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## 7. QUALITATIVE EVALUATION OF POLICIES : LESSONS FROM 11 EUROPEAN CITIES

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### 7.1. Introduction

This section reports on the literature review and the analysis of 11 case studies that offer insights into the theoretical and practical implications of the design and implementation of policy measures to control urban sprawl. It combines a literature review on innovative methods and practices with an analysis of case studies in order to overcome the sectoral approach of the former with the more integrated and operational approach of the latter.

Compared to existing and similar reviews (TRANSLAND and TRANSPLUS projects) we have adopted an innovative approach based on the use of a reference matrix (see Table 7.1) that identify policy measures at the crossing between, on one hand, issues and impacts resulting from sprawl and, on the other, policy categories such as fiscal measures, land use planning instruments, housing and design in the private sector, transport, and other projects/actions in the public sector.

Using this approach throughout the analysis of the literature and case studies results can be structured as follows:

- **Tackling land consumption:** land consumption is an effect of low-density development, which is one of the key feature of urban sprawl both in Europe and in the US. Policy measures to limit consumption of land focus on two approaches: the setting of constraints to the extent to which a city can expand such as in the greenbelt and growth boundaries measures and the promotion of more compact, dense and possibly mixed use development.
- **Mobility:** key mobility problems related to urban sprawl are decreased accessibility to employment and services and increased dependence on the private car over public transport. These are two conflicting issues with regards to policy implementation since the former assumes the need to increase mobility of people and goods while the second portends the reduction of the overall need to travel. Case studies show how this apparent conflict can be resolved by integrating different policy measures that address the two issues. While higher accessibility can be provided for by a strategic planning of transport infrastructures focused on connecting isolated and segregated residential areas to employment and service centres, the integration of transport planning with land use planning can provide the spatial and functional urban structure that best accommodates the use of public transport.
- **Decline of urban areas:** in the US, urban sprawl is firmly related to the decline of core areas which tend to lose employment, economic activities and population against the development of peripheral areas. This is confirmed by the literature review in which the problem is addressed mainly via measures for urban centre regeneration. In Europe cities have not been subject, at least not with the same strength to the decline of their urban core. The analysis of case studies underlines this difference presenting a wider range of regeneration cases located in peripheral areas.

All the case studies presented in this review show some degree of policy or institutional integration and coordination. Integration in these cases is the response to the acknowledgment that interactions between policies and between the different effects

of policies must be dealt with. Integration is therefore recognised as a key success factor.

Space	Issues	Policies				
		Fiscal	Land Use Planning Instruments	Housing and Design in the Private Sector	Transport	Other Projects/Actions in the Public Sector
	<b>Environmental Quality</b>	Policies lacking these issues are addressed under the issues of consumption, mobility, adaptability of physical infrastructure and segregation of social groups				
All	Less of environmental quality to region					
All	Increased land pollution					
All	Increased air pollution					
Suburbs/Hinterland	<b>Consumption</b>	3.2.5: development impact fees	3.2.1: compact city, 3.2: decentralized concentration, 3.2.2: greenbelts and urban growth boundaries	3.2.3: compact building design/new urbanism, 3.2.4: cluster zoning	3.3.2: <a href="#">settlement around public transport corridors</a>	3.2.4 transfer of development rights, 3.2.4: purchase of development rights, 3.2.4: land banking
	High land consumption for housing development					
	Land consumption for infrastructure development					
	Higher local government costs					
	Higher housing and infrastructure development costs					
	<b>Mobility</b>	3.3.5: private car use (Versement Transport, location efficient mortgage high automobile taxes; high taxes on fuel)	3.3.1: accessibility, 3.3.2: settlement around public transport corridors	3.2.3: <a href="#">compact building design/new urbanism</a> , 3.2.4: <a href="#">cluster zoning</a>	3.3.3: extension of the public transport network, private car use (getting the business in the right place), 3.3.4: parking (in lieu parking fees, shared car parking spaces, centralized parking, maximum parking limits, parking freezes, demand reduction, ABC policy)	
All	Increased trip numbers, trip lengths and travel times					
Regional Centres	Increased congestion of radial roads					
Core	Rings of traffic jams					
Suburbs	Insufficient use of public transit due to low density development					
Core	Reduced accessibility of low income residents to jobs and services					
	<b>Adaptability of Physical Infrastructure</b>	3.4.3: housing demand (location efficient mortgage), financing revitalization (tax incremental financing, capital allowances, incentive priority taxation)		3.4.2: mixed use		3.4.2: mixed use
Core	Less of economic activities / jobs in certain sectors and in areas of disadvantaged groups (urban centre)					
Core	Degradation of built environment					
Core	Loss of local tax revenues from urban centre					
Suburbs, Regional Centres	Inequitable distribution of services among subregions					
	<b>Segregation of Social Groups</b>	3.5: segregation of social groups (housing vouchers)	3.5: segregation of social groups (planning regulations)	3.4.2: <a href="#">mixed use</a>	3.3.3: <a href="#">extension of the public transport network</a>	3.5: segregation of social groups (inclusionary zoning, housing trust fund, accessory apartments)
Suburbs	Concentration of disadvantaged groups in suburbs (lowest income groups, minorities, elderly) and loss of middle class groups to core (families, first time home buyers from centre)					
Core	Concentration of disadvantaged groups in urban centre and less attractive areas (lowest income groups, minorities, elderly) and loss of middle class groups (families, first time home buyers from centre)					
Suburbs	Shortage of affordable housing in suburbs					

Table 7.1: Policy framework

## 7.2. Objectives and methodology

Within the SCATTER project, the role of this work package is to produce a review of strategies and policies that directly or indirectly address urban sprawl in Europe and the USA. The aim is also to provide inputs to the selection of policies to be simulated in the next stage of the project.

There are three main components to the work package:

1. a review of policies addressing urban sprawl in Europe and the USA;
2. a review of institutional barriers and
3. interviews with US experts on urban sprawl.

The review provides a description of various measures implemented in the case cities (Brussels, Bristol, Helsinki, Milan, Rennes and Stuttgart) and other European and US cities. The review of institutional barriers highlights possible barriers to implementation of policies. The interviews in the USA are intended to highlight ways of identifying sprawl on the ground, ways to mitigate the negative impacts of sprawl and to identify policy measures which may control the problem.

### 7.2.1. Literature review

#### 7.2.1.1. Sustainable urban development

Urban sprawl has become an increasing priority on the urban agenda due to its contribution to unsustainable land use and consumption. Current patterns of development, combined with the changing economic and social context of European cities have resulted in increased land consumption; wider social and economic disparities between social groups; the spatial segregation of opportunities for employment, education and housing in urban neighbourhoods; a decrease in the quality of the urban environment, in the quality and quantity of green space, and in the physical and cultural heritage of the built environment; and problems with urban transport namely, increased use of the private car and decreased use of public transport, leading to pollution, traffic congestion, and reduced accessibility to services and economic functions of cities. Urban sprawl is to some extent the result of this changing economic and social context.

Urban sustainability has been high on the European Agenda, and a comprehensive list of work addressing sustainable development can be found in EEA-DG-JRC (2002). This concept can provide a general context for the evaluation of policies to combat sprawl. The key principles of sustainability are given as (European Commission 1996):

1. Environmental capacity: human activities should not exceed the environment's carrying capacity thresholds
2. Management of demands: policy processes should limit demands to within the limits of the natural environment rather than meeting demands which exceed this.
3. Reduce the use of natural resources.
4. Diversity: increase the benefits gained from economic activity by multiple use and increased economic and social diversity.

