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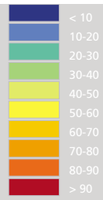
ESPON in progress Preliminary results by autumn 2003

ESPON
EUROPEAN SPATIAL PLANNING OBSERVATION NETWORK

ESPON in progress

Preliminary results by autumn 2003



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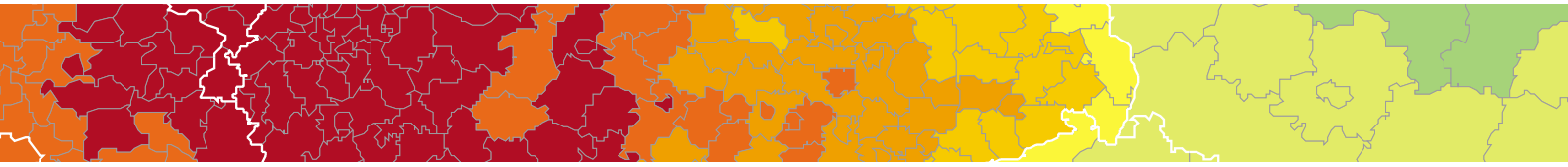

ESPON in progress

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Information on the ESPON programme and projects can be found on www.espon.lu.

The web site provides the possibility to download and examine the most recent document produced by ongoing ESPON projects.

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Foreword

The purpose of this report is to communicate the progress made within the ongoing projects of the ESPON programme and shall be considered a tool for the ongoing debate of issues related to the structure, cohesion and development of the European territory.

The report is based on extracts of interim reports from 16 Transnational Project Groups currently working on new knowledge and a better understanding of trends and policy impacts affecting the enlarged territory of the European Union.

The report reflects the preliminary results achieved by autumn 2003, less than one and a half year after the first transnational project groups started their research activities. It represents a snap-shot of reported results, not taking into account further progress made in the research groups since then.

All research undertaken addresses the territory of 29 European countries including 25 Member States of the EU, the EU accession countries Bulgaria and Romania, as well as Norway and Switzerland.

The preliminary results already reached by these ESPON projects provide deeper information of the territorial diversity of Europe, on territorial imbalances as well as on potentials for development.

The present report has been drafted by an external expert, Mr. Jacques Robert supported by an editorial group including Mr. Patrick Salez (European Commission), Mr. Peter Schön (BBR in Bonn) and Mr. Peter Mehlbye (ESPON CU).

The structure of the report is largely conditioned by the intention of providing an input to the development of the Third Cohesion Report published recently by the European Commission. The extracts made of preliminary ESPON results, and in that sense the content of the synthesis report, reflects the choice and personal interpretation by the expert and the editorial group of the results achieved so far.

It is envisaged continuously to inform about ESPON results in an open and transparent way and to nourish the discussion of territorial development in the European research community as well as in the political sphere.

The ESPON web site on **www.espon.lu** provides full and extensive information on the actual development of the ESPON programme and gives the opportunity to consult each of the project reports, which have been the basis for this synthesis report.

Please note that the present report is not validated by the ESPON Monitoring Committee and does not necessary reflect the opinion of members of the Monitoring Committee.

Introduction

Objectives and content of the report

Observation of the European territory and its evolution is an important prerequisite to formulating territorial cohesion policies and for the application of the European Spatial Development Perspective (ESDP) in Community, national and regional policies. The European Spatial Planning Observation Network (ESPON)[1] has been launched as a programme jointly managed by the Member States and the European Commission in accordance with the work programme adopted at the meeting of spatial planning Ministers in Tampere in 1999. The aim is to increase knowledge about territorial structures, trends and policy impacts in the enlarged European Union. The ESPON programme started in 2002 and is planned to continue until 2006. Although none of the studies undertaken are currently completed, a number of valuable outputs are already available.

The programme is being carried out within the framework of the Community Initiative INTERREG III. Under the overall leadership of Luxembourg, the EU Member States submitted a joint application entitled "The ESPON 2006 Programme – Research on the Spatial Development of an Enlarging European Union". The European Commission agreed the application on 3 June 2002.

The administrative arrangements for ESPON are as follows:

- Monitoring Committee (MC),
- Managing and Paying Authorities (MA/PA),
- Co-ordination Unit (CU),
- ESPON Contact Points (ECP), and
- Transnational Project Groups (TPG).

The TPGs are carrying out the research projects. Each TPG has to include research institutes from at least three countries and is led by a Lead Partner.

The activities of the network are co-ordinated and supported by the Co-ordination Unit, working in conjunction with the ESPON Contact Points. The ECPs represent the research capacities of the member states, through their own expertise and their links with and knowledge about national research on spatially relevant topics.

The Managing and Paying Authorities and the Monitoring Committee are responsible for the management and monitoring of the ESPON 2006 programme. The functions of the MA and PA have been delegated to the Ministry of the Interior of Luxembourg. Two delegates per participating member state, and two Commission representatives are full members of the MC. EU Candidate countries can join the ESPON programme as observers, as well as full partners. Neighbouring States have been invited to join the programme as full partners.

1) The area of study (called the ESPON Space) comprises by April 2004 the 15 present EU Members States, the 12 accession and candidate countries (Poland, Hungary, Slovakia, Czech Republic, Estonia, Latvia, Lithuania, Slovenia, Malta, Cyprus as well as Romania and Bulgaria), as well as two non-member countries which have joined the programme: Switzerland and Norway.

The Monitoring Committee is responsible for the overall strategic management and monitoring of the ESPON programme. The MC consists of two delegates per participating member state (EU-15), and two Commission representatives.

Following an official invitation to EU candidate and neighbouring countries, Slovenia, Norway, Hungary and Switzerland have already joined the ESPON programme as full partners. Full membership involves participation in all bodies of the ESPON programme, under the same conditions as the EU member states.

The ESPON Monitoring Committee has as well offered EU candidate countries the possibility of joining the ESPON programme as observers. A Memorandum of Understanding has to be signed to obtain observer status. Cyprus, the Czech Republic, Malta and Latvia have taken up this opportunity before joining the EU as member states.

The present document aims at presenting a number of findings produced so far by the ESPON work programme. However, it is not intended to be an exhaustive presentation of all intermediate results. Instead, a number of examples have been chosen in relation to specific fields of territorial analysis and policy. The choice also takes account of the stage reached by the individual projects. A specific section is then devoted to the added value of the ESPON programme in terms of innovative scientific approaches. Perspectives on the future development of the ESPON programme are provided in the final section.

Background and context of the ESPON studies

The ESPON programme is designed to improve European knowledge on trends and policy impacts affecting the enlarged European territory and through networking support a further development of a European research community in the field of territorial development and spatial planning. The ESPON programme indicate an explicit support policy development and ESPON results are expected foreseen to complement, detail and apply the policy orientations as set out in the ESDP. This is being done by studying in-depth trends and the impacts of policies, and by recommending efficient ways to achieve spatial objectives in the enlarged European territory. Linked to a broader agenda, ESPON is also focusing on enlargement and its implications for EU policies; the influence of competitiveness and globalisation; as well as the challenge of sustainable development.

The ESPON studies are intended to address:

- Factors relevant to securing a more polycentric Europe;
- Territorial indicators and typologies, capable of identifying and measuring development trends as well as monitoring the political aim of a better balanced and polycentric Europe;
- Tools supporting diagnosis of principal structural difficulties, as well as potential;
- Territorial impacts of European sectoral and structural policies, such as the Structural Funds; and
- Integrated methods to support balanced and polycentric spatial development, including spatial scenarios for 2015 and 2030.

The projects launched under the ESPON programme follow an integrated approach and have a clear spatial dimension. Seen together, they cover a wide range of issues and types of research. These include scientific methods and data bases via strategic projects to institutional and implementation questions. The following fields of research have been identified.

- Thematic studies (projects under Priority 1), which examine the spatial effects of major developments on the relative status of regions and cities. These studies and those in the next category are based on broad empirical data.

- Policy impact studies (projects under Priority 2), which look at the spatial impact of Community sector policies and Member States' spatial development policy on different types of region. The focus is on the institutional inter-linkages between the governmental levels and the implementation of policies.

- Horizontal and coordinating cross-theme studies (projects under Priority 3), which form a key component of the ESPON programme. They involve evaluation of the results of the other studies, with a view to producing integrated results such as indicator systems and data, typologies of territories, spatial development scenarios and policy conclusions for spatial development.

- Scientific briefing and networking (projects under Priority 4), which explore the synergies between the national and EU resources for research and research capacities.

The ESPON builds on two key policy concepts for achieving a better balanced Europe, which act as guidelines for the programme: territorial cohesion[2] and polycentric development. Sustainable development also appears to be a necessary objective, both for making the enlargement process benefit all parts of the enlarged EU and for strengthening the competitive position of the EU in the global context. Territorial cohesion is a more general objective than polycentric development, which has an intrinsically spatial dimension. However, both are linked and complementary when adopting a spatial approach which includes policy recommendations.

Territorial cohesion is the subjects of continuing debate. The links between territorial cohesion and economic and social cohesion - two fundamental aims of the EU (Article 16 of the Treaty) – remain to be further clarified. Article 3 of the new, draft European Constitution indicates that the EU should promote economic, social and territorial cohesion.

The introduction of a territorial dimension to cohesion shows that the meaning of cohesion may be richer and more complex, taking into account the territorial diversity of Europe. Each territory enjoys assets and suffers constraints, some of which cannot be fundamentally modified by policies. There is thus a need to have a broader vision of cohesion that encompasses many dimensions of the development of territories and of their interrelationships.

Territorial cohesion is basically envisaged as a concept for the enlarged EU territory that should both add to and reinforce the aim of economic and social cohesion. The objective includes the wish of a

2) The concept of territorial cohesion is further developed and reflected upon in the third report on economic and social cohesion "A new partnership for cohesion" European Commission (2004). The report will form a basis for further European debate clarifying the link of territorial cohesion to economic and social cohesion.

better balanced development, smoothening disparities and territorial imbalances, and more coherence to broad range of policy interventions with spatial impacts. This latter explains its frequent association with the aim of coordinating policies that apply to the same places, be they regions, urban settlements or rural areas.

Polycentric development is the main territorial concept related to the aim of territorial cohesion. The concept of polycentric spatial development can be described as a "bridging" concept, as it merges two not always congruent policy aims. These are economic growth and balanced development, which are also present in the ESDP. Thus polycentric development bridges the different interests of the Member States. It encapsulates the economic and social cohesion objectives, particularly the need to encourage more balanced competitiveness. Indeed, interest in polycentric development is fuelled by the hypotheses put forward in the ESDP that polycentric urban systems are more efficient, more sustainable and more equitable than either monocentric urban systems or dispersed small settlements. Moreover, the concept of polycentrism needs to be examined and addressed at different spatial levels or scales.

At the European level, the main issue is to stimulate the development of regions beyond the "Pentagon" into becoming global integration zones. Zones of global economic integration offer high-quality global economic functions and services, which enable a high-income level and a well-developed infrastructure. Important components of these zones are internationally accessible metropolitan regions. Well functioning of metropolitan regions are characterized by good accessibility, headquarters of enterprises and international institutions, concentration of decision power, and a solid integration in global markets.

The implementation of a polycentric development model calls for a shift of paradigm away from the centre-periphery thinking in European policies, as well as in national and local policies. Targeted assistance through EU structural policies, the creation of trans-national functional regions, support to specialised networks, and the specialisation of urban areas, as well as institutional setting, transportation and communication links are important elements for achieving a more polycentric Europe.

At the national level, the challenge is to make higher-order services available to all parts of the country in order to stimulate economic competitiveness and to improve territorial cohesion. The urban system does have an impact here, as it provides a framework for structuring important parts of economic life. Policies at this level should focus on the divisions between the various national urban centres, and the balance between the economically strongest regions and the urban structure elsewhere in the country. In mono-centric countries, this implies a focus on the second tiers cities.

At the regional level, the challenge is to enhance regional strengths in order to stimulate welfare and economic development. As a general rule, large city regions do have a wider set of economic activities than smaller regions, especially as regards services. They do also have larger labour markets. Therefore, they offer better services for businesses and families as well as more job opportunities.

The ESPON studies undertaken so far attempt to build upon and to provide a clearer view on the concepts mentioned above and new knowledge on their application in a wide diversity of European territorial circumstances. They also aim at policy formulation, by identifying appropriate recommendations for the further development of EU, national and regional policies.

Part I:

Analysis of territorial imbalances and interactions

Territorial imbalances are numerous and significant in the European context. Their nature is very diverse and the forthcoming enlargement will increase a number of them. Very important imbalances exist in population density[3], with extremes as high as 8778 inh/sqkm in Inner London and as low as 3.3. inh./sqkm in Övre Norrland (Sweden). Numerous regions in the accession countries have a population density below the EU-15 average. The trends reveal heterogeneous spatial patterns of concentration and dispersal of population, as well as of economic wealth. Further territorial imbalances can be observed in the infrastructural endowment of regions[4] (roads, motorways, railways, airports and ports) resulting in subsequent imbalances in connectivity and accessibility. Large areas with a density of motorways and expressways related to population below 40% of EU-27 average can be found in many accession countries, as well as in the northern periphery. In contrast, high levels of motorway and expressway density (> 140% of EU-27 average) are to be found predominantly in the European core, as well as in a limited number of more peripheral zones (Spain, Latvia, eastern part of Bulgaria, central part of Greece). As far as the knowledge society is concerned, R&D potential as well as the progress of modern telecommunication technologies[5] show very different levels and patterns among European regions, with a relative lack in a number of accession countries.

Territorial imbalances also exist in the structure of urban systems[6]. European integration has favoured the growth of a large number of cities located in the central parts of Europe. On the other hand, it has also contributed to an increase in competitiveness and the attractive power of the larger cities. This applies particularly to state capitals in peripheral countries and regions, although in a more isolated context. One common challenge facing the 12 accession countries is the ability of their urban systems to support polycentric development. All these urban systems are found, with important differences between them, away from the single Global Integration Zone (GIZ) of EU-15[7]. The urban systems of the Czech Republic, Slovakia, Hungary and Slovenia are located in axial extensions of the GIZ. These extensions present the potential for fast growth and will certainly reinforce the urban system of Poland as well. The urban systems of the three Baltic enlargement countries have possibilities for enhancing their links with the wider Baltic region relatively rapidly, and to a relatively smaller degree with the countries of CIS and Russia. The connections of the urban systems of the Balkan countries with the urban systems of EU–15 countries are rather weak, with significant variations among the different countries. Another common issue that concerns the vast majority of accession countries is the accelerated growth of capital cities at the expense of the rest of the urban system. This reproduces the model already observed in the peripheral countries of EU-15.

3) Cf. ESPON Project 1.1.4. "The spatial effects of demographic trends and migration" led by the Swedish Institute for Growth Policy Studies (ITPS) Stockholm. Second Interim Report.

4) Cf. ESPON Project 1.2.1. "Transport services and networks: territorial trends and basic supply of infrastructure for territorial cohesion" led by CESA in Tours. Third Interim Report.

