organisational networks, neighbourhood networks etc.

In view of environmental externalities, particular emphasis has to be laid upon coping with the social costs of transport. Apart from developing market-orientated strategies for controlling mobility (e.g., tradeable mobility rights, road pricing), also land use policy is a prerequisite for urban sustainability. There is certainly scope for more rationality and business orientation in urban planning.

Focal points of policy attention at the interface of transport and urban development are:

- strict land use planning (including prevention of illegal land use);

- provision of satisfactory housing for a sustainable habitat (including prevention of squatter movement);
- access to collective transport (including user change for externalities caused by private transport);
- development of environmental infrastructure (water sewage systems, waste treatment plants, renewable energy systems etc.);
- stimulation of a competitive urban economic environment (including sufficient accessibility via modern infrastructure).

Different tasks for governments may be distinguished in this context, depending on the level of competence. Examples are:

- *national* governments: in charge of national environmental and health standards, main infrastructure provision and social amenities, using both regulatory and economic incentives, with a particular view on reinforcing local government competence and management
- *urban* governments: in charge of active involvement in local sustainability by providing the necessary overhead capital and stimulating new initiatives, using inter alia market-orientated strategies and strict enforcement of sustainability regulations (e.g., environmental impact analysis).

As far as the problem of financing new public infrastructure provision is concerned, two elements may help to provide the necessary resources:

- the revenues from environmental taxes, fuel taxes, road and parking pricing levied at the urban level should be short-circuited to investment in local infrastructure;
- if investment in public transport and communication infrastructure helps urban sustainability, and sustainability implies long-term development, and development drives demand for urban locations and use of urban infrastructure, it follows that the initial investment cost can be easily matched by a combination of betterment levies on rising real estate and urban land rents and privately managed project-financing schemes addressed to the building and operation of the infrastructure.

In order this virtuous circle to be closed, many conditions are requested, belonging mainly to the cultural, political and public administration spheres: intense environmental concern, efficiency of the planning officials, trust between public and private partners, and local community participation and consent.

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