## 5. Equity: increase the equitable distribution of wealth

More specific frameworks for the development of urban areas have been laid out in Committee on Spatial Development (1999), which states that sustainable urban development should encourage

- control of the physical expansion of towns and cities
- a mixture of functions and social groups
- wise and resource saving management of the urban ecosystem
- better accessibility by different types of transport
- conservation and development of the natural and cultural heritage

Other frameworks for sustainable land use given in the European Sustainable Cities Project, the European Spatial Development Perspective, CEMAT, and Member State's Urban Exchange Initiative are listed in Expert Group on the Urban Environment (2001)

### 7.2.1.2. Why using policies to control urban sprawl?

The decision to implement policy assumes that a problem exists and that it cannot be resolved by market forces. The urban sprawl literature has not always agreed on the need for public intervention, and this is summarized in the debate between Gordon and Richardson (1997) and Ewing (1997). Gordon and Richardson argue that the decentralized suburban development offers advantages to the individual in the form of reduced travel times and lower housing costs, as well as higher consumer satisfaction. Ewing points out that there are increased infrastructure costs, travel distances and loss of land due to sprawl.

In light of this debate it is also useful to outline the rationale for government intervention which is explained by Stokey and Zeckhauser (1978) and some key issues to consider when applying policy to urban sprawl. Government may intervene for reasons of "efficiency" or "equity". The "efficiency" rationale applies to urban sprawl principally because of the non-existence of markets for some goods such as the loss of environmental quality on future generations. In terms of equity, the market may not provide goods equally to all areas or groups, which applies clearly to the issue of segregation of social groups.

Policy solutions can take the form of attempting to improve the working of the market; implementing measures that require individuals and firms to behave in certain ways, such as greenbelts and planning laws; providing incentives that influence decisions of private individuals and firms such as housing vouchers; the direct provision of goods and services, such as social housing; and encouraging the private provision of goods and services, such as housing associations. The European Commission (1997) acknowledges that the trend in public sector and city management is less towards the direct provision of services, but while it emphasizes the importance of provision of "services of general interest" it does not state a clear preference for how these services are to be provided.

Current trends suggest that the growth of cities is likely to continue, however, the form and impacts of that growth can be directed through public policy. Once it is decided that a problem exists and that government intervention is necessary, the de-

sired policy must be determined. It is useful to outline the general decision making framework, which is applied before implementing a policy. According to Stoke and Zeckhauser (1978) this involves:

1. Establishing the context: identify the problem and the objectives to be addressed
2. Laying out alternatives: examine alternative courses of action to the present
3. Predicting the consequences: what are the likely consequences of each alternative
4. Valuing the outcomes: deciding on the criteria used to choose each objective; deciding on the importance of each objective
5. Making a choice: some alternatives will fulfil certain objectives better than other alternatives and perform worse on other objectives. The choice of action will inevitably depend on a tradeoff of objectives.

When considering these steps it is particularly important to note the following:

*Aims of policies:* Any policy involves significant choices between conflicting objectives, groups and physical regions. A decision must be made as to the nature of the problem, the interest group being served and the geographical area targeted. No policy is neutral and will involve normative (and political) choices starting from the decided objectives, and the criteria for choosing those objectives.

*Interactions of policies:* Policies to achieve sustainable development, and combat complex problems such as sprawl cannot be viewed in isolation. Successful implementation of sprawl policies often depends on other related policies, and these often have impacts on sectors outside their orbit. This is particularly so in the case of urban areas, which operate as interconnected systems where activities in one sector have positive or negative feedback effects on other sectors. This view of cities as complex interconnected systems is hindered by the sectoral specialization of policy makers and departments in urban government.

*Level of approach:* To some extent urban sprawl can be dealt with at different spatial levels, for instance as a neighbourhood problem, a city wide problem, or a regional problem. It is important to approach the issue of sprawl at a broad enough scale so that the problem is addressed directly rather than being shifted to another locality or political jurisdiction. This is in accordance with the spatial policy discussed in Committee on Spatial Development (1999) which seeks to strengthen the metropolitan regions at an EU level. Policies therefore need to promote cooperation between cities and regions in economic competition, culture, education and knowledge and social infrastructure. Successful policies to combat sprawl may be targeted at individual cities, but should be viewed as part of an interdependent network of urban centres and smaller towns, with the outcomes evaluated in terms of the effect on the polycentric network as a whole.

## **7.2.2. Conclusions from the literature review**

This section provides an overview of the most innovative practices used to control the spread of urban sprawl and highlights the main debates in the literature. The theoretical discussion of policies in the literature is guided by the sectoral framework of research activity, however, in actual implementation, policies are more integrated as discussed in the results from the analysis of case studies.

### 7.2.2.1. Land Consumption

With regards to policies with a land use dimension the literature clearly advocates the concept of the *compact city* and related land use planning policies. The crux of the compact city concept is not so much the spread of urban form, as the creation of higher density cities. While there is debate over the attainability of the compact city, there is an increasing consensus that some form of targeted development is the key to containment of urban sprawl, most often discussed in ideas of *decentralized concentration* and *settlements around transport corridors*. These policies are supported by less comprehensive policies of containment such as *greenbelts* and *urban growth boundaries*. The main point of emphasis is not so much on the effectiveness of such policies, which after fifty years of implementation, has been proven but whether such policies have the ability to accommodate physical growth in rapidly growing cities, and whether there are detrimental side effects namely, rising house prices which would conflict with the prevention of urban sprawl's impact on housing affordability. The effect of rising house prices can be offset by increasing housing density, but this is unlikely to occur through market forces and requires a system of integrated policy measures.

This concept of the compact city is most often applied to European cities which are supported by the necessary planning and regulatory structures. This provides a strong contrast to the tools used in weak planning systems where the emphasis is on control through the market, using fiscal measures and demand led strategies. The measures of *new urbanism*, and *cluster zoning* are the primary measures used to cut land consumption, but have been of little success in preventing urban sprawl. These are useful measures to improve the quality of suburban housing, but do little to restrict supply of low density housing.

### 7.2.2.2. Mobility

The literature cites the key mobility related problems of urban sprawl as decreased accessibility to employment and services, and increased dependence on the private car over public transport. This reinforces the demand for suburban housing, the decline of inner urban areas, and the segregation of social groups. The policies in this section aim to increase accessibility to jobs and services, using a combination of *incentives to increase public transport* use and *disincentives to private car* use. One of the most widely discussed policies is that of *settlement around public transport corridors*, which is seen as a way to provide an incentive to public transport use and to promote mixed use development. The main emphasis is that the success of the policy lies not merely in the generation of housing around transport hubs, an approach that can exacerbate urban sprawl, but also in the creation of a mixture of uses – workplaces, services, shopping and leisure in the neighbouring area. Without this, inaccessibility and car dependence are likely to continue and the policy merely increases the spread of housing further out into the outer urban rings.

Other transport policies focus on disincentives to private car use, by *restricting parking in the city centres*, a policy which is usually accompanied by provision of alternative modes of transport and which must be monitored to ensure that it does not contribute to the decline of city centre jobs and services, a side effect which only exacerbates the problem of urban sprawl. The other main method discussed in the literature is the use of fiscal incentives to decrease private car use, such as high *automobile taxes*, *high taxes on fuel* and the *Versement Transport policy*. For such policies to be successful they must be accompanied by an increase in levels of public transport. The ability to increase public transport is to some extent determined by levels of housing and employment density. This leads to one of the key points discussed in



the literature, that land use and transport policies must be combined if the negative impacts of urban sprawl are to be tackled, with the most closely related being policies which increase public transport, mixed use and land use density.