5) Cf. ESPON Project 2.1.2. "The territorial impact of EU research and development policy" led by ECOTEC Research and consulting Ltd. Third Interim report.

6) Cf. ESPON Project 1.1.1. "The role, specific situation and potentials of urban areas as nodes in a polycentric development" led by NORDREGIO Stockholm. Third Interim Report.

7) as defined in the ESDP (the so-called Pentagon delimited by the metropolises London, Paris, Milan, Munich and Hamburg)

In the general context of growing interdependence between urban and rural areas[8], a number of remote rural areas do not benefit enough from growth generated by urban functions and are facing severe development constraints. There are, therefore, important territorial imbalances in urban-rural interactions, with the accession countries having a rather modest tradition in the field of urban-rural relationships inherited from the former regimes. Finally, a number of regions are confronted with specific constraints of a socio-economic character, such as the areas with very low population densities or border areas with strong socio-economic discontinuities.

As a result territorial imbalances possess different time horizons. Some have a rather permanent nature (regions with specific geographic handicaps); others have a long-lasting character (imbalances in population density); and a third category may be subject to change in the medium-term, in particular when appropriate policies are applied.

1. Imbalances in the European territory

1.1 Centre-periphery issues in the European context

Territorial imbalances between the centre and the periphery of Europe are the most striking feature of imbalances at the European scale. As demonstrated in several studies on the successive enlargements of the European Communities/European Union, the enlargement process gives rise to the reinforcement of the centre. The ESDP recognises that there is presently only one outstanding larger geographical zone of global economic integration. This is the core area of the EU: the Pentagon defined by the metropolises of London, Paris, Milan, Munich and Hamburg. This zone offers strong global economic functions and services, which provide a high level of income and well-developed infrastructure.

The centre-periphery imbalances can be observed in various fields. In the demographic sector[9], there is a large concentration of regions with high population density in the Pentagon, such as Brussels (5932 inh./sqkm), Ile de France (912), Dusseldorf (995), Hamburg ((2255), Zuid-Holland (1182) and Utrecht (808). Regions and countries with a low population density are generally to be found in the periphery, such as Aragon (24.6), Castilla la Mancha (21.5), Corsica (30), Thraki (39.8), Borders and Midlands in Ireland (29.7), Alentejo (19.5), Latvia (37.7) and Estonia (33). Even lower densities are observed in the Highlands and Islands (9.3) and in the northern periphery, such as Pohjois Suomi (4.3) and Oevre Norrland (3.3). This is not to deny that there are also regions with high population densities in the European periphery, such as Campania (425), Attiki (906), Madrid (636), Bucharest (1238) and Kibris Praha (2399). But they are more isolated than within the Pentagon.

Centre-periphery imbalances are also very significant in the field of accessibility[10]. The index of multimodal accessibility to population in wide areas of the Pentagon is three to four times as high as that of most parts of the peripheral regions. Examples are the differentials existing between Andalusia or Galicia on the one hand (approximately 50% of EU-29 average) and Baden-Wurttemberg and Zuid Holland on the other hand (approximately 150% of EU-29 average). A number of central regions (Brussels, Frankfurt, Amsterdam) even show values higher than 160% of the EU-27 average, while more peripheral and landlocked areas (Extremadura, Highlands, eastern Finland) have less than 40% of EU-27 average. The most accessible regions by road virtually coincide with the Pentagon, while the lowest levels are found in the northern periphery, in the Highlands and Islands and in West-Ireland as well as in Sardinia, Crete and various other parts of Greece. The picture is not very different in

8) Cf. ESPON Project 1.1.2. "Urban-rural relations in Europe" led by the Centre for Urban and Regional Studies of the Helsinki University of Technology. Third Interim Report.
9) Cf ESPON Project 1.1.4. op. cit.
10) Cf ESPON Project 1.2.1. op. cit.

the case of accessibility by rail, but areas with low accessibility are more extended in the case of Spain, Bulgaria and Romania. Only accessibility to population by air departs from a strict centre-periphery model, with a number of metropolitan regions in the periphery having reasonable levels of accessibility thanks to their large airports. It must be stressed that only accessibility stemming from the transport of people is taken into account. Accessibility for goods transport would show quite different results, with a stronger accentuation of peripherality.

The territorial pattern of R&D functions[11] also reveals important imbalances between central and peripheral regions. Strong territorial concentration at EU level is observed in the fields of R&D intensity, employment in high technology services and R&D infrastructure. In the field of R&D intensity, the EU-15 average is 1.93%. Various German regions have an R&D intensity above 4.5%, while in the case of the accession countries (excluding Malta) the average is around 0.77%. The domination of the Pentagon in the European context is confirmed in a number of other territorial fields (cultural infrastructure, level of public transport networks, location of very large ports and airports, etc.).

1.2 Changes in demographic and economic weight 1995-2000 (including EU accession countries)[12]

The 1990s have witnessed important shifts in the spatial centre of gravity of both the economic and demographic structures across Europe. At the moment a full statistical picture of the ESPON space is only available for the years between 1995-2000. The contribution, in terms of change in both population and GDP, of each NUTS3 region to the total of ESPON is the basis of the analysis. The change in the position of a region is, however, heavily influenced by its initial size or share of the ESPON total. Accordingly, small regions need to grow faster to improve their positions, while bigger regions can achieve this with lower growth rates.

Changes in demographic weight

During the last half of the 1990s, there has been an obvious westward shift in population shares[13] along a dividing line from Trondheim in Norway, via Copenhagen, Munich and Rome, to Valetta in Malta (see Map 1). The westward drift has some exceptions, in particular due to depopulation in the northwestern Iberian Peninsula, central France, parts of Scotland and Sardinia. Correspondingly, the shift from Eastern Europe has several exceptions, in particular most capital regions display an increasing proportion of total ESPON space population.

The territory of the EU-15 clearly comprises more regions with stronger relative increases in relation to total ESPON population than the accession and candidate countries. A large "carpet"[14] of relative population gain is to be found within the Pentagon. London, the Netherlands and the strokes at the northwestern German border and Denmark, as well as the South of Norway, form an extended area of growing population contribution. Figures for London and its surrounding are distorted by their large absolute concentration of population. The whole island of Ireland stands out, with an exceptional gain in its contribution to the global European population. Other carpets of growing population contribution are to be found in the coastal areas of the southwestern European

11) Cf ESPON Project 2.1.2. op. cit.

12) Cf. ESPON Project 1.1.3. "Options for spatially balanced developments in the enlargement of the European Union" (ODEN) led by The Royal Institute of Technology of Sweden (Division of Urban Studies)

13) Changes in population shares in Europe-29 population at NUTS 3 level (1995-2000)

14) carpets of increasing or decreasing contribution indicate clusters of similar development and in some cases a harmonised polycentric development

countries, such the entire coast of Portugal, the southeastern coast of Spain (Costa del Sol) and France, and along the French Atlantic coast. In Spain, the Greater Madrid area is strengthening its position. Many other areas are more or less parts of carpets with a decreasing contribution to the total European population. In Sweden large swathes of regions follow this trend, with a clear "monolithic"[15] structure comprising Stockholm's growing contribution in population terms. Finland's increasing population contribution stems from several centres: the triangle Helsinki-Tampere-Turku and the Oulu region. In many of the more or less monolithic regions in the centre of Europe, the enlargement of population cores can be observed (e.g. Berlin and its surrounding, as well as in Poland).

The three Baltic States suffered from significant population losses during the last decade. Hence the total carpet here contributes less to the total ESPON population (an exception is found in Taurage county). The contribution of the regions of Poland to the total EU29 population is diverse. Regions on the Baltic Sea coast gain in share, while many inner/hinterland "patches", especially the strokes south of Warsaw down to the Czech border, are losing significantly. Even the patches[16] at the eastern and future external EU-25 border to Belarus and Ukraine are following the trend. There are even some monoliths loosing their position, such as Warsaw, Posznan and Gdansk. However the adjacent regions are counterbalancing this trend. The development of several enlarged centres of population seems ongoing.

The urban systems of the axial extensions of the Pentagon - Czech Republic, Slovakia, Hungary and Slovenia - largely form a carpet of relative loss. A Slovakian patch at the Ukrainian border shows the reverse of this trend, stretching over the Polish border regions into the proximity of Krakow. The loss of the monolith of Budapest seems to be counterbalanced by its surroundings, a pattern of enlarged population centres already observed in Poland. Slovenia is the only country in the enlargement area facing a modest relative population loss in all of its regions. However, Ljubljana is improving its position in the ESPON space.

Romania and Bulgaria are almost entirely losing in terms of demographic position, being part of the southeastern declining carpet stretching up to Hungary. However the patches at the eastern border seem to perform better, especially in Romania. It is here that the few regions with a relative population gain can be found, except for the Bulgarian capital of Sofia acting as a rising monolith in population terms.

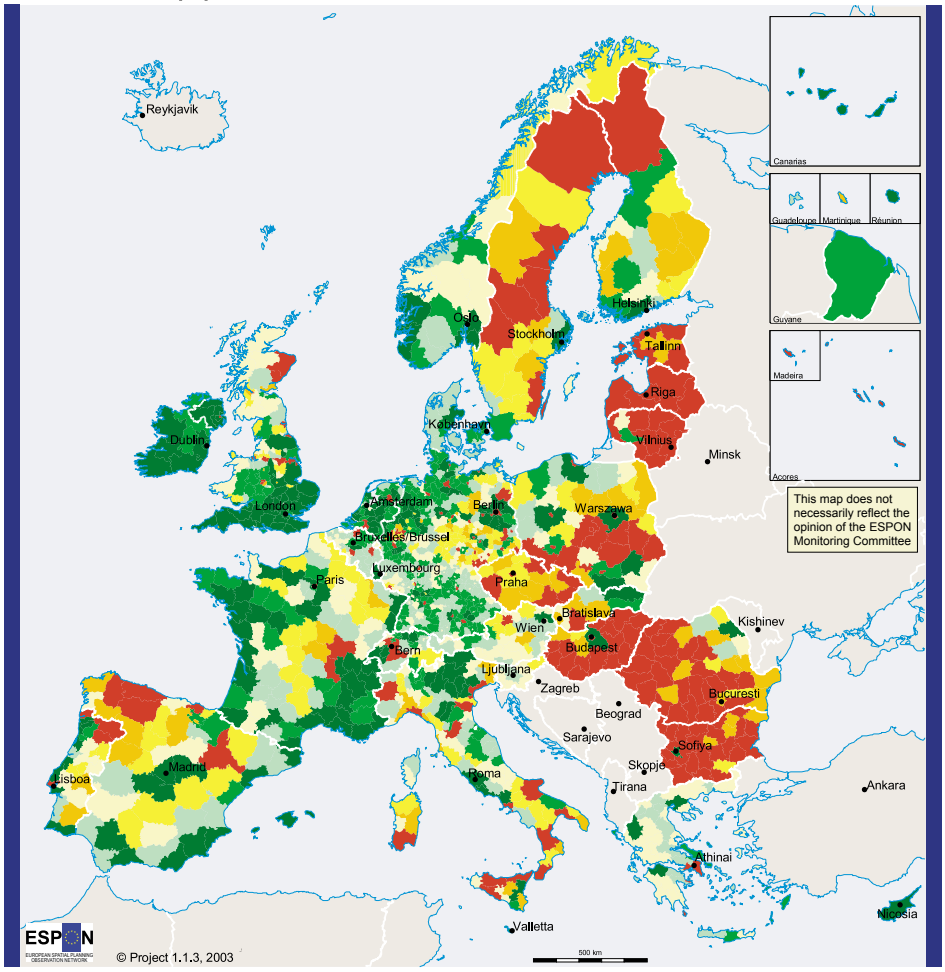
Malta and Cyprus clearly succeeded in gaining population weight during the latter half of the 90s, with Cyprus being in the group of regions strongly improving its position.

15) monolith = region with European or national importance with increasing or decreasing contribution to the total, indicating a changing importance of a monocentric regional system.
16) patches characterize a number of neighbouring regions within a country or in border regions with strongly diverse directions in their contributions to the total in an enlarged EU;

Summing up, the ESPON studies show that EU-15 faces fewer challenges, in demographic terms, than the accession countries. This is the main cause of the east-west shift observed. The main exceptions, with a decreasing demographic contribution in the west, are the northwestern parts of the Iberian Peninsula, central France, parts of Scotland and Sardinia. The main exceptions in the eastern part, with an increasing demographic contribution, are the northern Polish regions, the Slovak border regions with the Ukraine, Slovenia, the surroundings of Budapest, as well as Cyprus and Malta.

Map 1

Concentration of population



Change in share of population relative to total EU29 GDP between 1995 and 2000, 1 unit = 0.001%

Relative gain	Relative loss
> 1.5	0 - -0.5
1.0 - 1.5	-0.5 - -1.0
0.5 - 1.0	-1.0 - -1.5
0 - 0.5	< -1.5

Origin of data: Eurostat, National Statistical Offices

Source: ESPON Database

Changes in GDP weight

The areas on the western border of Germany and Belgium are loosing weight. The carpet of large, relative wealth losses continues all over the French territory, except for some coastal parts and into Switzerland (see Map 2). Other major carpets of loss are to be found in Scotland, especially in the urban areas, and in Sweden, except for the economic monocentre of Stockholm. Lappland and the Finnish patches on the eastern border face a modest lost in their position, standing opposite strong gains in the Helsinki-Tampere-Turku triangle and Oulu. The South of England, Ireland, the Netherlands and the Spanish coastal patches are strongly on the rise in terms of total ESPON GDP, similar to their trend in population concentration. Spain, Portugal, Italy and Norway have improved their positions in the overall ESPON-area economy by a contribution from almost all regions, pointing to polycentric sources for gains in GDP.

The three Baltic States enjoyed strong growth during the period in many regions and hence have significantly improved their contribution to total ESPON space GDP. This is remarkable when taking into account the generally small share of those regions in total ESPON GDP. However, the success is based on growth in capital regions disfavouring other parts of those countries. This monocentric structure is especially prominent in Latvia, with the Latgale area experiencing the strongest relative loss in contribution among all regions in the Baltic States. In Lithuania the growth area is extended around the capital of Vilnius, but also the Lithuanian Baltic Sea coast has increased its contribution.