#### 7.2.2.3. Adaptability of Physical Infrastructure

The discussion in the current literature on urban regeneration strategies is focused firmly on the core urban areas. The policies in all cases attempt to reverse the decline of jobs, services and housing in these areas. There is little focus however on the reduction of suburban housing demand, as to some extent this is due to the broader, deeply rooted changes in the demographic and economic structure. The literature emphasizes that policies to increase demand for core area housing are more successful when targeting specific groups, namely childless households of older adults and young singles, who are attracted to urban amenities and access to public transport, but do not require the advantage of high quality suburban schools.

The majority of the literature focuses on increasing the attractiveness of the core areas through mixed use development. The main tool used is change in the land use planning regulations to allow multiple uses and designation of mixed use districts in development plans. The policy appears to be most successful in large cities where it is supported by market demand for dense development, with little mixed use development occurring in smaller cities, despite changes to the regulations. While the literature discusses specific projects that would be suitable for mixed use, such as waterfront developments, etc., there is little emphasis on the more substantial issue of how to generate demand and provide incentives for developers to invest in such projects.

This is to some extent related to the financing of urban revitalization, the most common methods discussed are tax based incentives, such as tax incremental financing, capital allowances and incentive property taxation. There has been little examination of the success of these measures in offsetting the lack of private market investment, beyond one or two case studies. However, it appears that the main obstacle to mixed use development is exactly this.

#### 7.2.2.4. Segregation of Social Groups

The dispersal of concentrations of low income residents is achieved through housing policies. The main trend has been a move away from direct public sector investment in housing provision to subsidies to the renter, through housing vouchers and housing trust funds and increasing the levels of affordable housing provided through the market using planning regulations, inclusionary zoning and accessory apartments.

### **7.3. Comparative analysis of case studies**

#### **7.3.1. Framework for the review**

The main idea that helped choosing the cases was to make a large overview of the policies and measures designed and implemented to combat urban sprawl and its negative impacts. The selection had to reflect the results of the literature review but also provide a different perspective on existing policy measured based on the implementation mechanisms involved in the different contexts and case studies. The analysis of case studies is designed to address research questions regarding the implementation of policies and the planning practice in which they are embedded: How are policies implemented? Which are the main elements of the implementation proc-

ess? Can we identify some success factors? Are new trends in the planning practice emerging, as a consequence of urban sprawl?

Case study profiles have been drafted according to a common analysis template, which includes a description of the geographical, demographic and socio-economic context of the case study, a presentation of the planning system both at the national and at the local level, an overall description of the long term planning strategy adopted by the city, region or metropolitan area and a detailed description of the policy or policies of interest for this review. The latter accounts for the implementation of the policy focusing, when possible on the actors and financial mechanisms involved. When and where available, results and outputs of the policies are also provided.

A major difficulty in the reporting and comparative analysis of case studies has been the evaluation of the outcomes of the implemented policies, due to the unclear nature of the precise object of the evaluation. This ambiguity can be attributed to two essential limits: the first is the dependence of the analysis on second-hand sources information. Information available through bibliographic and journal literature has usually been pre-processed for some particular purposes, which do not necessarily match with the purpose of our investigation. Information available through local authorities' public sources (as for instance local and regional governments' websites) tends to (and understandably so) overestimate the success of the implemented policies. Secondly, the majority of the policies and measures investigated have not been in force long enough to provide sufficient results for a qualitative evaluation.

### **7.3.2. Selection criteria**

In order to select a limited number of significant case studies a preliminary list of potential cases has been built mainly by investigating existing Internet databases and other European research projects. These sources have also been used in the second stage of the in-depth investigation on the selected case studies.

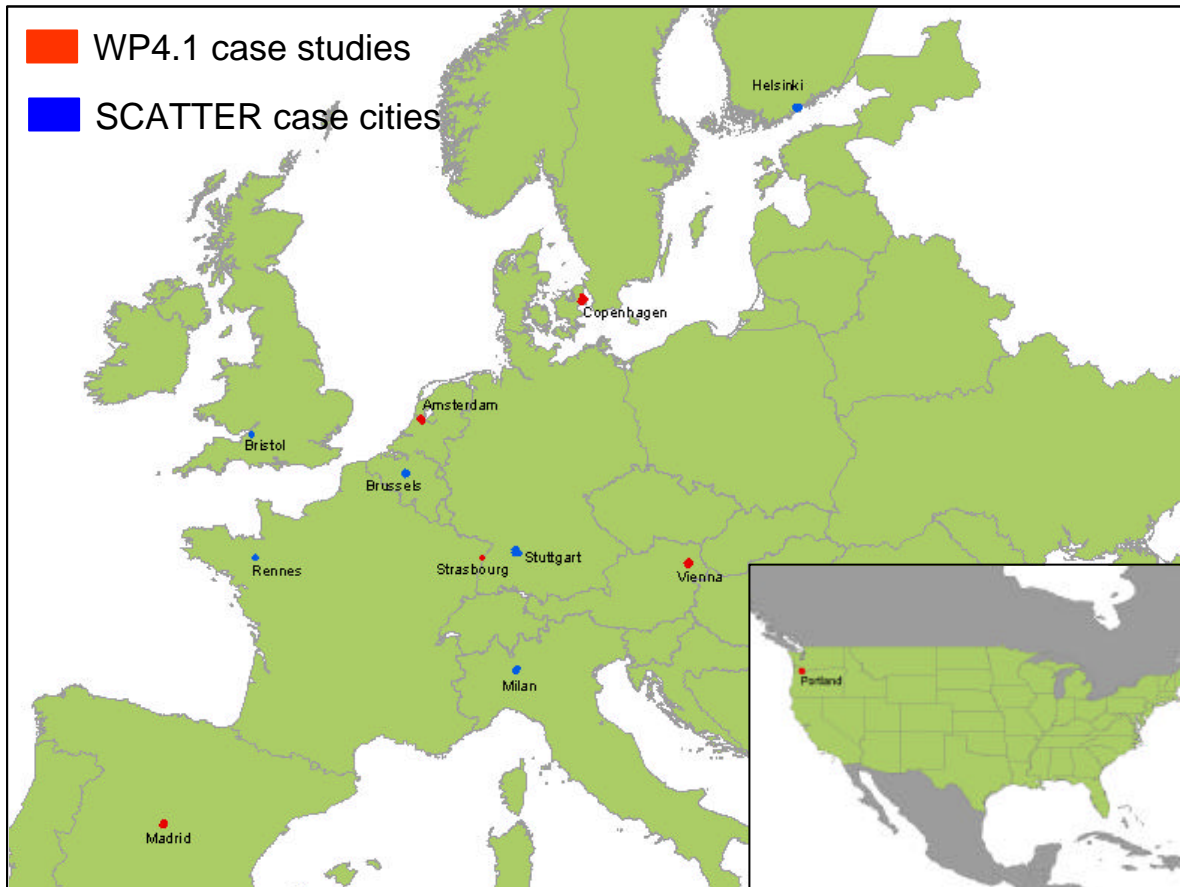
Databases:

- SURBAN, database on sustainable urban development in Europe by the European Academy of the Urban Environment, <http://www.eaue.de/winuwd/default.htm>
- Local Sustainability, the European Good Practice Information Service, by the International Council for Local Environmental Initiatives (ICLEI), <http://www3.iclei.org/egpis/>
- Legal and regulatory Measures for Sustainable Transport in Cities (LEDA) databank, <http://www.ils.nrw.de/netz/leda/>
- Online Transport Demand Management Encyclopedia, at <http://www.vtpe.org/tdm/>
- Best Practices Database, by UN-Habitat programme, <http://www.bestpractices.org/>

European projects

- TRANSPLUS, Transport Planning, Land Use and Sustainability
- TRANSLAND, Integration of Transport and Land Use Planning

- PROGRESS, Pricing Road Use for Greater Responsibility, Efficiency and Sustainability in Cities
- PROSPECTS, Procedures for Recommending Optimal Sustainable Planning of European City Transport Systems



*Figure 7.1: Geography of case studies*

Criteria for the final selection of the case studies presented here have included

- the necessity to cover as many different European contexts and planning backgrounds as possible avoiding overlaps with the SCATTER case cities, also included in this review; the selection includes Austria (Vienna) Denmark (Copenhagen), France (Strasbourg), Germany (Ruhr region), Netherlands (Amsterdam), Spain (Madrid); one case study is located in the US, Portland;
- the different demographic scales of the case studies in order to be able to cover a wide range of cases, from European capital cities to National Metropolitan regions, to medium-sized cities;
- the idea to cover as much as possible all the urban sprawl related issues discussed in the literature review section of this work package: environmental impact; land use and land consumption; transport and mobility; adaptability of physical infrastructure; social segregation;
- the idea to have mostly cases of good practices but also cases of bad practices.