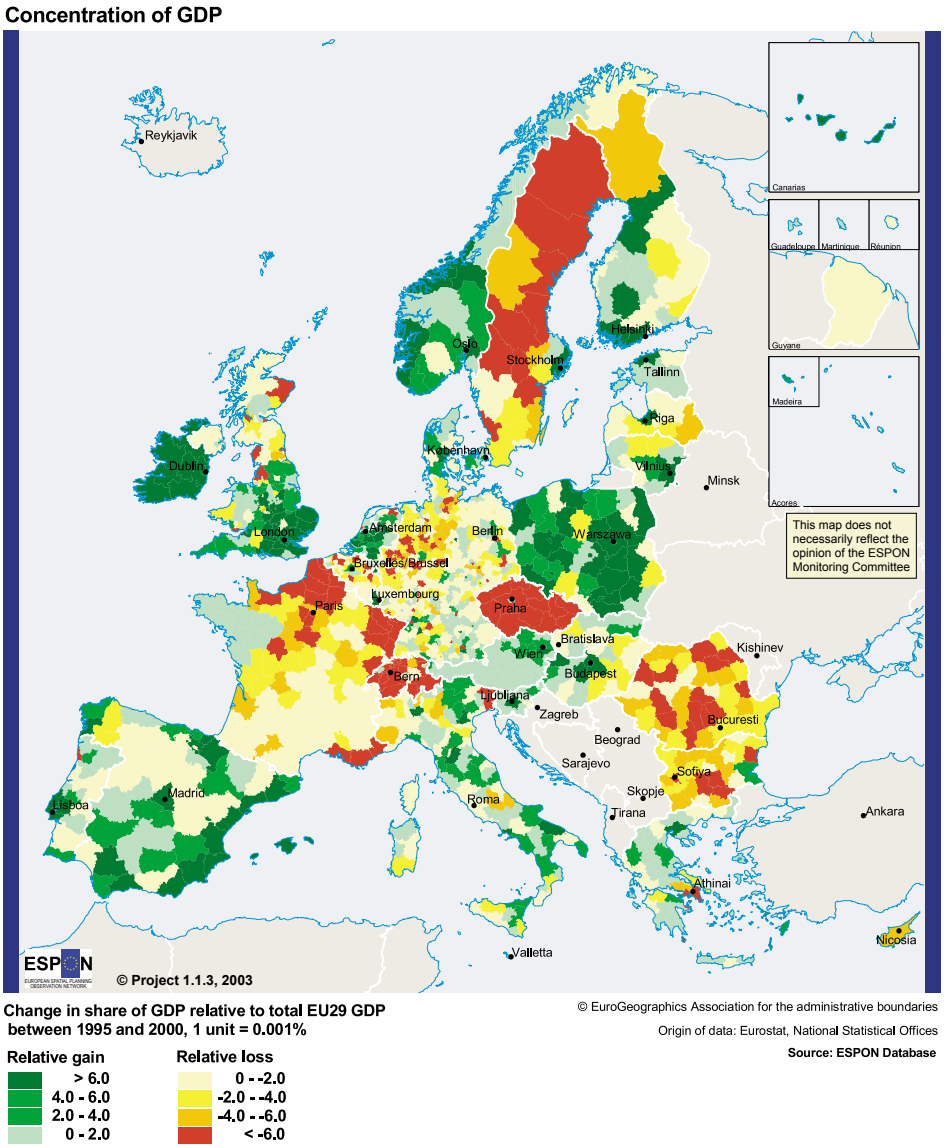
Poland clearly holds a different position among the countries of the enlargement area. In terms of wealth contribution to the total of the ESPON space, it almost entirely comprises a carpet on the rise. Major gains in the Polish contribution came not only from the big city regions. They also arise from almost all regions and in many centres, including the ones along the German border and also some on the Belarusian and Ukrainian borders. Some minor losses, however, took place along this border. Two major Polish wealth growth patches are developing along a North-South axis, centred on Poznan and Warsaw.

The Czech Republic, Slovakia and Hungary play different roles in terms of their economic contributions. While the Czech carpet faces dramatic losses in contribution except for the monolithic rise of Prague, a similar monocentric growth structure cannot be recognised in Slovakia and Hungary. These patches experienced minor losses and gains, but are more balanced over their territories. In Slovakia, the gain is connected to the Polish north-south growth axis around Warsaw and is situated at the Ukrainian border. In contrast, the Hungarian patch is gaining along its border with Austria. Budapest, however, is strengthening its position in wealth contribution, being the only area with strong relative gains in wealth. The Slovenian patch gains in wealth position almost across the country. Ljubljana is leading this rise.

Romania and Bulgaria entirely perform as an economic decreasing carpet in ESPON terms, Varna located on the Black Sea coast being the only exception. Cyprus and Malta have moved their position in relative GDP contribution in opposite directions. Malta slightly gains whereas Cyprus faces a rather strong loss.

The ESPON studies show that, regarding wealth contribution, the share of eastern countries is on the rise mainly due to strong contributions from the Polish carpet and the EU10 (accession countries) capital regions. The eastern areas of Europe have experienced more monolithic growth relative to the ESPON space, especially in the three small Baltic countries and the Czech Republic. However, total shares of EU10 GDP in ESPON are still small compared to that of EU-15. Beside the London-Netherlands patch, increased contribution in EU-15 came from parts outside the core such as the Spanish and Italian carpet, Ireland, Denmark and some Finnish regions. The core of EU-15 is subsequently decreasing its strong contribution in wealth in the ESPON space, as is the case for Germany and France. The position of Swedish regions is rapidly shrinking, except for the monolithic growth of Stockholm.

Map 2



1.3. Urban systems

1.3.1: Concentration in capital cities and central conurbations; and situation in the accession countries[17]

The description of the European urban system requires common criteria. In the choice of criteria, functional definitions appeared for many reasons as more appropriate than physical criteria. This is why an attempt has been made to find a common definition and delineation of Functional Urban Areas[18] (FUAs) at the level of EU-27+2 (EU-27 + Norway and Switzerland). On the basis of this common definition, 1595 FUAs have been identified in EU-27+2.

The analysis made at the level of these 1595 Functional Urban Areas confirms that there is a dense urban structure in the central parts of Europe, stretching from the United Kingdom in the north via the Netherlands, Belgium, western Germany and northern France, and continuing both west and east of the Alps. In the west the dense urban structure stretches into Italy, and in the east into the Czech Republic, South Poland, Slovakia and Hungary. Countries further north and south are less populated and have less dense urban systems. This is especially true for Ireland, the northern areas of the UK, Norway, Sweden, Finland, Estonia, Latvia and Lithuania, but also for parts of Spain, Greece, Bulgaria and Romania.

In demographic terms, large FUAs (Map 3) are concentrated in the Pentagon, but there are extensions reaching down to southern Italy and to central and eastern Europe, where there is a strong concentration of large urban agglomerations. In peripheral Europe most of the large urban agglomerations are more insular in character. For both private and public-sector investments the demographic weight normally constitutes the most favoured indicator for choosing the location of certain services and facilities.

The most crucial economic functions of FUAs are concentrated within the Pentagon. The influence of an urban system is not solely dependent upon its demographic weight, but also upon its economic attractiveness for private investors[19]. Business headquarters tend to locate in places with good accessibility and where they are close to business services. FUAs with significant decision-making functions remain highly concentrated in the Pentagon. Stockholm is the only FUA outside the Pentagon that belongs to the top list. Also, the busiest transport nodes are to be found in the Pentagon. Not one accession country has a transport node of European significance. Lastly, many industrial FUAs are selling globally, even the small ones. Hence, the strongest FUAs are found in the Pentagon. Gross value added is often low in accession countries, except in capital regions and in Poland.

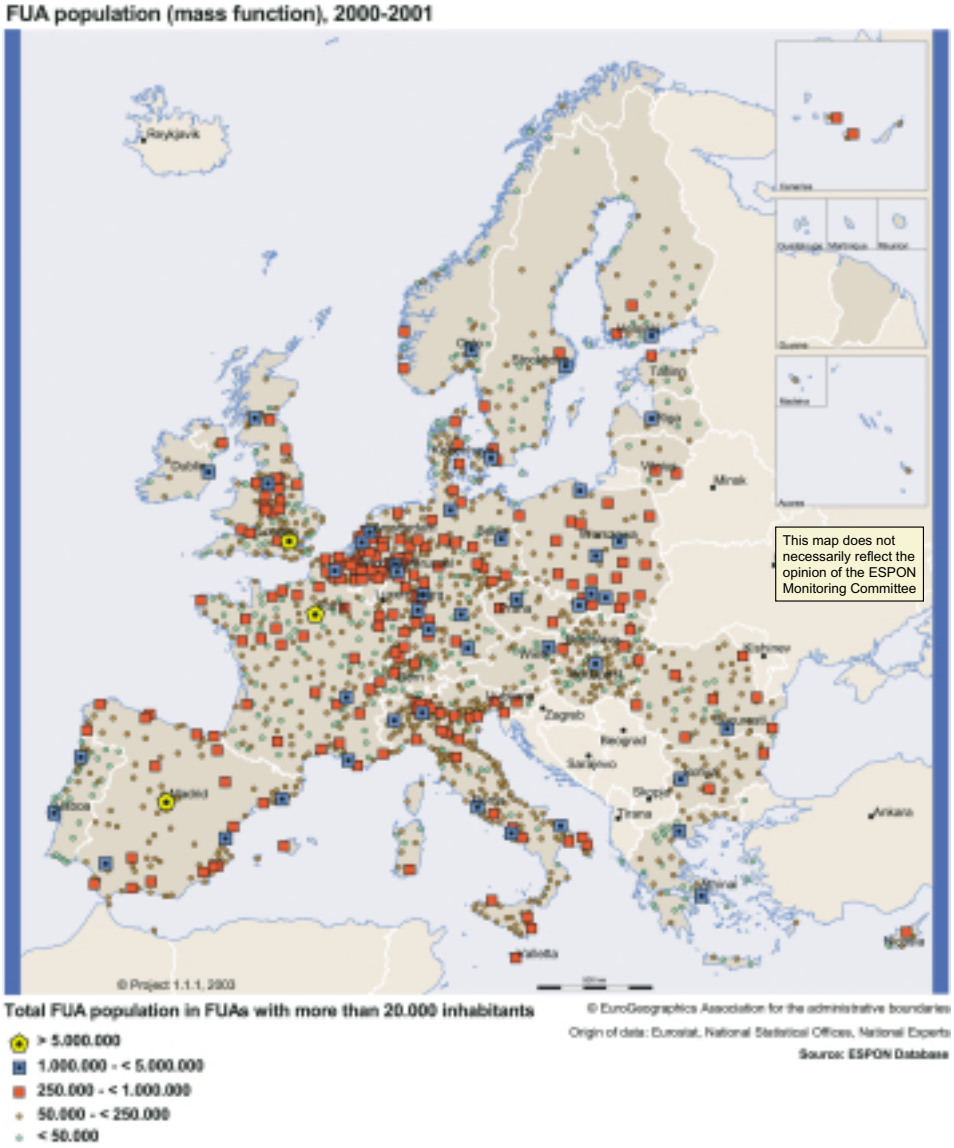
17) Cf. ESPON Project 1.1.1. "The role, specific situation and potentials of urban areas as nodes in a polycentric development" led by Nordregio and ESPON Project 1.1.3. "Options for spatially balanced developments in the enlargement of the European Union" (ODEN) led by The Royal Institute of Technology of Sweden (Division of urban Studies)

18) Most European countries have definitions of Functional Urban Areas or similar concepts, such as travel to-work-areas, commuting catchment areas, commuting zones or functional urban regions. The figures are in these cases built upon national statistics. However, Germany, Luxembourg, Belgium, the Czech Republic, Bulgaria and partly Spain and Portugal do lack an official definition. In these cases, the identification of FUAs was solely based on insights provided by national experts. The definitions used for identifying FUAs in each country are:
- FUA population over 50 000 inhabitants and urban core (agglomeration) with more than 15 000 inhabitants (i.e. excludes those artificially large 'urban' areas with minor urban core).
- Or FUA population more than 0,5% of national population and urban core (agglomeration) with more than 15 000 inhabitants (i.e. in less populated countries smaller FUAs were taken into account).
- Smaller FUAs were included if they had at least local importance in transport, knowledge or decision-making functions or regional importance in administrative, tourism or industrial functions.

19) The distribution of the headquarters of top European firms is an indicator of economic attractiveness.

The knowledge function among FUAs is more balanced, due to the location of universities in national educational systems all over Europe. A similar pattern exists in the case of administrative functions, which leads to strong hierarchies within national urban systems where the capitals are the main nodes of the European administrative system. Tourism is concentrated in the Mediterranean coastal regions, showing a specific pattern of functional division of labour at EU level. Transport functions are mainly concentrated within the northern-most parts of central Europe.

Map 3

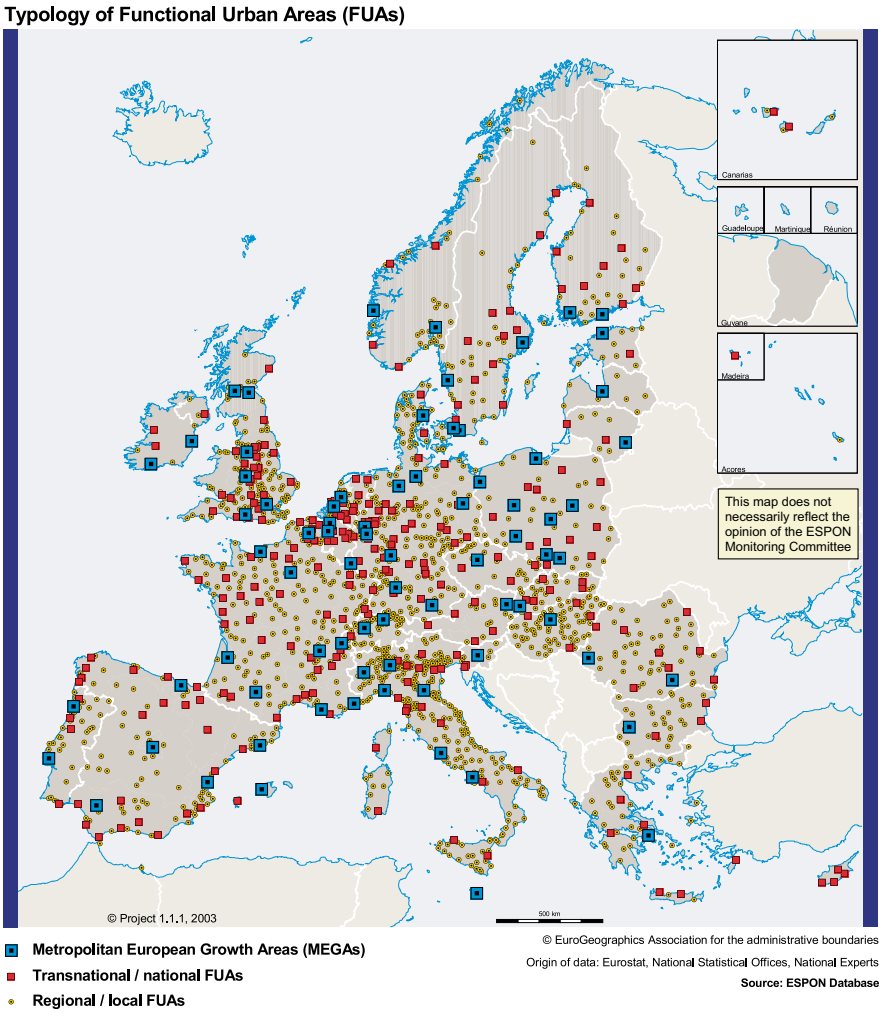


A typology of FUAs (Map 4) has been elaborated according to their functional importance in the European context (population[20], transport[21], tourism[22], industry[23], knowledge[24], decision-making[25], administration[26]). Three levels have been identified:

- Metropolitan European Growth Areas (MEGAs);
- Transnational/National FUAs; and
- Regional/Local FUAs.