- the amount of documentation and literature available for each of the case studies.

Table 7.2 provides a list of all the case studies analysed.

City	Policy	Strategic Framework
Vienna City Region	Policies for land and town development management	Urban Development Plan and Settlement Scheme for the Eastern region
Community of Madrid	Regeneration of the Gran Sur	Madrid Regional Strategic Plan
Greater Copenhagen	Travel management policy	Copenhagen Municipal Plan
Communitè Urbain de Strasbourg	Management and Organisation of Employees' Commuting	Urban Mobility Plan
Amsterdam Metropolitan Area	ABC and VINEX policy (office and housing location)	Amsterdam Structure Plan (2000/2001)
Portland Metropolitan Region	Urban Growth Boundary	Regional Framework Plan
Bristol Urban Region	Local Transport Plan	Joint Replacement Structure Plan
Brussels Capital Region	ABC Policy (office location)	Brussels Development Plan
Helsinki Metropolitan Area	Helsinki Metropolitan Area Transport Plan	Helsinki Metropolitan Area Vision 2020
Municipality of Milan	Several local actions/policies for environmental, transport, economic and social development	North Milan Strategic Plan
Rennes Métropole	Cognitive measures to raise awareness and inform planning decisions	Master Plan for Rennes Metropolitan Area
Stuttgart Region		

*Table 7.2: List of case studies of policy evaluation*

### 7.3.3. Key Findings

As it has been said above, the qualitative evaluation of case studies remains difficult. In the following pages some aspects, which seems of interests in relation to the purpose of the work package are identified. These have been grouped under three areas that can be considered as answers to the following research questions: is urban sprawl and, in general, unsustainable urban growth promoting innovations in the planning practice? Which, among the available policies, are actually being implemented to tackle urban sprawl and mitigate land consumption and increasing traffic congestion? Which are the most interesting (and successful) features of the implementation process that should be taken into account?

### 7.3.3.1. Emerging trends

New forms of planning practice are emerging which represent an adaptive response of local and regional authorities to the challenges posed by the changes in the scale and type of urban growth, demographic migration and economic activities relocation.

Differences in culture, political economy and administrative structures can explain the differences in comparative planning systems, and the regulatory mechanisms and authorities that determine the respective urban outcomes. In cases where urban sprawl and its impacts are the problem, the only application of tight land use control regimes, which has been the traditional way of containing urban growth, loses out against economic and political interests or just against the unpredictability of social and economic changes.

Increasingly, however we see efforts by local and regional authorities to structure and contain the impacts of urban sprawl by means of innovative ideas and measures that promote sustainable development. These include higher density mixed use and infill development, proactive containment of urban growth through the reduction of land available for development and its designation to green and public service uses, the adaptive reuse of abandoned industrial structures and brownfields, a wider range of alternative modes of transportation, public transport oriented urban development.

Besides innovating the contents of planning policies, public institution and organisations are also changing the practice, the “how to” of planning. This is the case for instance of three major changes:

- Increasingly, large cities and particularly metropolitan areas are faced with difficulties in financing urban policies and programmes. As cities lose population, activities and incomes they also lose their strength as promoters of development. In several cases the response of local administrators has been the abandonment of the traditional forms of welfare planning and the adoption of a more entrepreneurial approach characterised by the “planning-by-projects” practice;
- The increasing use of regional planning strategies coupled with local regulations and detailed plans in order to regulate urban growth and urban change; this practice is not always successful. It requires a long-term coherence of the regional framework. In cases when regional government doesn't have the possibility to enforce binding regulations a large consensus from local planning authorities is also required. Strategic plans at the supra-local level are used as frameworks for the definition of local land-use and transport planning according to the criteria of balanced regional development both with regards to the spatial and economic dimensions. The degree to which the revision of local plans can be achieved in a flexible and prompt manner can influence the successful achievement of strategic goals
- Progressive shifts from top-down to bottom-up approaches and from centralised to decentralised and collaborative planning. This is sometimes the response to the requirement of consensus building;
- Institutions building as response to the increasing trans-boundary and trans-sector nature of urban growth and development. Collaborative and bottom-up practices can lead to the establishment of temporary or long-term voluntary cooperation among different types of public and private actors and among different administrative levels, but new institutions can also be the result of more traditional top down approaches. Administrative institutions build coalitions to strengthen the

role of public actors and interests in competitive environments ruled by market forces. In these contexts public coalitions can better plan their strategies towards more entrepreneurial or collaborative behaviours.

A further challenge for cities, which are undergoing processes of significant urban growth or change, is the necessity to balance the promotion of economic competitiveness (both against other cities in the metropolitan area or region and at the national or international level) with the control of spatial growth and its impacts (land and natural resources consumption, social segregation). In this field EU regulatory framework can play a key role.

#### 7.3.3.2. Implementation of policies

Using the framework designed to organise the bibliographical review, we will present a summary of the policies implemented in the case studies and of the characteristics of the implementation processes. Actually, implemented policies differ from the ones discussed, from a theoretical perspective, in the review on at least two relevant elements: the first one is the fact that implemented policies always belong to some extent to an urban or regional development strategy within which they are integrated more or less strongly, with other policies. They are often designed as part of the strategy or as its operational arm and they are managed and sometimes even financed by a web of public, private and public-private sources. These policies would often be devoid of meaning and, most certainly, of effectiveness if deprived of their integration with other policies. The second element of difference is that policymaking and planning practice don't (only) work by the simple application of theories. Rather, it is strongly rooted in the historical, institutional, political and planning background of each case. These backgrounds decide what should or can be done to tackle urban sprawl or its related impacts and also how. They also limit the transferability of policies from one territorial context to another. More or less flexibility in plan making, fiscal regulations on land property, a higher or lower degree of power of public actor, the degree of centralisation or decentralisation of planning activities, a declining versus a growing economy: these differences can all influence policy design and implementation. Indeed the presentation of case studies takes these backgrounds into account. The main areas of concern in the implementation of policies are land consumption, transport and mobility, neighbourhood regeneration and policy integration.

Fiscal measures are a high concern of the SCATTER project as valuable push and/or pull instruments to direct the location and types of urban growth. However such policies are currently seldom implemented in European cities with the finality of growth control. This is sometimes due to the centralised structure of fiscal legislations sometimes just to a lack of knowledge of their potential as urban growth management tools. For these reasons, they are not listed in this summary of implemented policies.

##### 7.3.3.2.1. Land Consumption

Land consumption generated by uncontrolled and unplanned growth and location of (mainly residential) urban functions is an issue of great concerns for local and regional governments preoccupied by the possible reduction of natural resources and of their environmental quality and by the increased costs of public infrastructure provision. Two are the most common approaches presented by the case studies: control of land consumption by a reduction of the supply of land available for development and one based on promoting or imposing urban growth only in selected location and with selected land-use structure and density levels.

### Reducing the supply of land

*Greenbelts* and *green corridors* (Vienna, Copenhagen) are commonly used as instruments for the preservation of natural resources especially by those countries and cities with a long tradition of regulations for environment protection. The interesting feature in their implementation regards the use of “active protection” of these open and green spaces. The area reclaimed as greenbelt and green corridors are not left idling for an undetermined time, but planned and used as part of the city’s supply of public services such as parks, sport facilities. In this way, local government can, on the one hand exert a long-term control and management of the areas and, on the other, promote consensus for the greenbelt policy. The areas to be included in the greenbelt and green corridors policies are sometimes acquired through the requisition of land, but most of the times they are areas already protected by national or regional environmental legislation.

By means of *land banking*: land is made unavailable for development and subsequently released according to scheduled planning. Land can be released for market purchase already equipped with basic infrastructure or not. Private developers can acquire development’s rights only if their development project matches some publicly defined criteria, often based on sustainability principles such as social equity, minimum environmental impact, economic development. Land banks are either compulsory by law as in the Spanish constitutional law, publicly funded or self-financed via resale of land.

Urban growth boundaries, only used in the US, are mainly a boundary that separates urban from rural land or urbanisable from non-urbanisable land. In this sense, a part from being an instrument to control the outward expansion of cities they act as a scheduled programme for urban growth. This type of programming is often provided for in national planning legislations in European countries, without any reference to the concept of boundary but solely to identify areas where urban development can take place. These areas are identified in local planning instruments.

### Selective location of land uses

Policies which regulate the location of land uses in order to reduce land consumption are, in some way, a particular form of more traditional zoning practices. They are specifically targeted to promote development based on the criteria of mixed land uses, high density. They also target the problem of accessibility and car dependency and in this sense can be grouped under the category of policies that promote a general reduction of car usage.

The practice of transport oriented development whereby urban growth is directed along transport axis or in proximity to interchange nodes such as railway stations, is rather different from the general theory and the policy must always be “customised” in order to be successful. Problems emerge for instance when this policies are not accompanied by the provision of dependable public transport service. Another issues of concern are the criteria used to determine the concept of “proximity” in the selection of location for economic activities. These criteria must take into account the need for economic activities to grow and at the same time be flexible with regards to the different types of economic activities that are required to locate in “proximity” of transport corridors and hubs. If these issues are ignored the targets of mixed-use development are hardly met.

Even when development is not directed specifically in proximity of transport infrastructures, the main success factor for the promotion of high density and mixed-use

urban developments is the coordination among agencies and actors involved in the development process. Coordination of public and private agencies responsible for the location of economic activities has been the key factor in the case of Vienna. In Rennes the voluntary coordination of local authorities for the location of residential development and for supra-local density control has been based on an intensive and long term information campaign and consensus building.

#### 7.3.3.2.2. Mobility

The policies implemented acknowledge the fact that while mobility must be eased and promoted both within and between urban centres, the use of cars must be reduced and the use of public transport must be increased as much as possible. Mobility is the key to the economic and social development of a region, but if mobility is only or mainly supported by private cars, environmental quality is deemed to be irreversibly damaged in the long term. This goes against the principle of sustainability that requires all three issues (social, economic and environmental quality and development) to be tackled.

#### Supply of infrastructures

It is commonly recognised (see also D1 and D2 of the SCATTER project) that the extension of transport infrastructure can be one of the causes of urban sprawl. However there are cases, also presented in this review, that show how spatially strategic *extensions of railway, light railway and underground infrastructures* (Vienna, Madrid, Strasbourg) can successfully support the development of a more polycentric structure by improving access to secondary urban centres and help to remove isolation of peripheral areas and centres suffering social deprivation and economic decline.

The realisation of *ring roads coupled with the supply of parking areas* that adopt park&ride schemes in connection with public transport nodes located outside the city centre are also a successful measures to reduce the number of cars entering the city centre therefore promoting a higher environmental quality of the urban core.

Similarly the supply of *bicycle and walking paths* can promote the use of these alternative means of transport in the city centre and in the close periphery. However these interventions can only be successful if accompanied by road safety measures, such in the case of Copenhagen.

#### Supply and/or organisation of services

In order to reduce car usage, it is necessary to provide end-users with an economical and dependable public transport alternative. Given the change of mobility patterns towards a regional rather than local and urban scale, the management of public transport must increasingly take into account the need to coordinate different scales and therefore different public transport networks and agencies. Coordination has been achieved in different ways in the case studies: the harmonisation of local and regional fares in the case of Madrid, the unification of public transport providers in a single agency in the case of Vienna, coordination of time tables between different modes of transport (*rendez vous*) at interchange nodes (Strasbourg).

Traffic management in favour of public transport by means of traffic light priorities, reserved lanes, computerised management of traffic flows, can also provide the framework within which public transport is more dependable.



Finally, measures based on incentives have also been successfully implemented to promote the use of public transport service. Transport-for-all marketing measures are based on the definition of a flexible design of fare systems, sensitive to the needs of different end-users (commuters, students, unemployed), to the different motivations for trips (shopping, work, flexible working timetables) and to seasonal events (Christmas shopping, sport and cultural events). Employees commuting management schemes require each employer to design a mobility management schemes for their employees and in some cases to financially support their employees' use of public transport.

#### 7.3.3.2.3. Neighbourhood regeneration

Despite a common disbelief in the capacity of piecemeal approaches to control urban growth, regeneration programmes presented in the case studies owe their success to the containment of the scale of intervention. Both in the city centre and in peripheral areas regeneration is used to reduce social segregation and promote economic vitality. By so doing they provide the entire city with areas to accommodate demographic and economic growth that would otherwise need to locate in the suburbs. The scale of regeneration schemes is of concern because the success of the projects is linked to two major issues: their financial feasibility and the public consensus (via public participation) generated by the projects.

Regeneration measures must, as much as possible, avoid eviction and relocation of inhabitants and economic activities and the onset of gentrification processes. These can be avoided by involving residents at all levels of the project from concept to urban design. Subsidies to purchase or rent of the renovated dwellings have also been implemented.

#### 7.3.3.3. Integration in response to interactions

All the case studies presented in this review show some degree of policy or institutional integration and coordination. Integration in these cases is a proper response to the acknowledgment that, regardless of the scale of the urban area and of the issues to be tackled, interactions between policies and between the different effects of policies must be dealt with. Integration is therefore recognised as a key success factor.

#### 7.3.3.3.1. Integrating land use, transport and mobility measures

Traditionally the interactions between land uses and mobility have been investigated on a theoretical level. The fact that the spatial and functional structure of an urban system influences the levels and types of mobility patterns is undisputable. Many difficulties remain in the identification of the impacts of transport planning on the structure of urban systems. Integrated land use and transport planning is therefore called for in order to deal with these interactions.

The case studies offer some interesting examples of how these interactions have been dealt with in order to successfully tackle urban sprawl. They show how the success of one policy measure can only be achieved by integrating it with accompanying measures. These sets of measures are sometimes implemented simultaneously, sometimes the latter are implemented in a second moment, in order to complement or increase the effectiveness of the former.