This typology is only a particular scenario, in which each functional indicator is equally weighted. Other scenarios are possible with different weighting systems and will be investigated.

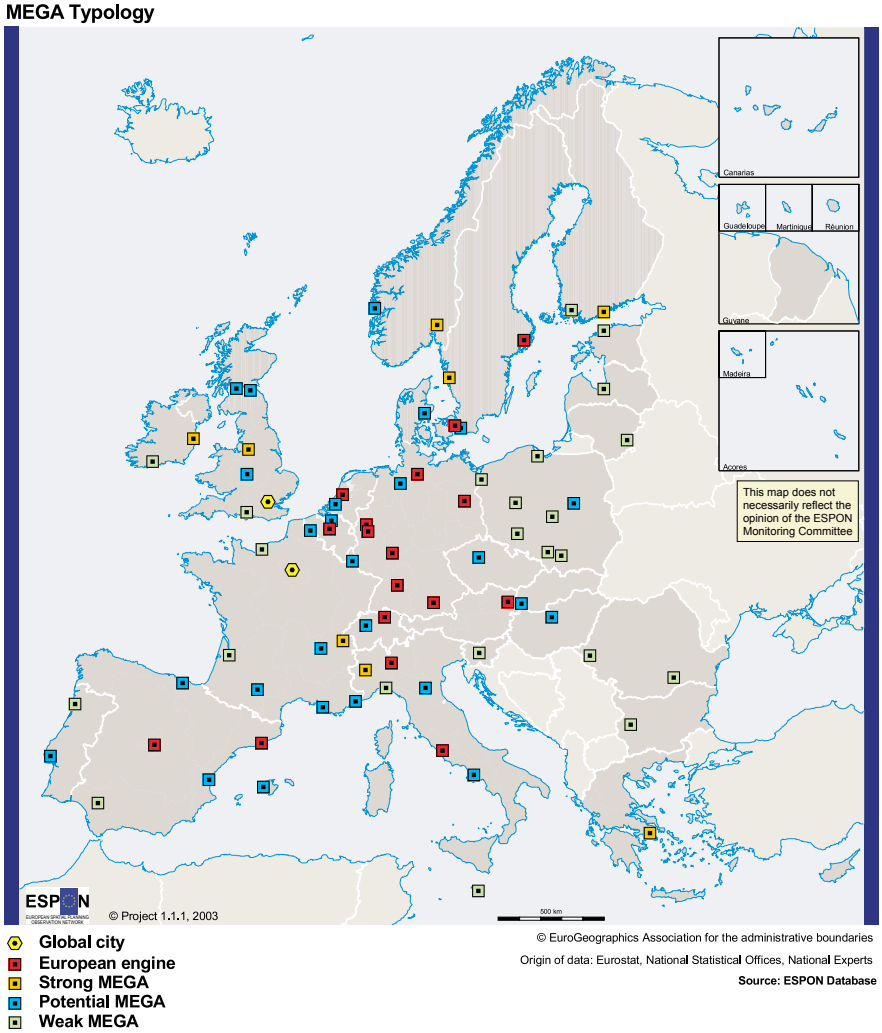
Map 4



20) Population over 50 000 inhabitants
21) Airport with more than 50 000 passengers in 2000 or port with more than 20 000 TEU container traffic in 2001
22) Number of beds in hotels or similar establishments in 2001.
23) Gross value added in industry in 2000.
24) Main location of universities and number of students
25) Number of headquarters of top European firms
26) Based on the national administrative systems, cities that are the administrative seat of the different levels, national capitals, province centres, regional centres etc.

The MEGA analysis seeks to identify those urban areas that can be seen as "counterweights" to the Pentagon in the future. Of the 1,595 FUAs, 64 reached the highest score on the basis of their functions[27]. When leaving out the tourist and administrative functions, the number of FUAs in the highest category (MEGAs), amounts to 76 (Map 5). Most country capitals are included as MEGAs. Only the six largest countries, in terms of population, have more than three MEGAs, and as many as 11 have only one. Of the 76 MEGAs, 18 (24%) are located within the Pentagon.

Map 5



27) Four building blocks are taken into account here: mass criterion, competitiveness, connectivity and knowledge basis. Each of these building blocks consists of two variables.

Classification of the 76 MEGAs	
Global Nodes:	
Largest and most competitive urban systems with high connectivity. Total score above 15	Paris and London
European Engines Often large, highly competitive, possess strong human capital and good accessibility. Total score from 10 to 14	**Location in the pentagon** Munich, Frankfurt, Milan, Hamburg, Brussels, Stuttgart, Zurich, Amsterdam, Dusseldorf, Cologne **Location outside the pentagon** Madrid, Rome, Copenhagen, Berlin, Barcelona, Stockholm, Vienna
Strong MEGAs Cities relatively large, competitive and often possessing strong human capital. Total score from 7 to 9	Helsinki, Manchester, Athens, Dublin, Gothenburg, Turin, Geneva, Oslo
Potential MEGAs Smaller, with lower competitiveness, more peripheral and often having weaker human capital than Strong MEGAs. Total score from 5 to 6	**Capital cities:** Warsaw, Budapest, Prague, Lisbon **Non-capital cities:** Lyon, Antwerp, Rotterdam, Malmö, Marseille, Nice, Naples, Bremen, Toulouse, Lille, Bergen, Glasgow, Edinburgh, Birmingham, Luxemburg, Palma de Mallorca, Bologna, Valencia, Bilbao, Aarhus, Bern
Weak MEGAs Often smaller, less competitive, more peripheral and have lower human capital figures than Potential MEGAs. Total score from 1 to 4	Bordeaux, Le Havre, Genoa, Bucharest, Tallinn, Sofia, Seville, Porto, Ljubljana, Katowice, Vilnius, Krakow, Riga, Gdansk-Gdynia, Wroclaw; Bratislava, Poznan, Lodz, Szczecin, Timisoara, Valetta, Turku, Cork, Southampton/Eastleigh

The diversity of situations found in the accession countries with regard to the demographic evolution of FUAs reflects the relative importance of various factors. These include the general demographic evolution at national level; the re-conversion of the economy of large and medium-sized towns; and the demographic de-concentration of large towns over the borders of the FUAs.

Growth and decline of FUAs in the accession countries

Accession countries with mainly population decline in FUAs are:

- Bulgaria with Sofia as the dominating city and only three FUAs with more than 200 000 inhabitants. All FUAs are declining, the smallest most.

- Czech Republic which has two large FUAs (Praha and Ostrava) and a couple of medium-sized cities. Large cities are losing population.

- Estonia which is dominated by Tallinn. All but one FUAs are losing population.

- Hungary has one dominating FUA, Budapest, and a dense network of small and medium-sized cities. The largest cities are losing population

- Lithuania has eight FUAs with a balanced structure. Larger FUAs are losing population.

- Latvia is strongly dominated by Riga. All FUAs are losing population.

- Poland has a balanced urban structure with two large FUAs and many medium-sized cities. Polish FUAs are larger (population) than in most of the other countries. Large FUAs are losing population.

- Romania is dominated by Bucharest and has in addition seven FUAs with approximately 300 000 inhabitants. All but two FUAs are losing population.

Only few accession countries are characterised by general population growth in FUAs:

- Cyprus has four FUAs. The population is increasing rapidly in all of them.
- Slovakia is rather polycentric. Most of the weight of urban system is in medium-sized cities. Most FUAs are growing.

In a number of countries, however, where the population of large FUAs is declining, medium-sized and small FUAs have growing population. This is the case in:

- Czech Republic where the largest population growth is in FUAs with population 100 - 200 000 inhabitants.
- Hungary, where growth takes place in many small and medium-sized cities.
- Lithuania, where small FUAs are growing.
- Poland, where only cities with less than 500 000 inhabitants are growing, some of them very rapidly.

Monocentricity and polycentricity of urban systems in the accession countries

Rather monocentric urban systems

Estonia:

Tallinn (400 000 inh.) represents 29% of total population. Tartu (100 000 inh.) plays a national role.

Latvia:

Riga (760 000 inh.) represents 32% of total population. Daugavpils (110 000inh.) plays a national role.

Lithuania:

Vilnius (540 000 inh.) represents 16% of total population. Kaunas (380 000 inh.) has a transnational/national role.

Hungary:

Budapest 1.78 million inh.) represents 17% of total population. Eight cities (Debrecen, Miskolc, Szeged, Pécs, Gyõr, Nyíregyháza, Kecskemét and Székesfehérvár) with a population of 100.000 to 210.000 inhabitants have a national role and a more or less important transnational role.

Slovenia:

Ljubljana (260.000 inh.) represents 13% of the total population. Maribor (90.000 inh.) could have a significant transnational role

Malta:

the whole territory of Malta constitutes a single urban region

Rather polycentric urban systems

Poland:

Warsaw (1.610.000) represents only 4 % of total population. Eleven cities, in addition to Warsaw have a population in the range of 250.000 – 800.000 inhabitants. All these cities have an important national role. Eight of them have an important transnational role (Katowice, Wroclaw, Lódz, Gdansk, Kraków, Poznan and Szczecin), while the other three as well as some other less populated cities have a relatively less important transnational role.

Czech Republic:

Prague (1 180 000 inh.). Brno (380.000 inh.) and Ostrava (320.000 inh.) have an important national and transnational (nearly "European") role, while Plzen (170.000 inh.) and Olomouc (100.000 inh.) have a national role and a comparatively less important transnational role.

Slovak Republic:

Bratislava (430.000 inh.) represents 8% of the total population. Ko_ice (240.000), has a relatively important transnational / national role.

Romania:

Bucharest (1.920.000 inh.) represents 9% of the total population. There are, in addition to Bucharest, thirteen cities with a population in the range of 150.000 – 320.000 inhabitants which have a national role and, in most cases, a more or less important transnational role.

Bulgaria:

Sofia (1.100.000 inh.) represents 14% of the total population. Plovdiv (340.000) and Varna (310.000) have an important national and a moderate transnational role, while Burgas, Russe, Stara and Pleven (120.000 – 190.000) have a national role and a comparatively less important transnational role.

Cyprus:

Nicosia (200.000 inh.) represents 29% of the total population. There are two other relatively important cities on the island: Limassol and Larnaka.

Taking into account their potential in several sectors (economy, transport, higher education, etc), Budapest and Prague have undoubtedly a considerable international role ("European cities"), Bratislava and Ljubljana have a considerable transnational role, while the other large centres have a more or less important transnational role. These four large cities are stronger and more integrated (internally) than the three small Baltic countries, Poland, Bulgaria and Romania.

The links between the large cities of these four countries and those of the western EU–15 countries are already important. Especially Budapest and Prague already constitute powerful nodes of the central European urban system and their role could be strengthened rapidly in the future. Bratislava and Lubljana, even though smaller, present a considerable degree of integration into the Central European Urban System.

Considering the Central European Urban System at a wider scale, growth potential as well as the challenges of old industrial regions are particularly identified in the central transnational macro-region of the accession countries. This covers the transnational territory between Warsaw in the east; Poznan (and possibly Berlin) in the west; and Krakow, Saxony (Dresden), Prague, Bratislava, Vienna and Budapest in the south. This macro-region constitutes a specific transnational entity which includes most of the central European growth poles and innovation potential (capital cities and surrounding areas); the main old industrialised regions in the accession countries; and rural regions undergoing change. This Triangle[28] can be seen as a European macro-region which constitutes an agglomerate of major cities; contains significant human resources and innovation potential; and has long industrial traditions comparable to the European macro-region of North-West Europe.

1.3.2 Identification of development poles and cooperation/networking as a means of counterbalancing concentration in the core area

The current European urban system is seen as monocentric, in the sense that there is only one major urbanised area with sufficient mass and economic potential to be integrated in the global economy. At the European level, the main issue is, therefore, to stimulate the development of regions beyond the Pentagon, with the aim of making them global integration zones. A more polycentric structure, with several strong urban regions of European and global significance, would contribute to the competitiveness of Europe as well as to cohesion between different territories.

A first scenario has identified 64 MEGAs at Europe-wide scale. Out of these, 33 MEGAs are located outside the pentagon (see Map 7) and can be considered as potential counterweights to the Pentagon. They are rather widely spread throughout the European territory: Iberian Peninsula, UK, Mediterranean Basin, Central and Eastern Europe, Nordic countries).

Another less restrictive scenario identified in total 76 MEGAs at Europe-wide scale (instead of 64 MEGAs). In this case, 12 additional MEGAs (45 instead of 33) can be considered as potential counterweights to the Pentagon (see Map 6). It should be noticed that the cities of the East-European Triangle, as potential new European Global Integration Zone (see above) are contained in the list: Berlin, Dresden, Vienna, Budapest, Bratislava, Prague and Krakow.

In order to investigate further the development potential of polycentric regions outside the

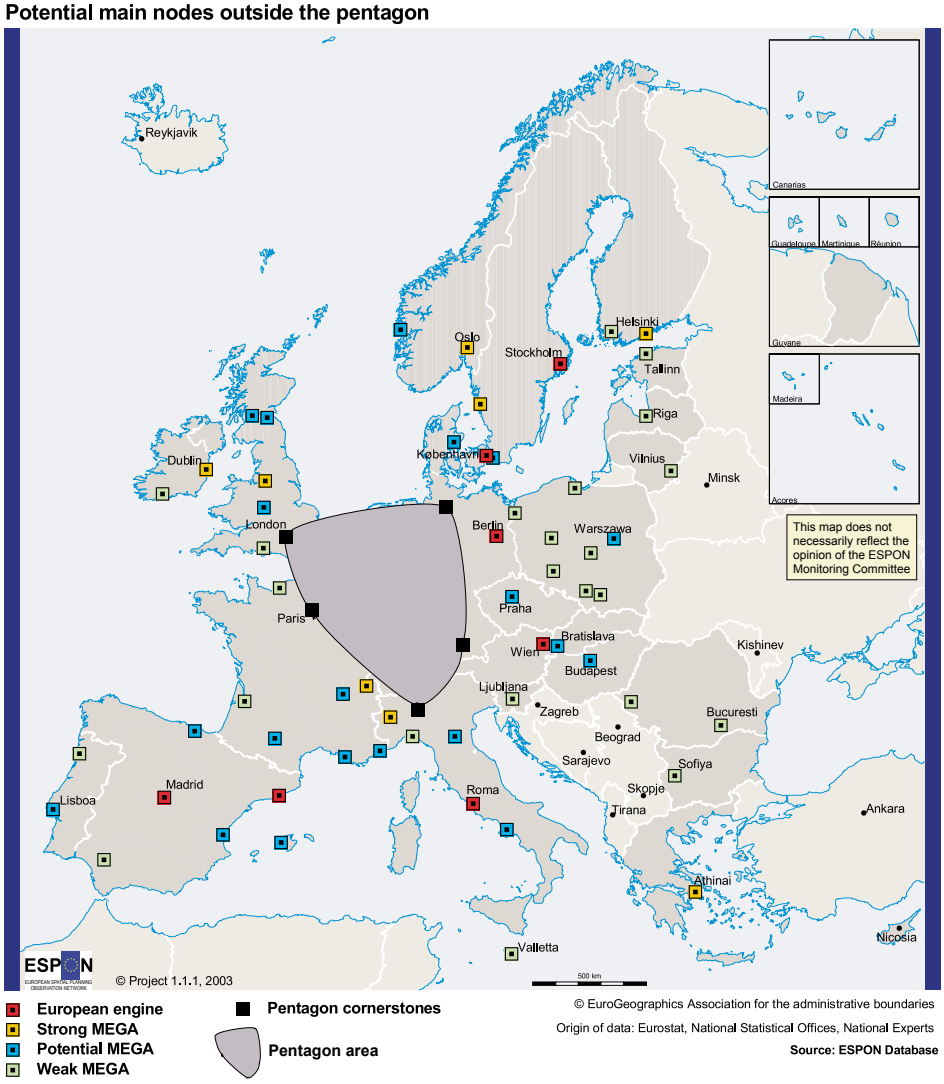
28) It has already been identified by Gorzelak in 1995 and quoted in the ESPON project 2.2.2 "pre-accession Aid Impact Analysis carried out by IRS, EPRC and CRT

Pentagon, strong MEGAs[29] have been identified in close proximity to other FUAs, as these are regions with potential for cooperation and functional specialisation. The actual potential should, however, be clarified by further examination in the local context of institutional, functional and economic endowments, as well as political aspirations.