Greenbelt measures to control urban growth for instance would only end up relocating urban sprawl outside the belt if an accompanying policy for the regeneration of secondary centres outside the belt is not implemented. The requirement of a com-

compact growth of all the centres of a polycentric region to avoid the sprawl of the main urban centre can only be met if accessibility to the different urban centres is improved by means of public transport. Greenbelt policies, *per se* are not successful in tackling urban sprawl but only in protecting a limited part of the natural resources surrounding the urban centre. Effective control of urban growth is only achieved by complementing the policy with regional development and an efficient public transport regional network.

In cases where urban growth is directed in the proximity of transport corridors and hubs for the purpose of reducing car usage, the supply of highly dependable public transport should be improved, otherwise cars will remain the most “economical” alternative for transport. Transport hubs can play a key role in attracting development and simultaneously reducing car use if great attention is given to criteria such as the calibration of the amount and cost of available parking spaces to make car use more costly and difficult; the flexible and accurate management of inter-modal exchange via timetables harmonisation.

#### 7.3.3.3.2. Inter-institutional integration

Integration can also occur among different administrative levels, which exert their planning competences on the same area but at different scale. This is for instance the case of coordination among all the actors involved in the provision of public transport services within one metropolitan or urban area. Integration can be achieved between the private developers and the public planning authority for the selection of location for economic activities and for the definition of development criteria.

## 8. QUALITATIVE EVALUATION OF POLICIES : LESSONS FROM THE USA

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In order to highlight ways of identifying sprawl on the ground in a context like the US where sprawl and anti-sprawl measures have a longer history than in Europe, interviews were conducted with academic experts from United States.

### 8.1. Background to the interviews

Interviews were held at Rutgers University – the State University of New Jersey – at New Brunswick, NJ on 4th March 2003 and conducted as an open seminar with Professors Richard Brail, Robert Burchell, and Reid Ewing. The seminar was also attended by Dr. Mike Lahr from the Center for Urban Policy, and three graduate students John Renne, Jianye Chen and Stephan Schmidt. The following sub-sections give an abridged version of the issues that were discussed.

Richard Brail is a Professor and Chair of the Rutgers University Department of Urban Planning and Policy Development and Director of Computer Resources at the Bloustein School of Planning and Public Policy. He set up this meeting with Reid Ewing, Bob Burchell, and Mike Lahr, key academic researchers in the US, if not the world dealing with issues involving urban sprawl.

Bob Burchell is Distinguished Professor at the Center for Urban Policy Research, is the author of 25 books and more than 50 articles. Professor Burchell, co-director of the Center, is an expert on fiscal impact analysis, land-use development and regulation, and housing policy. Dr. Burchell co-authored the *Development Impact Assessment Handbook for ULI* -The Urban Land Institute. His major publications include *The Fiscal Impact Handbook*, *The New Practitioner's Guide to Fiscal Impact Analysis*, *The Adaptive Reuse Handbook*, and the *Environmental Impact Handbook*. He has served as principal investigator on more than \$2 million in research spanning a twenty-five year career at Rutgers. One of these efforts included the Impact Assessment of the New Jersey State Development and Redevelopment Plan, an encompassing study of the growth management program adopted by the New Jersey State Planning Commission in June 1992. Similar 'costs of sprawl' studies have been done for the state of Maryland, the Lexington (KY) Metropolitan Area, the Delaware Estuary, the Southeast Michigan Council of Governments, and the South Carolina Advisory Commission on Intergovernmental Relations. His contributions to the National Academy Study *The Costs of Sprawl* (1999) are the seminal publication in this area.

Reid Ewing is Director of the Alan M. Voorhees Transportation Center at Rutgers University, overseeing the National Transit Institute and the Voorhees Transportation Policy Institute. He is also Research Director of the Surface Transportation Policy Project in Washington, D.C., the recognized US leader in transportation reform. He has been the American Planning Association's top selling author since 1996, with two books to his credit. He is the author of three other books and many articles on growth management, community design, and traffic management, and speaks and consults widely on these subjects. Before his academic career, he was a state legislator in Arizona, and before that, a Congressional staff member. His most recent books are *Flexible Design of New Jersey's Main Streets* (2002), *Traffic Calming: State of the Practice* (1999), *Land Use and Transportation Innovations* (1997), and *Best Development Practices* (1996).

## 8.2. Successful instruments to contain urban sprawl: the case of Portland

The interview began with a discussion on best practices, that is successful examples of containing suburban sprawl and the interviewees naturally turned to the example of Portland, Oregon.

Metropolitan Portland is the Oregon's largest metropolitan area. It is composed of parts of three counties and 24 cities and is home to 1.1 million residents. Oregon is one of the US states, which has the longest continuing history of statewide growth management and land preservation. It is a recognised leader of urban growth management in the US and many states are now implementing features of Oregon's planning system.

Oregon uses urban growth management to:

- direct the regional demand for urban development into areas contained by urban growth boundaries (UGBs) and away from resource land;
- restrict ex-urban (beyond UGB) development so that it is compatible with resource activities;
- restrict resource land to resource activities.

Oregon's statewide goals are achieved through local comprehensive planning. State laws require each city and county to adopt a comprehensive plan which must be consistent with the state-wide planning goals.

The statewide planning goal n. 14 on urbanisation calls for each city to establish an "urban growth boundary" to "identify and separate urbanisable land from rural land". An urban growth boundary is essentially a line drawn around a metropolitan area that delineates where urban development may take place (inside the UGB) and where it may not (outside the UGB). "By restricting urban development to a well-defined, contiguous area it is thought growth can be accommodated without permitting urban sprawl". Land outside UGBs is restricted to farming, forestry and other resource uses.

The establishment and change of a UGB is a cooperative process between a city and the county or counties surrounding it. Urban Growth Management Agreements (UGMAs) are used to establish procedures for coordination between counties and cities that have jurisdiction within a specific urban growth boundary.

Although simple in concept, the construction of UGBs has proven difficult in practice. Part of the difficulty stems from the uncertainty concerning the rate of urban development which makes it difficult to determine exactly how much land to include inside a UGB. Too little urban land could cause land price inflation whereas too much would not prevent urban sprawl. However to enhance the possibility of successful growth management, UGB in Portland has been accompanied by a detailed and comprehensive growth management programme which details land-uses, densities and public transport development.

Reid Ewing (RW) confirmed that he thought that Portland was a classic example of best practice in that less land per capita had been consumed there than any other US city of comparable size, as a result of density targets which had led to average densities some 40 percent less than the average US city. Moreover the downtown

had not decanted its activity in the manner of other places and it was still a vital part of the city's infrastructure. But the downside of all this was that housing in Portland was no longer affordable, it is a city for the relatively well off, all as a result of control of land supply. In fact the urban growth boundary that had been put in place to ensure these controls was slowly but significantly being extended to provide more breathing space for the city. If the wider region is considered, then the picture changes in that sprawl begins a distance from Portland where the strict controls end and other municipalities and counties begin to exert their influence.

This introduction to the concept of the urban growth boundary is rather different from European experience where there is no such instrument per se and it is significant that it has become enshrined in US land use planning during the last 30 years. In some ways it is not very different from the edge of the 'green belt' in British planning although it is operated in a much more bottom up fashion for individual cities. Bob Burchell (BB) also introduced the example of Lexington, Kentucky which he argued is perhaps the most successful boundary and has been in existence for several decades. But he made the point that the boundary was drawn far too loosely and within Lexington, urban sprawl has taken place within the boundary. The kind of relativism which such boundaries presume is similar to the way green belts around cities are continually changed in response to emerging conditions. Reid Ewing also introduced the issue of infrastructure provision arguing that the great success of Portland was to avoid, indeed to abolish the idea of a beltway around the city and to develop a light rail system in its stead. The LUTRAC demonstration project he argued was perhaps the best example too of the development of models and techniques to assess infrastructure provision for managing urban growth and referred us to examine this project in more detail. But Bob Burchell argued that success in containing urban growth is never easy to evaluate. In Portland, he said: "... for every positive issue, there is an equality ripping negative issue".