Considering the demographic evolution of the 33 MEGAs (Map 7) outside the Pentagon and despite the lack of data availability for a number of them, the following pattern appears. Generally, MEGAs located in the EU-15 had significant population increase during the 1990s (with the exception of Dresden, Berlin and Barcelona): Copenhagen +7%; Malmö +8%; Lyon +9%, Marseille +13%, Bordeaux +11%, Athens +7%, Porto +5%, Lisbon + 7%, Madrid +10%, Stockholm + 11%; Edinburg +7%, while the MEGAs located in accession countries had population decrease (except Bratislava + 2%): Sofia -4%; Prague -2%; Gdansk -2%; Krakow -1%; Katowice -7%; Bucharest -7% . This may suggest that the catching up process outside the Pentagon has been stronger in the EU-15 than in the accession countries.

Map 6

Potential main nodes outside the pentagon



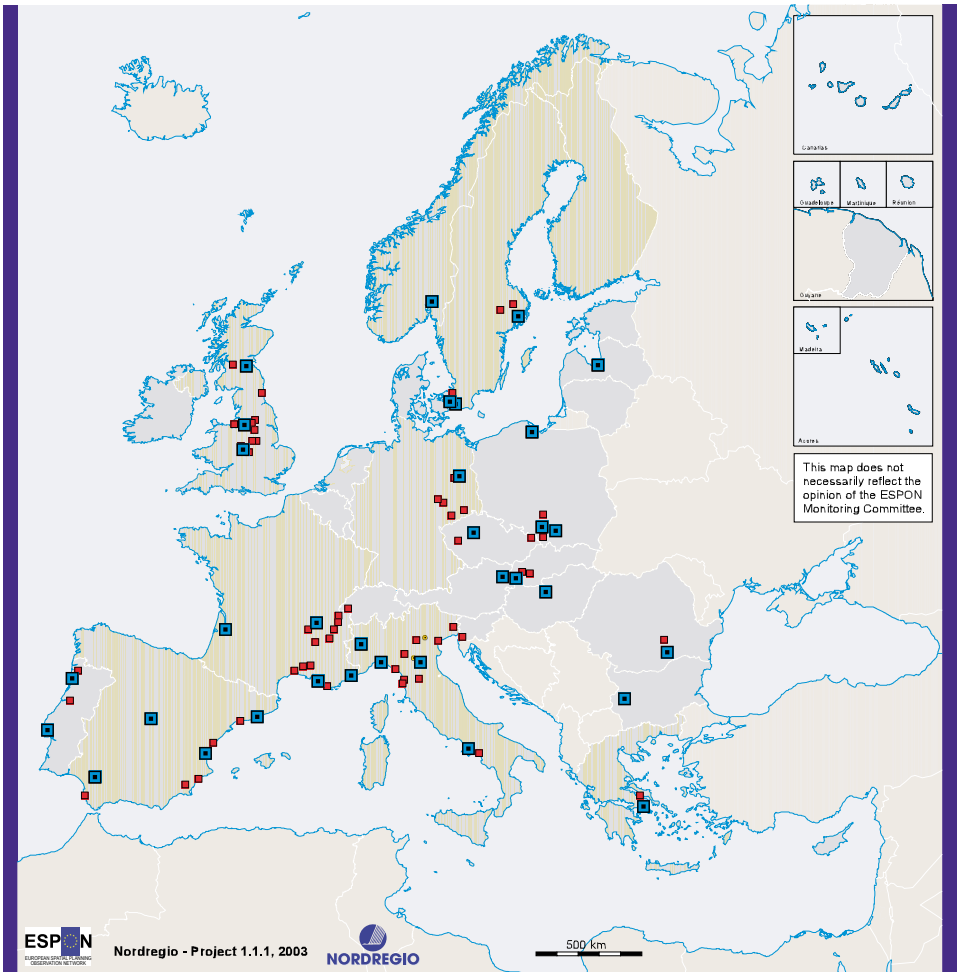
29) The strengths of the MEGAs are analysed on basis of their size (population and GDP), competitiveness (GDP per capita, head offices of top European companies), connectivity (air transport, accessibility) and knowledge basis (education level, R&D personnel share of total employment).

Examples of possible counterweights to urban systems existing in the Pentagon could be Manchester (together with Derby, Sheffield, Liverpool, Leeds, Tyneside-Newcastle-Gateshead Huddersfield), Lyon (together with St Etienne, Chambery, Annecy, Grenoble, Valence, Geneva and Lausanne) or Genoa (together with La Spezia, Pisa, Florence, Livorno). However, embracing a larger territorial context combination of MEGA's, for instance in the Nordic-Baltic area and on the Iberian peninsula, can through strategic cooperation have a territorially balancing effect.

Despite the identified potential, the area identified as peripheral has a number of disadvantages in relation to the European core. The first is increased travel and transport cost resulting from remoteness relative to the main centres of population and economic activity. The second is the absence of agglomeration advantages (external economies of scale) enjoyed by more central locations. Contingent causes are, for example, the high cost of service provision and low rates of entrepreneurship and innovation.

Map 7

Potentials outside the Pentagon for FUAs to form polycentric regions



Potential counterweights to the Pentagon

MEGAS and FUAs	Population change of MEGAs 1990-2000
AUSTRIA/SLOVAKIA	
Vienna (AT)	**-**
Bratislava (SK)	**+2%**
Trnava (Slovakia)	
Nitra (Slovakia)	
BULGARIA	
Sofia	**-4%**
CZECH REPUBLIC	
Prague	**-2%**
Plzen	
DENMARK/SWEDEN	
Copenhagen (DK)	**+7%**
Malmø (SE)	**+8%**
Helsingborg (SE)	
FRANCE/ SWITZERLAND	
Lyon	**+9%**
St.Etienne	
Chambery	
Annecy	
Grenoble	
Valence	
Geneve (CH)	
Lausanne (CH)	
Marseille	**+13%**
Montpellier	
Nimes	
Avignon	
Toulon	
Bordeaux	**+11%**
Nice	**+73%**

MEGAS and FUAs	Population change of MEGAs 1990-2000
GERMANY	
Berlin	**-1%**
Potsdam	
Dresden	**-22%**
Chemnitz	
Leipzig	
Halle	
GREECE	
Athens	**+7%**
Khalkis	
HUNGARY	
Budapest	**-**
ITALY	
Napoli	**-**
Salerno	
Genova	**-**
La Spezia	
Pisa	
Florence	
Livorno	
Torino	**-**
Bologna	**-**
Parma	
Modena	
Udine	**-**
Trieste	
Venezia	**-**
Vicenza	
Verona	

MEGAS and FUAs	Population change of MEGAs 1990-2000
LATVIA	
Riga	**-**
POLAND	
Gdansk	**-2%**
Krakow	**-1%**
Katowice	**-7%**
Bielsko-Biala	
Czestochowa	
Ostrava (CZ)	
PORTUGAL	
Porto	**+5%**
Braga	
Coimbra	
Lisboa	**+7%**
ROMANIA	
Bucharest	**-7%**
Ploiesti	

MEGAS and FUAs	Population change of MEGAs 1990-2000
SPAIN	
Madrid	**+10%**
Barcelona	**-7%**
Tarragona	
Valencia	**-**
Castellon de la Plana	
Alicante	**-**
Murcia	
Sevilla	**-**
Cadiz	
SWEDEN	
Stockholm	**+11%**
Uppsala	
Västerås	
UNITED KINGDOM	
Birmingham	**-**
Wolverhampton	
Coventry/Bedworth	
Nottingham	
Manchester	**-**
Derby	
Sheffield	
Liverpool	
Leeds	
Tyneside-Newcastle-Gateshead	
Huddersfield	
Edinburgh	**+7%**
Glasgow	

The ESPON studies show that the distribution of the 1595 FUAs reveals a dense urban structure in the central parts of Europe, in particular as far as large FUAs with advanced economic functions are concerned. In peripheral Europe, most of the large agglomerations are more insular in character. "Potential MEGAs" and "Weak MEGAs" are more numerous in peripheral regions, while Global Nodes and Strong MEGAs are dominant in the Pentagon. In accession countries, numerous large agglomerations are facing population decline, which creates a constraint on the catching up process. A quite large number of MEGAs (33 or 45 according to the functions selected) could act as counterweights to the Pentagon, if appropriate policies were applied. This is particularly true for those such as Lyon, Marseille, Birmingham and Manchester, which are surrounded by numerous other FUAs.

2. Interactions between rural and urban areas (at regional level)

2.1. Characteristics of growing urban-rural interdependence[30]

According to the theory of differential urbanisation, any city system undergoes various phases in its development, passing through a complete cycle of urbanisation (polarisation), polarisation reversal and counter-urbanisation. The various stages of urbanisation have also been conceptualised in terms of urbanisation (population increase of the core); suburbanisation (increase of the ring, decrease of the core); disurbanisation (decrease of core and ring); and re-urbanisation (increase of core, decrease of ring). The major overall tendency of urbanisation in Europe is counter-urbanisation, i.e. a flow of people down the urban ladder from larger to smaller urban settings. This tendency underpins ESDP policy options[31] (nr 19 and 21). However, important exceptions to the rule exist in several countries.

In the context of these concepts, various factors lead to growing urban-rural interdependence:

- as an effect of suburbanisation the division between town and country has disappeared altogether or become somewhat blurred in many regions;
- industries are relocated from urban to rural settings on a significant scale;
- R & D activities are increasingly located in attractive semi-rural/semi-urban environments in proximity to large towns;
- agriculture is carried out in an increasingly industrialised fashion, which means that traditional environmental values connected to rural environments are disappearing;
- huge, bulky and land consuming activities become located in places where land is comparatively cheap, i.e. semi-urban or, if possible, rural settings; and
- even corporative headquarters are not necessarily located in the centre of cities.

Structural urban-rural relations are characterised by a certain degree of stability, because the physical world cannot be rebuilt overnight. Functional relations on the other hand can be changed quickly, given the flexibility of the physical setting to house a multitude of various activities, as well as the flexibility of various functions to adapt to various physical settings.

30) Cf. ESPON Project 1.1.2. "Urban-rural relations in Europe" led by the Centre for Urban and Regional Studies of the Helsinki University of Technology

31) The ESDP contains European policy orientations for a polycentric and balanced spatial development as well as 60 policy options which are objectives applied to specific issues of spatial development

The SPESP Study[32] identified the following categories of urban-rural relationships.

Home-work relationships. Home-work relationships are traditionally seen as the most intense and obvious component of the relationships between towns and cities and their surrounding areas. Home-work relationships appear in statistics in the form of labour market areas, which may extend over vast areas, although their size and the levels of commuting they involve vary enormously over the European Union. Homework relationships expanding the physical limits of urban centres have led to the notion of Functional Urban Regions. In some areas of Europe, where urban labour markets are penetrating each other, it is hardly possible to make a distinction between the different functional regions and, hence, between functionally connected urban and rural areas.

Central place relationships. The services and amenities provided by urban centres are often referred to as central place relationships: a city or urban centre supplies its surroundings with services that call for concentration at a specific point in space (education and training, markets, shopping centres, banks, insurance, hospitals, health centres, cinemas, theatres, libraries and other cultural facilities). There is a general tendency for central place systems to become more hierarchical or simply lose their lower echelons in rural as well as in urban areas. Many of the services and amenities discussed here require a large number of users or high turnover over time. Where population figures are dropping, which is the case in many rural areas in Europe, the consequences in terms of service level are often extremely negative. In response some suppliers of services and facilities may offer a system of mobile outlets.

Relationships between metropolitan areas and urban centres in rural and intermediate areas. Many small and medium-sized town and cities located in the vicinity of a large city or conurbation often grow rapidly in terms of employment and population size. Their scale, amenities, accessibility and supply of locations for new development place these towns and cities in a highly competitive position vis-à-vis large cities. This is especially the case in corridors, which stretch from one conurbation to another or cross large, polycentric urban systems. It is here where one finds an intricate patchwork of rurality and urbanity. Being further away from large metropolitan areas does not necessarily mean that small and medium sized cities lack development potential. For instance, towns located in attractive areas or which are by themselves attractive can draw in new residents and businesses. As a result even small towns in fairly remote locations may be part of national and even global economic systems. This is especially true where a particular specialisation has occurred due to historic circumstances or where a successful company has kept aspects of its activity at its original location.

Relationships between rural and urban enterprises. Some urban enterprises deliver their services primarily to the general public, like banks and (some) insurance companies. Other relationships are

Central place relationships tend to retain their traditional character. Layered over this are new relationships between urban and rural areas and between urban centres and nodes within rural areas. The picture that emerges shows complex centre-periphery dynamics. Often the balance between urban and rural areas is uneven. Although rural areas play a vital role in present-day life and in the modern economy, in many ways these areas are very dependent upon economic activities and facilities located in cities and urban areas. It is clear that the spatial and ecological footprint of

32) Study Programme on European Spatial Planning. Synthesis report. 2000.

exclusively between enterprises. One can think of consulting or Research & Development in this connection. Modern agriculture is also connected to urban centres in many ways. Modern agriculture in general is very dependent on the transfer of knowledge and new products supplied by companies and institutions with an urban location and local trading centres have been replaced by regional trading centres. With the emergence of large supermarket chains, farm products are in a growing number of instances sold directly to these companies.

Rural areas as recreation and consumption areas for urban dwellers. Near large metropolitan areas some rural areas have been completely restructured to form large recreational spaces. Elsewhere rural areas have maintained their physical shape, but offer a wide range of facilities stretching from bridle paths to holiday resorts and theme parks. Rural areas characterised by a valuable natural and/or cultural heritage are especially sought after, often beyond the limits of their carrying capacity.

Rural areas as open spaces and suppliers of natural resources for urban areas. Sub-urbanisation and the seemingly unlimited growth of cities have made the policy goal of maintaining openness an important aspect of spatial diversity. As a consequence limits are set on building, not primarily because the rural areas are particularly scenic, but as the result of public values attached to the concept of open areas. This policy often also encompasses building and development restrictions on endogenous functions. An open space or green belt policy sometimes leads to the development of recreational facilities like footpaths, picnic areas, etc. Modern urban society cannot function without the use of natural resources like water and energy. For drinking water especially, urban centres are almost completely dependent on rural areas. It is there where the main purification plants and reservoirs are located, often with an enormous impact on the local environment. Many rural areas show the scars of historical or present day open-pit mining, another example of exploiting natural resources in rural areas.

Rural areas as carriers of urban infrastructure. Roads, rail links, waterways, telecommunication lines, high-voltage lines, pipelines, television and telecommunication towers - overhead and underground Europe are covered by an intricate system of networks, with a very high density in highly urbanised regions. Many of these networks cross rural areas, sometimes forming corridors when more than one line follows the same route. Although many facilities cater for rural areas a well, the main networks link up urban areas within and across national borders. Spatial fragmentation and environmental pressure are a few of their consequences. Furthermore, urban waste collection and processing could conceivably be included under the heading of urban infrastructure. Although a growing part of Europe's waste production is recycled or incinerated, a substantial part of it is still dumped, primarily at locations in rural areas.

urban areas extends well beyond the city limits. Although some crude forms of exploitation have disappeared, other softer forms of exploitation have emerged. These include the transformation of rural areas into consumption landscapes. In many ways the influx of urban activities, for instance, ICT companies (information and communication technologies) and new residents brings a new dynamism to rural areas. On the other hand, this invasion and succession can push local people out of housing and labour markets. Redefining urban-rural relationships, therefore, demands new forms of urban-rural partnership.

Growing urban-rural interdependence is subject to various driving forces:

- space as a major, continuing requirement for choosing sites for different activities;

- the increasing priority given to environmental quality in terms of pleasant living conditions for employees and "a good address" for companies (as well as good accessibility), since an increasingly important factor in deciding the location of new establishments is the supply of qualified labour;

- some of the present day features of urbanisation (or counter-urbanisation) are caused by overall trends related to developments in technology, demographic change and the globalisation of markets; and

- the current high concentration of immigrants in large metropolitan areas in Europe, which could set in motion the next phase of counter-urbanisation.

A number of consequences also result from growing urban-rural interaction:

- the expansion of commuter catchment areas, brought about by the improved traffic systems, which is one of the most striking trends with respect to urban-rural relationships;

- the evolution of the value of land, with the increase of urban-rural integration causing high land use pressures and rising land prices in accessible areas, leading to longer commuting distances as people search for affordable housing in rural areas;

- in the regions with high GDP per inhabitant the lifestyle choices of the population may add to the housing pressure in the rural areas, increasing the land use pressures further; and

- the emergence of "rurban" lifestyles, indicating the merge between urban and rural lifestyles.

In most regions both urban and rural environments and modes of life are present simultaneously. This statement is valid for the densely exploited centres of Europe, as well as for the peripheral areas. It means that urban-rural relations are almost always present on the regional level. A relatively strong urban-rural integration can be found in most of Europe. The extent of peripheral areas with low urban integration is thus quite limited. The sphere of influence from the major cities also covers large areas outside the Pentagon. Parts of Nordic, Mediterranean, Atlantic and eastern European fringe areas lack major cities, but in some of those areas a network of regional/local level cities exists instead.

A major migration trend in the central parts of Europe is driven by the desire for a "rural" lifestyle. Suburbanisation is not only a characteristic of households with children, but increasingly for single-person households as well. The driving forces behind this appear to be twofold. On the one hand, the rural ideal is conceived as "close to nature". On the other hand, the rural context is supposed to imply an enhanced feeling for community in terms of more fulfilling social relationships.

However, the variety of types of urban-rural interdependence in Europe is huge. This is related to the fact that various countries and/or regions are at different stages of the urbanisation cycle. In addition other factors play an important part, such as inter-regional migration, the natural evolution of population, the economic specialisation of urban areas and the socio-economic transition processes taking place in the accession countries.

Ongoing processes in urban-rural interdependence (national examples)	
Further demographic concentration in and around large urban units; concentration of advanced economic functions in metropolitan areas and larger medium-sized towns (metropolisation)	Further demographic concentration in large urban units takes place in southern Italy, in Portugal and also in Finland. Helsinki, Tampere, Oulu and their neighbouring municipalities are the only true growth centres in the country. Forecasts indicate that Helsinki (together with Lisbon in Portugal) will be one of the fastest growing capital regions of Europe.
Deconcentration processes	The deconcentration process in Germany differs in the West and in the East. The West follows the trend of deconcentration and the rural regions record the highest population gains (process of re-industrialisation and residential preferences for low-density housing). In the East, only suburban rings of metropolitan areas have rising population figures whereas the big cities show the highest decrease. A similar deconcentration process can be observed in the urban regions of France and Northern Italy. In the Netherlands, deconcentration trends are contained by strict land-use control.
Increase of population in remote rural areas	There are few examples of increases of population in remote rural areas. This happens, however, in the case of some accession countries. In Romania for example, part of the retired population, originating from the countryside, periodically or permanently return to their native villages to work the plots of land re-appropriated to them.

2.2. Territorial typology related to urban-rural interaction[33]

Urban-rural interactions are of strategic importance for regional and spatial development policies. They are however very diverse in nature and for this reason extremely difficult to map in homogeneous way at European level. A typology of 10 groups has been elaborated, using criteria related to land-use, population density and FUA population.

33) Cf. ESPON Project 1.1.2. "Urban-rural relations in Europe" led by the Centre for Urban and Regional Studies of the Helsinki University of Technology

Typology of urban-rural interactions

High share of artificial surface only

1. Urban, densely populated and high urban integration: only the share of artificial surface above average, population density (and possibly share of FUA population) above average.

High share of artificial surface and agriculture or "wilderness"

2. Urban-rural, densely populated and high urban integration: share of artificial surface + other types of surface (agriculture or "wilderness") above average, population density (and possibly share of FUA population) above average.

3. Urban-rural, not densely populated but high urban integration: share of artificial surface + other types of surface (agriculture or "wilderness") above average, population density below average, share of FUA population above average

4. Urban-peripheral, not densely populated and low urban integration: share of artificial surface + other types of surface (agriculture or "wilderness") above average, population density below average, share of FUA population below average

2.3. Identification of rural areas with declining population[34]

A major challenge to economic and social cohesion is remote rural areas, the revitalisation of which is particularly difficult. Demographic factors play an important part: long periods of out-migration of younger age groups have caused accelerated population ageing resulting now in population decline.

The most negative demographic change (Map 8) is found in the least densely populated regions in France, Spain and Portugal, the northern and southern parts of Eastern Europe, and in peripheral regions of Sweden and Finland. In the Nordic countries, the less central regions have the most

34) Cf ESPON Project 1.1.4. "The spatial effects of demographic trends and migration" led by the Swedish Institute for Growth Policy Studies

High share of agriculture only or agriculture and "wilderness"

5. Rural-urban, densely populated and high urban integration: share of agricultural land (and possibly "wilderness") above average, population density (and possibly share of FUA population) above average.

6. Rural-urban, not densely populated but high urban integration: Share of agricultural land (and possibly "wilderness") above average, population density below average, share of FUA population above average

7. Rural-peripheral, not densely populated and low urban integration: Share of agricultural land (and possibly "wilderness") above average, population density below average, share of FUA population below average

High share of "wilderness" only

8. Peripheral-urban, densely populated and high urban integration: Only the share of "wilderness" above average, population density (and possibly share of urban population) above average.

9. Peripheral-rural, not densely populated but high urban integration: only the share of "wilderness" above average, population density below average, share of FUA population above average

10. Peripheral, not densely populated and low urban integration: only the share of "wilderness" above average, population density below average, share of FUA population below average

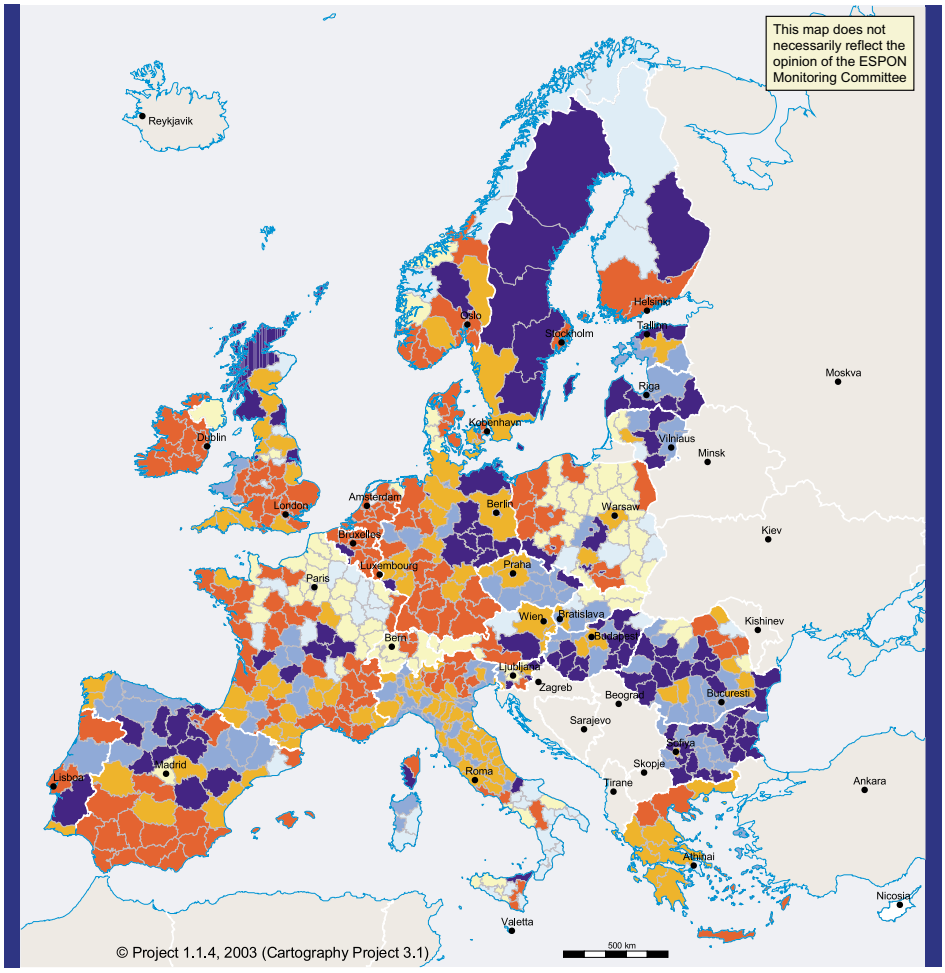
negative figures. Examples of depopulation in weakly populated areas are for instance the Finnish regions of Itä Suomi (-2.5% between 1995 and 1999), the Swedish regions of Mellersta Norrland (-3%), Övre Norrland (-1.9%), the Spanish regions of Aragon (-1%), Castilla Leon (-1.6%). Further details on issues of low populated areas are provided below.

While low fertility rates and population ageing are the main causes of the depopulation trends in remote rural areas, the ability of these regions to retain and attract inhabitants is related to various factors. Among these are the improvement of accessibility; the increased endowment with public and private services and facilities; the enhancement of the natural and cultural heritage; and the promotion of economic activities. Regional and spatial development policies need to address these issues and support the development of small and medium-sized urban centres likely to provide services, employment and amenities. Future regional development programmes will have a particular role in seeking to increase the competitiveness of rural areas.

The ESPON studies show that numerous processes lead to growing urban-rural interdependence in Europe. Most are related to the spatial deconcentration of urban functions, in particular from metropolitan areas. There is however a great diversity of regional situations, depending upon the stage of cities in the urbanisation cycle, but also upon numerous other variables. Consequently, policies addressing urban-rural relations must be tailored to local circumstances. These policies have to take into account differences in population density and degree of urban integration; the character of the region in terms of its urban centres; economic activities; the overall physical landscape and the potential of the region concerned. Urban functions will be more and more in a position to provide a dynamic for rural areas. Regional and spatial development policies, as well as rural development policy, will need to reflect this opportunity.

Map 8

Components of population development, 1996-1999



Population development by components

Population increase with

- positive migratory balance and positive natural balance
- positive migratory balance and negative natural balance
- negative migratory balance and positive natural balance

ulation decrease with

- negative migratory balance and positive natural balance
- positive migratory balance and negative natural balance
- negative migratory balance and negative natural balance
- no data

Origin of the data: EU15 and CC's: Eurostat, Norway and Switzerland: National Statistical Offices

Regional level NUTS 2 (besides NUTS 3) = AT, CH, DE, FI, GR, MT, NL, PT, SE, UK

Source: ESPON Data Base

3. Regions with specific constraints

3.1 Areas with a low population density (< 10 hab/km2)[35]

Modern society functions on the basis of economic, social and cultural infrastructure and services, the feasibility and profitability of which requires a minimum amount of users. For regions with a population density below the respective thresholds, the maintenance, modernisation and further development of infrastructure and services raise difficulties for public and private decision makers. In addition, a low level of infrastructure and services reduces the attractiveness of the areas concerned, in particular for young, skilled people. Too low a population density is, therefore, considered as a handicap to development.

NUTS 2 regions with a population density below 10 inh/sqkm in 1999	Population density	Population change 1995-1999 (%)
Finland		
Itä Suomi	9.8	-2.5
Pohjois Suomi	4.3	+0.2
France		
Guyane[36]	1.9	+3.9
Sweden		
Mellersta Norrland	5.4	-3.0
Övre Norrland	3.3	-1.9
UK		
Highlands and Islands	9.3	-0.5

NUTS2 regions with a population density below 10 inh./km2 are to be found in only four countries of EU-25. In addition to the Nordic countries (Finland and Sweden), the French overseas region of Guyana and the Scottish Highlands and Islands belong to this category. Out of the 6 regions concerned, 4 were facing population decline between 1995 and 1999.