### **8.3. Growth management and Smart Growth**

In a sense the success stories of containing sprawl are being gradually added to the measures which constitute the idea of 'smart growth'. Smart growth is a recognition, says Burchell, that growth cannot be stopped but we need to take an intelligent approach to managing growth – Americans use the word 'smart' to stress this (and we should note that the term 'smart' is widely used in American, not British/European English). Burchell defined smart growth as encompassing five types of issue which all have accompanying measure or policies often bundled into various types: these are:

- Control of outward development, assuming that growth is polarized in some manner around an historic core or region
- Refocusing of the centre
- Land conservation
- Reorientation of transportation and movement
- Ensuring a minimum quality of life, usually in environmental and access terms

Moreover the concept of smart growth is consistent with what Americans hold most dear – to own land free from government interference – which is enshrined in to the Constitution. Smart growth in fact is the evolution of ideas about growth management which have dominated US planning for the last 20 or more years but with much more

focus on incentives to be smart about growth – to set aside areas for specific public and related uses and to preserve rural legacy areas in the context of sprawl. Moreover smart growth is loosely associated with more compact development although there is still ambiguity about this.

#### **8.4. Scale, growth and sprawl**

There is little doubt that as one aggregates the unit in which sprawl might be measured then the variations become less and the picture becomes more homogeneous. However Reid Ewing also argued that as metropolitan and municipal governments become more ‘fragmented’ then sprawl tends to increase inter alia. This is because there is less concerted and coordinated action and too much competition between jurisdictions. Bob Burchell essentially made the point that there is no longer any appetite in the US for regional government, thus instruments to control sprawl at this level have little teeth while the most uniform level of administration still in the US is the county. Furthermore, sprawl is being exacerbated as are issues of urban finance and taxation by the general decline in city-county annexation. Our experts referred to the Colorado in the Denver-Boulder region, Houston and Portland as three examples that we should study further with respect to the way municipal and county and city governments affect the issue of sprawl and how it can be dealt with. They referred to David Rusk’s work on annexation and sprawl in the mountain states and to Paul Lewis’s study on *Reshaping Suburbia*. Issues of leapfrogging in terms of growth and sprawl are central to the question of how fragmented administrative units are.

#### **8.5. The costs and benefits of sprawl**

Bob Burchell was adamant that urban growth and involvement in the democratic process were closely related in that as administrative areas become more fragmented, there is more chance for local populations to exert their democratic rights and to become involved in the community. In fact in a way he went as far as to say that suburban and sprawl are part of the ‘American Dream’: he quoted the doyen of urban growth, Tony Downs of Brookings, as saying: “sprawl promotes democracy”. There are very clear benefits of sprawl for those who have a certain income, are single family households, probably youngish and mobile, and wish to live in low density communities where they can become involved in small governments and generally meet all their needs easily at a relatively low cost. Low taxes in remote municipalities, more school participation than average, lower services cost and provision in terms of central public services (not infrastructure), and more public safety due to lower densities and non-pressurized police services are all issues that characterize the benefits of sprawl. This as both Reid Ewing and Bob Burchell argued, implied living far from the center city. But the general cost of this is a degree of subsidization by those who do not live in sprawling suburbs. This is a tricky argument for as any one knows who has tried to track the impacts of direct and indirect costs and subsidies and benefits, the chain continues indefinitely, becoming circular with no beginning and end unless terminated in space and time.

Counter arguments to sprawl were then discussed, with a focus on the right to own land, the freedom to choose, and the need for self-governance. The notion of sprawl being efficient in producing the most flexible form of urban development was also noted but there does not appear to be any general consensus or even good scientific work on this argument as yet although there should/could be. Bob Burchell raised the issue of sprawl being for the rich while the central city and inner suburbs were now for the poor but also indicated that the baby boomers had largely driven the path to sprawl and in an era when the population begins to age, then there is likely to be less

favorable conditions for the intensification of sprawl. In fact what BB argued was that aging and demographics would probably result in a much more heterogeneous pattern of urban development during the next 20 years as demographics and immigration together would lead to some very different forms of urban pattern. Central city living is probably back on the cards in some sense purely due to large numbers of aging but relatively wealthy people who do not want to drive and this in turn could see some small increase in mass transit. Some evidence of this is already clear in places like Old Naples in Florida and in the key examples of the new urbanism and cluster housing at places like Seaside. What BB and RW were both agreed upon was that rising costs of gasoline would not change sprawl very much as there would be dramatic substitution of large for small vehicles and the quest for fuel efficiency in vehicles had barely yet started in technological terms.

## **8.6. Changing life styles and sprawl**

All were agreed that life style change is likely to have a much greater impact on what cities will look like in the future than any technological changes in that technological changes are always adapted in terms of life style change. For example the shift to smaller and more fuel efficient vehicles would be forced by the need to keep travel costs the same or even to lower these as a percentage of income and this would in turn be forced on manufacturers and technologists through the market place. RW identified several issues that are already being incorporated in emerging lifestyles which relate to housing location:

- The preference for smaller places in terms of residential living, both in terms of lot size as well as community size.
- The move towards fitter lifestyles where there is a recognition that walking is more important than it has been. This is partly a function of medical awareness but also related to aging.
- The need to building more robust communities, again due to aging but also due to a recognition that sprawl leads to a loss of community in some, not all instances.
- Greater opportunities and wealth amongst the young leading to a preference for urban living in denser areas.

However countervailing trends which tend to reinforce sprawl involve

- The need for enhanced security which appears to be easier to achieve in the suburbs and in low density areas.
- Better schools which tend to be the result of collecting children from low density suburbs over a wide area.
- The need for secure and livable environments in which to raise young children which seem inconsistent currently with most urban living.
- The long standing quest for residential homogeneity rather than ethnic mix.
- The need to minimize local taxes in terms of the space required.

It was also clear that in the history of urban development in the last century in the US, it was in the 1980s that sprawl really became significant, after the 1974 oil crisis,

when vehicles become larger, highway building continued in the suburbs and the baby boomers began to dominate the economy. In this era, home ownership was dramatically extended .

## **8.7. Fiscal measures**

RW argued that in many cases sprawl was exacerbated by public policies in that the evidence seemed to show that urban growth boundaries were of limited use in that development could easily fragment and leapfrog such boundaries. The notion of fiscal measures to contain sprawl was also discussed. In particular impact fees charged by a developer on development such as charging by the lane miles produced when land is developed were also seen as significant. However such fees were often passed on to the consumer of housing which out of 18000 or so jurisdictions with the power to charge such fees in the US, only 500 actually operated such instruments often with mixed results. All this interview managed to do was to identify their importance and their feasibility and ease or difficulties of implementation while at the same time, indicating that there was a wealth of literature in America which needs to be synthesized.

## **8.8. Current policies: the future**

Both BB and RW agreed that there was a new sense of policy development in this area with particular emphasis on the idea of smart growth. Conservation was a key issue here and this is something that we have not spent much time on in SCATTER. The idea of conserving large areas of open land – agricultural yes, but also resources based such a forest and wetlands – these are key issues in the quest to limit urban sprawl in American. Moreover better coordination of land use and transportation as in the Portland case study is also a key issue which has been recognized.