The most striking example of low population density in Europe concerns parts of the peripheral sub-arctic and sub-arctic areas of Finland, Sweden and Norway which cover an area of 424 thousand sqkm and have an average population density of 5 inh./km2. Some of these areas have an extremely low population density, such as the NUTS3 regions of Kainuu (4.2 inh/sqkm), Lappi (2.1 inh/sqkm), Jämtsland Län (2.6 inh/sqkm), Norbottens Län (2.6 inh/sqkm). Remoteness and emigration flows of the younger and more skilled confront these regions with specific challenges, although they are rich in mineral, wood and energy strategic resources, as well as in natural and cultural heritage.

Since out-migration is still an important factor in the depopulation of a large number of regions with low population density, regional and spatial development policies have to strengthen the attractiveness of these regions. This can be achieved through better provision of services and employment and the improvement of accessibility.

35) Cf. ESPON Project 1.1.4. « The spatial effects of demographic trends and migration » led by the Swedish Institute for Growth Policy Studies (ITPS)

36) In Guyane, population is concentrated in a few localities. The situation is not comparable with the other low-density areas.

3.2 New discontinuities in cross-border areas[37]

With the eastwards enlargement, the structure of European borders will change substantially. The length of borders of the EU will increase by 42% (EU-25) and 60% (EU-27). The length of land borders will increase both in relation to the area and to the population. EU enlargement will have significant impact primarily on the economy of border regions, because hindrances such as limitations to market areas or tariff barriers will be removed. New challenges and problems will emerge along the new external borders.

The importance of border regions, of cross-border cooperation and of the permeability of these borders will increase. After political changes in 1989/90, cross-border cooperation started with difficulty because of the non-existence of competencies at the regional level in central and eastern Europe. The only competent level was that of the municipalities. The political, legal and economic conditions for cross-border cooperation improved substantially after 1995, in particular in the context of administrative/territorial reforms (Poland, Czech Republic, Slovakia, Bulgaria) and the support of the EU. Currently, there are 58 Euroregions or "Euroregion type" organisations with the participation of accession countries.

From the point of view of cohesion, decisive criteria are the size of the gap in economic welfare and development level between the two sides of a border. Previously, the largest gap existed on the external EU border. The income gap between the respective countries was 2:1 as an average. In the case of Poland, Hungary and Slovakia it was larger: in the case of Slovenia and the Czech Republic it was smaller. In the case of Hungary and Slovakia, however, the gap at regional level is substantially smaller, because the most developed regions of Hungary and Slovakia and the least developed region of Austria, Burgenland, meet at the border.

In recent years, as a consequence of diverging developments, a new gap has emerged along the eastern borders of the accession countries. Today, the former Iron Curtain is not any more the single largest relative income gap in Europe. Large gaps are to be found in two border sections (Map 9). First, between Greece on the one side and Bulgaria, Macedonia, Albania on the other, where the quotients in development levels range from 2.5 to 4.5. Secondly, between Poland, Slovakia, Hungary and Romania on the one side and the Ukraine and Moldova on the other. This gap is even larger than what could be expected on the basis of the respective national GDP figures The western regions are the poorest ones in the Ukraine, in contrast to the spatial pattern of development level in the other countries (the quotients in development levels range from 1.35 to 2.4).

Though of minor importance, the other aspect of cross-border regional disparity is the employment (or rather unemployment) disparity. These disparities have a different pattern from income disparities. The largest gaps are in the Balkans, between the very high unemployment levels of Bulgaria, Serbia and Macedonia and the substantially lower levels of Greece, Romania and Hungary. The gap measured in differences of points of unemployment percentages ranges from 16.4 to 26.4. Statistically, there is a large gap between the relatively high unemployment levels of Poland, Slovakia and the Baltic States on the one hand, and the very low levels in the CIS countries Russia, Belarus and Ukraine. This gap is, however, only a "statistical gap". The low unemployment figures in CIS countries are the results of keeping former employees on the payroll even if they are not employed and receive no wages. The reason is that only this arrangement enables unemployed people access to some social allowances and amenities.

37) Cf. ESPON Project 1.1.3. "Options for spatially balanced developments in the enlargement of the European Union" (ODEN) led by The Royal Institute of Technology of Sweden (Division of Urban Studies)

The ESPON studies show that certain types of territorial constraints are of a socio-economic nature. Areas with low population density have reduced attractiveness because of the low level of infrastructure and services. The modernisation and further development of this infrastructure and services raise difficulties for public and private decision-makers. This explains why population is still declining in a number of these regions.

The main constraint along borders of central and eastern Europe is the discontinuity in economic development. Wide gaps in GDP per head exist across the borders in numerous regions of eastern and central Europe. This type of discontinuity will also exist along external borders after EU enlargement. Low-density regions and external borders have in common their very strong peripheral character.

Map 9

The dimension of economic disparities at the borders of the Enlargement Area

© EuroGeographics Association for the administrative boundaries

Origin of data: Eurostat

Source: ESPON Database

Very large economic disparities
Medium economic disparities
Small or no economic disparities

Part II:

Addressing the unbalanced distribution of factors of competitiveness in order to achieve territorial cohesion

As was indicated in Part I, a number of territorial disparities do not have a permanent character and can be reduced if appropriate policies are applied. Such policies, which aim to increase the competitiveness of regions, can also contribute to the reduction of territorial imbalances of a more general character. For instance increasing accessibility and connectivity, as ways of enhancing competitiveness, are significant tools for contributing to cohesion (Art. 16 of the Treaty). They are also likely to have positive impacts in reducing depopulation trends; in facilitating the development of activities in sparsely populated areas; and in strengthening urban centres in backward regions. Similar impacts can be expected from the promotion of R&D activities and of advanced telecommunication systems. Through its policies of support to the development of transport infrastructure, RDT and innovation and telecommunication and of energy systems, the European Union contributes to building on regional potential, to increasing the competitiveness of problem regions and to alleviating varied, long-established territorial imbalances.

1. Promoting innovation and ensuring an equitable reallocation of factors of competitiveness

1.1. R&D capacity and territorial competitiveness[1]

1.1.1 R&D Intensity[2]

When viewed on a European scale, the regional figures for R&D intensity show a marked concentration of European R&D in a relatively small number of core regions. This is at the expense of Less-Favoured Regions and more peripheral areas. A number of regions in the candidate countries perform very well against this indicator. The strong performance of Sweden, Finland, parts of the UK, Netherlands, Germany, France and Austria is clearly visible.

The analysis of the most recently available data confirms to a large extent the familiar pattern of R&D strengths in Europe. Five of the European regions with the highest R&D intensity are to be found in Germany, of which the top three are Braunschweig, Stuttgart and Oberbayern with an R&D intensity in 1999 of 6.34%, 4.84% and 4.76% respectively. This compares to a EU-15 average of 1.93%. The regional top ten also include two Finnish regions (Pohjois-Suomi and Uusimaa), Midi-Pyrénées and Sweden. A more surprising finding is perhaps the strong performance of the Czech region of Stredni Cechy (the area surrounding Prague), where R&D expenditure accounted for 3.3% of GDP, placing it third in the regional ranking. The Prague region itself, the Polish region of Opolskie and the Hungarian region of Kozep-Magyarorszag (which includes Budapest) also feature in the top 25 regions, along with more traditionally recognized research centres such as Berlin, the East of England and Ile de France. These high R&D intensity figures in key candidate country regions are significant, but should be interpreted with care, as the absolute levels of R&D expenditure in these areas remains low by European standards.

1) Cf. ESPON Project 2.1.2 "The territorial impact of EU research and development policy" led by ECOTEC

2) R&D intensity is defined as total R&D expenditure (performed in business enterprises, higher education, government and private non-profit sectors) as percentage of GDP in relation to EU-15 average. Data are provided for NUTS2 except UK (NUTS1), Sweden, Belgium, and Ireland (NUTS0). Year 1999; Austria 1998.

In contrast to these areas, the average R&D intensity for regions in Greece, Spain and Portugal and all the Candidate Countries except Slovenia and the Czech Republic, remains below 1% of GDP. In 2000, the average R&D intensity for the 11 candidate countries (excluding Malta, for which no data is available) was 0.77%, compared to an EU average for the same year of 1.93%. Cyprus, Romania and Latvia display the lowest R&D intensities (0.26%, 0.37% and 0.48%).

R&D intensity varies considerably between regions within individual countries and is often concentrated at a national level in a small number of regions, generally near capital cities. In the EU-15, regional variation in R&D intensity is particularly high in Germany and Finland. However, this is largely explained by the regional characteristics of the sparsely populated regions of Finland and the exceptionally high R&D intensity figure for Braunschweig (the highest figure in Europe), which is significantly above the average for the German regions. Regional disparities are also pronounced in several of the candidate countries, particularly in the Czech Republic and Poland.

The concentration of R&D expenditure in capital regions is a particular aspect of this internal regional variation in several countries. This phenomenon is evident in Austria, the Czech Republic, Finland, France, Hungary, Greece and Portugal, where the top spending regions all account for approximately half of national R&D spending. In France, 45% of national R&D expenditure is concentrated in Ile de France (the region with the highest R&D expenditure of any European region in absolute terms), compared to a figure of 10% for Rhône-Alpes, the region with the second highest levels of R&D expenditure in France.

Considering the respective roles of public and business-related R&D expenditure, it is apparent that a number of high expenditure regions are dependent on the public funding of R&D. Business expenditure is rather more concentrated in a limited number of regions than gross expenditure. In 2000, the highest intensities of BES (Business Enterprise Sector) expenditure were found in German, Swedish, Finnish and UK regions. Braunschweig and Västsverige stand out with particularly high levels. In absolute terms, Ile de France again has the highest levels of BES spend, while in 1997 BES accounted for over 70% of total R&D spending in Sweden, Germany, Ireland and Belgium. In the candidate countries, the level of business expenditure on R&D is significantly lower. Slovenia and the Czech Republic both have levels of business R&D expenditure significantly above the candidate country average (0.83% GDP in Slovenia (1999), 0.81% GDP in the Czech Republic (2000)), although these figures are still well below the EU-15 average.

1.1.2 R&D personnel[3]

In the EU-15, the levels of R&D employment as a percentage of the labour force largely mirror the pattern of R&D expenditure. Many of the highest regional concentrations of total R&D personnel are located in the northern part of the European territory. The average level of total R&D employment in the EU-15 in 1999 was 1.36% of the labour force, although analysis highlights a number of core regions with research employment rates considerably above this.

On the basis of available data, 9 of the top 25 regions in terms of total R&D employment were located in Germany (the top three again include Oberbayern, Braunschweig, and Stuttgart with 3.72%, 3.41% and 3.04% of the labour force respectively)[4], three in Sweden and two in Finland. Core R&D regions, in terms of research personnel, are also evident in many other countries, in particular Slovakia (where Bratislavsky gains the highest overall score of any region), Hungary, the Czech Republic, Austria, France

3) R&D personnel is expressed as a percentage of the total labour force. R&D personnel comprises individuals directly employed in R&D activities, as well as those providing direct services in the R&D sector, such as R&D managers, administrators and clerical staff

4) Figures for 1997

and Bulgaria. It should be noted that comparable total R&D employment figures are not available at regional level in the UK.

Once again reflecting the pattern of R&D expenditure, more peripheral regions of the EU-27, particularly in the cohesion countries and parts of eastern Europe, exhibit the lowest levels of R&D employment. There is also considerable variation in the proportion of R&D personnel in the labour force between the candidate countries. While in Slovenia and Hungary, the levels of R&D employment are very close to the EU-15 average, R&D personnel account for a much smaller proportion of the workforce in many other countries, particularly in Bulgaria (0.48%) and Romania (0.39%).

As with R&D expenditure, there is considerable variation in the level of regional R&D employment in many EU-27 countries. Indeed, the pattern of national "core" regions in and around capital cities is even more marked when R&D personnel data is considered. The regions with the highest levels of R&D employment in the Candidate countries are all in capital regions. Bratislavasky, Közép-Magyarország (Budapest), Prague, Yugozapaden (Sofia), Mazowieckie (Warsaw) all appear in the top 25 of EU-27 regions for this indicator. In contrast, peripheral regions in Bulgaria, the Czech Republic and Poland appear in the bottom 50 European regions for R&D personnel. This core-periphery pattern is also very striking in France, Austria, Italy and Spain, although large disparities in terms of R&D employment appear to exist in nearly all European countries. Even in Germany, which has the largest number of regions in the top 25, there are also regions which appear in the bottom quartile of the R&D employment ranking.

1.1.3 Human Resources in Science and Technology (HRST) [5]

Analysis of the distribution of HRSTC as a proportion of total employment across the EU- 15 produces interesting patterns. Two countries come out as clear leaders: Sweden (6 out of the top 25 regions, including Stockholm with the highest overall figure) and Belgium (7 out of the top 25 regions). This is largely explained by the fact that both these countries have high levels of working age population with tertiary education and important concentrations of high technology sectors. Both countries perform particularly well in terms of total employment in High Technology Services. Other leading regions in the EU-15 include core or capital regions in Finland (Uusimaa, Manner-Suomi), the UK (Inner London), Germany (Berlin), France (Ile de France) and the Netherlands (Utrecht). The lowest scoring regions against this indicator are found in Portugal, Greece, Italy and Austria. Italy and Austria also record comparatively low levels of tertiary level education, even in core economic areas.

Some countries in the EU-15 show marked regional disparities in terms of core human resources in science and technology. The UK and Spain emerge as the most unequal countries in this respect, ranging from London and Madrid in the top 25 regions in the EU-15 to Cornwall, Tees Valley and Durham and the Canaries, which are among the bottom 50 performing regions.

1.1.4. Relationship between RDT activities and GDP per capita

There is evidence that a catching up process is taking place as far as the RDT infrastructure and activities of backward regions is concerned. The gaps between regions in R&D capacities are narrowing. However,

5) Total HRST in a given territory is thus measured by the number of people having successfully completed third level education in a Science and Technology field of study (referred to as HRST – Education / HRSTE) and the number of people not formally qualified at this level, but who are employed in a S&T occupation where the above qualifications are normally required (HRST – Occupation / HRSTO). In practice, HRSTE covers nearly all educational fields. Those people who have third level education and work in an S&T occupation are referred to as the HRST "core" or HRSTC. Data are provided for NUTS2 except Ireland (NUTS1), Switzerland and Norway (NUTS0) for 1999.

this does not mean that this catching up process is already being translated into economic wealth. There is no significant correlation between the level of R&D activities of regions and the evolution of their GDP per capita. In other words, while R&D capacities are catching up in less favoured regions, the innovation processes in the economy are still insufficient to become a driving force. Policies need to pay particular attention to the fostering of the innovation process.

1.2 Innovation capacity

1.2.1 Employment in high and medium high technology manufacturing[6]

The average level of employment in High and Medium High Technology manufacturing sectors in the EU-15 in 2001 was 7.57%, compared to a figure of 6.63% across the candidate countries.