One issue which is of great importance if the extend to which sprawl varies regionally and demographically in terms of different places and people. What is happening in the south and west of America is very different from the north and east while what is happening in cities of different sizes also changes the picture of sprawl. It is clear that sprawl is not a linear phenomena in terms of city size for small cities tend to be able to contain it and deal with it more appropriately than big cities. These are impressionistic conclusions which require a clearer basis in an analysis, and in conclusion, the US experts argued that what we need to do is get a better understanding of sprawl is to unpack the analysis to different cities and different social groups, thus concentrating on the diversity of sprawl relative to other forms of development.



## 9. QUANTITATIVE EVALUATION OF POLICIES : THE QUANTITATIVE EVALUATION FRAMEWORK

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### 9.1. The approach to evaluation

The evaluation framework has to address 2 questions, when assessing a scenario:

- does the scenario generate sprawl or concentration ?
- what are the positive and negative effects of this sprawl or concentration (on environment, quality of life, economy, etc) ?

Two distinct sets of indicators were used, both tackling the 2 above mentioned issues, but the second set addressed them in a more comprehensive approach.

First, in order to be able to make intercity comparisons a set of *urban sprawl indicators* has been defined. These indicators are common for all the three cities and defined and calculated in a uniform way. The aim of these indicators is to describe and illustrate the effects of city sprawl. In addition to these indicators city sprawl is also illustrated using maps and graphs. All this information helps understanding the phenomenon of city sprawl.

However, the city sprawl indicators, although they include environmental, social and economic aspects, do not provide a global and comprehensive assessment of a policy. They do not completely answer the question if the development is sustainable. It is also not easy to say if one of the alternative policies is better than some of the other ones. The answers to the above questions are sought using the *PROPOLIS approach*. This includes analysing the results using *indicator sets* developed in the PROPOLIS project for the environmental, social and economic dimensions of sustainability. An *environmental, social and economic index* is calculated based on the weights of the individual indicators. The results are interpreted as being desirable at least in the case where the policy is able of simultaneously improving all the three dimensions of sustainability. The complete approach was used for the Helsinki case only in the SCATTER project. However, some indicators developed in PROPOLIS were also calculated for Brussels and Stuttgart, among the city sprawl indicators.

Both the city sprawl indicators and the sustainability indicators are calculated for the current situation, for the base scenario and for the individual policies tested. This makes it possible to make comparisons between the policies, between a policy and base scenario, and between the policies and the current situation.

The city sprawl indicators together with the environmental, social and economic indicators are defined in the next sections. A complete description of the PROPOLIS approach and methodologies of calculating the indicator values is described in the PROPOLIS Final Report, see [www.ltcon.fi/propolis](http://www.ltcon.fi/propolis)

## 9.2. The city sprawl indicators

The city sprawl indicators common for each of the three case cities are presented in the table below. The indicators are self-explaining except for “productivity gain for land use”. This is also an accessibility indicator, which measures how well the active people have access to the work places, the labour market. This accessibility has a link to the productivity of firms: the better the accessibility is the more productive can the firms become<sup>2</sup>.

It is worth noting that the land use indicators are calculated both for the core metropolitan area and for all the urbanised zones together (i.e. including secondary urban centres). This illustrates that two approaches can be considered when tackling the issue of sprawl: either a mono-centric approach in which the city sprawl is strengthened if the number (or share) of households or employees in the core metropolitan area is decreasing (centre-periphery competition), and a polycentric approach which also considers the benefits of a “decentralised concentration”, i.e. a concentration in secondary urban centres.

*Table 9.1 The city sprawl indicators*

<b>City sprawl indicators</b>	<b>Unit</b>
<b>Land use</b>	
Households in core metropolitan area	#
Households in urban zones	#
Jobs in core metropolitan area	#
Jobs in urban zones	#
H <sub>relative</sub> measure of population	km <sup>2</sup>
H <sub>relative</sub> measure of employment	km <sup>2</sup>
<b>Mobility pattern</b>	
Average home-work travel distance	km
Average travel time (all modes)	minutes
<b>Public transport</b>	

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<sup>2</sup> The precise definition of the Productivity Gain indicator is appended (source: PROPOLIS Final Report). The definition is based on two threshold times, which are defined as  $t_1 = 30$  min and  $t_2 = 40$  min. However in the case of Stuttgart, these thresholds were not appropriate to the general level of accessibilities and led to exaggerated boundary effects. The values for Stuttgart were therefore calculated with the more appropriate thresholds  $t_1 = 20$  min and  $t_2 = 30$  min.

Modal share of public transport	%
Passenger-km by public modes	passenger-km per year
<b>Road traffic</b>	
Private vehicle-km	vehicle-km per year
Average road traffic speed	km/h
Greenhouse gases from transport	tons/peak hours
<b>Accessibilities</b>	
Accessibility to city centre	minutes/trip
Accessibility to services	minutes/trip
Productivity gain from land use	%

The  $H_{relative}$  measure is an indicator of de-concentration which was developed in the statistical analysis. The higher the value of  $H_{relative}$  is the more the spatial structure is de-concentrated.

### 9.3. The urban sustainability indicators

The list of sustainability indicators is presented in the table below. A detailed description together with the calculation methods for each of the indicators is presented in the PROPOLIS final report and is not repeated here.

The table also shows the weights given to each of the indicator themes and each of the indicators. Weights are used in order to arrive at the *social and environmental index* that describes the social and environmental qualities of the policy. Thus, the index value takes into account the values of each individual indicator.

THEME	INDICATOR	UNIT	WEIGHT %
<b>ENVIRONMENTAL DIMENSION</b>			
Global climate change			[21.6]
	Greenhouse gases from transport	CO2 eq./1000 inh. /	21.6
Air pollution			[22,5]
	Acidifying gases from transport	acid eq./1000 inh. / year.	13.2
	Volatile organic compounds from transport	tons /1000 inh. / year.	9.3
Consumption of natural sources			[34,3]
	Consumption of mineral oil products,	tons /1000 inh. / year.	14.7
	Land coverage	percent of area	11.1
	Need for new construction	annual growth in %	8.5
Environmental quality			[21.6]
	Fragmentation of open space	index	13.4
	Quality of open space	index	8.2
<b>SOCIAL DIMENSION</b>			
Health			[37.6]
	Exposure to particulate matter from transport in the living environment	percentage of population	7.5
	Exposure to nitrogen dioxide from transport in the living environment	percentage of population	5.9
	Exposure to traffic noise	percentage of population	6.7
	Traffic deaths	deaths/1000000	10.6
	Traffic injuries	injured/1000000 inh/year	7.0
Equity			[23,0]
	Justice of distribution of economic benefits	justice index	5.1
	Justice to exposure to particulates	justice index	4.4
	Justice of exposure to nitrogen dioxides	justice index	4.3
	Justice of exposure to noise	justice index	4.2
	Segregation	GINI-index	5.0
Opportunities			[16.4]
	Housing standard	% of overcrowded	4.8
	Vitality of city centre	index	3.1
	Vitality of surrounding region	index	3.1
	Productivity gain from land use	percent / year	5.4
Accessibility and traffic			[23.0]
	Total time spent in traffic	hours/inhabitants/year	4.6
	Level of service of PT and slow modes	minutes/trip	5.8
	Accessibility to city centre	minutes/trip	4.0
	Accessibility to services	minutes/trip	4.6
	Accessibility to open space	minutes/trip	4.1
<b>ECONOMIC DIMENSION</b>			
Total net benefit from transport			
	Investment costs	Euro/capita	
	Transport user benefits	Euro/capita	
	Transport operator benefits	Euro/capita	
	Government benefits from transport	Euro/capita	
	Transport external accident costs	Euro/capita	
	Transport external emissions cost	Euro/capita	
	Transport external greenhouse gases	Euro/capita	
	Transport external noise costs	Euro/capita	