The highest proportions of employment in these sectors in the EU- 15 are found in Germany, where the top seven regions are all located. The region with the highest proportion of the labour force engaged in high technology manufacturing sectors is Stuttgart with 21.08%. Other top performing regions include Franche-Comté, Piemonte and Comunidad Foral de Navarra. The bottom 50 regions include a high proportion of regions from cohesion areas of southern Europe, along with a number of regions from core economic areas of such as Outer London (1.96%), Utrecht (2.14%) and Noord Holland (2.56%). The figures for these three regions reflect the proportionately dominant role of the service sector in these areas. The highest rates in the candidate countries are found in the Czech Republic, Hungary and Slovenia, all of which have levels of medium high and high tech manufacturing above the EU-15 average. Cyprus, the three Baltic States and Romania all have rates of employment in these sectors well below the EU-15 and candidate country average

Particularly marked regional disparities in terms of the level of high technology manufacturing employment occur in Germany, Spain and Italy. These variations reflect profound differences in the economic structure of regions in these countries, between some of the manufacturing heartlands of Europe and the rural periphery.

1.2.2 Employment in high technology services[7]

In 2001, 3.61% of the EU-15 labour force was employed in High Technology Services. The highest levels of employment in these dynamic sectors of the economy are found in North Western Europe, in London and the South East in the UK, in Stockholm, Helsinki, Utrecht and the Paris region. Berkshire, Buckinghamshire and Oxfordshire, all in the UK, registered the highest figure at 4.65% of the labour force. In the candidate countries, 2.34% of the labour force in 2001 was employed in high tech services. The highest proportion was found in Estonia (3.38%), with similarly high levels in the Czech Republic, Hungary, Malta and Slovakia (3.22%, 3.24%, 3.06% and 3.03% respectively). Romania, Cyprus and Latvia had the lowest rates of employment in these sectors (1.43%, 1.83% and 2.01%).

6) The medium high and high technology manufacturing sectors include chemicals, machinery, office equipment, electrical equipment, telecom equipment, precision instruments, automobiles and aerospace and other transport (based on the NACE industrial classification). As these sectors are viewed as the most innovative within the manufacturing economy, the proportion of the workforce employed in these fields is an indicator of the capacity of the economy as a whole to exploit the results of R&D and innovation.

7) This indicator focuses on three leading edge sectors that produce high technology services: post and telecommunications, information technology including software development and R&D services (NACE 64, 72 and 73). These sectors provide services directly to consumers and inputs to the innovative activities of other firms in all sectors of the economy. This indicator is considered to be a more accurate indication of innovative potential in the service sector than "knowledge intensive services", which includes a far wider range of sectors.

Strong concentrations of employment in High Technology Services are found in capital regions, such as London, Paris, Madrid or Stockholm. For obvious reasons, the levels of employment in these parts of the economy are much lower in peripheral and rural areas of the European Union.

1.2.3. Research and Innovation Infrastructure

One factor that can assist in the development of a strong and innovative economy is the strength of supporting innovation infrastructure. At a European level the strength of the local university base and the presence of recognised science parks and Business Innovation Centres can play a role. Analysis of the location of this infrastructure across Europe demonstrates some strong patterns:

- 4% of EU regions account for 40% of the leading research universities and institutes, 46% of recognised Science Parks and 25% of Business Innovation Centres, while in 76% of regions contain none of these;

- all EU-15 Member States contain at least one region in this leading group, although the institutional mix varies between having a very strong university base, or a balance between Science Parks, Business Innovation Centres and Universities;

- in the 12 Accession Countries the distribution of research infrastructure is spread more thinly, with just 18 recognised Science Parks and 10 Business Innovation Centres; and

- the concentration of research infrastructure is not just at a national level, with more than half of the research infrastructure in the leading EU regions located in just 7 regions, representing a significant endowment of knowledge and opportunity (Stockholm Län, Paris, Barcelona, Dublin, Greater Lisbon, Communidad de Madrid, Attiki and Rome.

Summing up, the promotion of innovation is characterised by very strong territorial imbalances throughout Europe. This concentration varies in intensity according to the indicators considered. Strong territorial concentration at EU level is observed in the fields of R&D intensity, employment in high technology services and R&D infrastructure. Concentration in the northern half of Europe is observed in the fields of R&D personnel and population with tertiary education. In the case of employment in high and medium/high technology manufacturing, the contrast is pronounced between the manufacturing heartlands of Europe and the rural periphery. A number of accession countries perform well, but important differences exist between countries, in particular in the field of R&D intensity and employment in high technology services. Important imbalances also exist between regions at national level in most countries. The objective of territorial cohesion requires strong innovation policies in favour of the less advanced countries and regions.

1.2.4 Territorial impacts of current EU RDT policy

Framework Programme participation

The EU Framework Programme for Research and Technological Innovation plays a leading part in promoting innovation and in channelling Community and national resources towards transnational research projects throughout Europe. Its potential contribution to territorial cohesion is important.

From a spatial point of view, Framework Programme participation (1999) is dispersed across the European territory (Map 10). Participation levels in Accession Countries and Candidate Countries are lower, although this increases somewhat if participation is weighted by GDP rather than population. For the purpose of the analysis, five classes of regions have been identified[8]. Participation in the Framework Programmes is highest in Type 1 regions. This pattern has remained stable between Framework Programme 4 and Framework Programme 5. Type 2 regions also register strong levels of participation, possibly reflecting their higher capacity for R&D activity. Between Framework Programme 4 and Framework Programme 5 there is some, albeit marginal, evidence of increasing levels of participation by some Type 5 regions, whilst participation levels by Type 3 regions have fallen back

The Framework programmes are supportive of actions in Objective 1 regions, but participation is skewed more strongly to non-objective 1 regions. The reasons for this are numerous, but reflect available infrastructure as well as the nature of the respective economies. Firms and organizations based within Objective 1 regions of the EU account for approximately 14% of total participation in the RTD Framework Programmes (FP). This proportion has remained stable in both FP4 (1994-1998) and FP5 (1998-2002). Proportionately, slightly more projects have been led by organizations based in Objective 1 regions in FP5 than previously (12% compared to 11%). The average number of participants in FP5 in an Objective 1 region is some 63% of the EU average. This is slightly below the average level of GDP for an Objective 1 region (70%), suggesting that FP participation is disproportionately greater in non-objective 1 regions. Notwithstanding this, participation is relatively high in a number of Objective 1 regions, particularly in Ireland, Portugal and some regions of Greece. Objective 1 regions account for some 22% of the EU population. Objective 1 regions are thus also under-represented in comparison to their share of population, although a mixed picture emerges with some regions in Ireland, Greece and Portugal demonstrating higher participation levels. Overall, participation levels weighted for population appear to be slightly lower than those weighted for GDP.

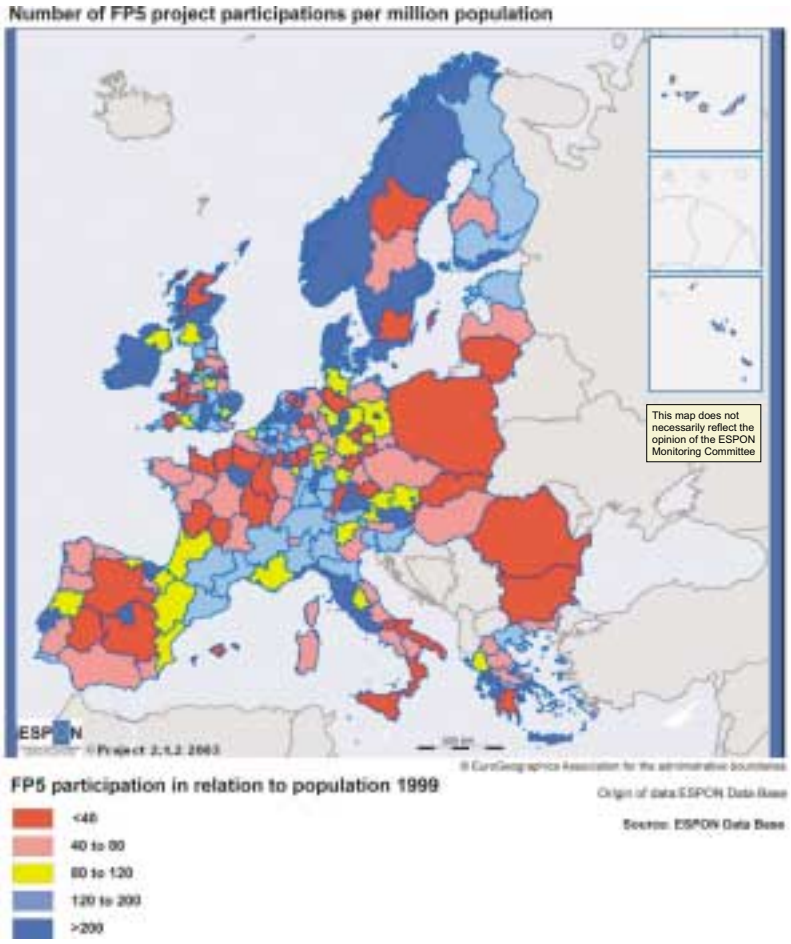
The Framework Programme generally has little impact in terms of improving the research infrastructure of the regions. Some small, project-specific effects can be identified through support for the purchase of project-related hardware. Important short-term employment effects can be identified through the creation of research posts, bursaries and fellowships. It appears that knowledge and know-how is more likely to spread throughout the consortia, and so outside the region/country, rather than within.

The contribution that the Framework Programme makes to knowledge flows between regions and across Europe must not be underestimated. The Programme is reportedly resulting in widespread and high frequency knowledge networks with strong ties. The networks and projects also foster ties between research institutions and firms, contributing to the development of active innovation networks. These are leading to new practices of working and communicating and promoting trust, a key feature in the progress of R&D and its ultimate adoption through new innovations. The Framework Programmes are also contributing to the development of clusters of activity in the best examples.

The Framework Programmes are having an effect on the development of new methodologies and interactions between different actor-groups. This enhances organizational and scientific practice. Transregional co-operation is also affecting working methods. The 'large players' in particular are reported to have benefited from the opportunity to develop new products and processes within trans-national partnerships. There is, however, little evidence of the development of sustainable network creation within regions because most job creation (or safeguarding) has been of a transient and temporary nature.

8) Type Description:
- Type 1 High R&D capacity and high innovation capacity
- Type 2 High R&D capacity but low or medium innovation capacity
- Type 3 Low or medium R&D capacity but high innovation capacity
- Type 4 Medium R&D capacity and medium innovation capacity
- Type 5 Low R&D capacity and low innovation capacity

Map 10


Number of FP5 project participations per million population
This map does not necessarily reflect the opinion of the ESPON Monitoring Committee
ESPON
FP5 participation in relation to population 1999
<40
40 to 80
80 to 120
120 to 200
>200
Origin of data:ESPON Data Base
Source: ESPON Data Base

Use of Structural Funds

In total some 10.6bn euros are intended to be spent on R&D activity in the 2000-2006 programming period. Around three-quarters (74%) of expenditure is contributed by the ERDF and a quarter (25%) from the ESF. Just under half of all planned expenditure is intended to support innovation and technology transfers through the establishment of networks and partnerships between businesses and/or research institutes. Support for research projects based in universities and other research institutes and the development of Research, Technological Development and Innovation (RTDI) infrastructure represent the other two main areas of activity.

The distribution of activity between Objective 1 and 2 varies, with a stronger emphasis in Objective 1 regions on actions supporting innovation and technology transfers. In contrast, a higher proportion of funds is focused on supporting the development of RTDI infrastructure in Objective 2 areas. Given that Objective 1 regions have a GDP of some 70% of the EU average and a population of just 22% of the EU average, this suggests that EU policy in this sphere supports territorial cohesion.

Objective 1 regions are generally characterised by low levels of R&D investment and poorly developed research and innovation infrastructure. As a result of these basic weaknesses, R&D related actions in early Objective 1 Programmes have traditionally been focused on infrastructure development, for example, support for research establishments and capital investment. However, the evaluation of RTDI actions in Objective 1 regions under the 1994-1999 Programming period notes a shift in emphasis from 1994 onwards, away from a concentration on science and technology supply and towards market demand.

Although the level of funding available under Objective 2 means that the large-scale infrastructure investments undertaken in Objective 1 areas are not possible, Objective 2 programmes often contribute to physical infrastructure development. Examples include support for expanding business parks and educational establishments (in East Netherlands, Lorraine and Cologne) or for the acquisition of equipment, such as computer software (Liguria). This includes support for public or private research, such as direct grants for R&D projects and R&D-related productive investment in businesses; contributions to the cost of recruiting R&D personnel; and subsidies for the registration of patents (Mecklenburg-Vorpommern).

Support is in some cases directed at the provision of advice and consultancy to businesses, in particular to SMEs. This encompasses a wide range of projects aimed as developing links between different actors in the regional innovation system, whether on the supply or demand side. Initiatives co-financed by Objective 1 Programmes include the expansion of Business Innovation Centre and creation of a network of business incubator support infrastructure in Wales; the development of a "one-stop shop" at a university in Calabria; and promotion of R&D co-operation among business in Mecklenburg-Vorpommern.

The category of action "Development of human capital" includes training initiatives with a specific focus on R&D or innovation, as opposed to more general skills development actions, aimed at the wider population.

In the category of action "Direct support for research and innovation projects" trends towards measures focusing on the demand side of the innovation system in Objective 1 programmes can be observed. That said, the examples also demonstrate that support for infrastructure and equipment will continue to account for a significant proportion of total support for R&D and innovation in Objective 1 programmes in 2000-2006. In general terms, it is clear that R&D and innovation-related activities in Objective 2 areas tend to focus more on the demand side of the innovation system than measures in Objective 1 areas. This

is partly a function of the level of funding available under Objective 2, but probably also reflects the relative strength of existing supply side R&D infrastructure (particularly in the field of Higher Education) in Objective 2 areas, when compared to Objective 1 regions.

A focus on innovation support activities is evident in programmes under both programming periods, although different programme structures often make it difficult to compare the focus of measures from one period to the next.

Summing up, the Framework Programme generates significant added value in terms of innovation capacity, development of active innovation networks and new methodologies, creation of technological clusters, etc. There is, however, evidence that participation is much higher in non-objective 1 regions on average, although a limited number of objective 1 regions draw significant benefits. The search for more territorial cohesion implies that participation of objective 1 regions should be increased, which underlines the need to increase capacity building.

Support from structural funds to science and technology has been characterised in recent years by a significant diversification. While it originally concentrated mainly on R&D infrastructure (ERDF support) and human resources (ESF support), other types of activities are increasingly supported: advice and consultancy, direct support to research and innovation projects, etc. It may result in some overlapping with the Framework programme, but a significant difference is that the supported activities are restricted to Objective 1 and Objective 2 regions. This evolution is justified by the recognition that the regional capacity to innovate depends not only on the local supply of technology, but also on the receptiveness (or absorptive capacity) of the local economy and in particular of SMEs.

2. Improving accessibility

2.1. Accessibility/Transportation

2.1.1 Europe-wide accessibility

Potential accessibility

Potential accessibility[9] is based on the assumption that the attraction of a destination increases with size and declines with distance, travel time and cost. Destination size is usually represented by population or

9)Potential accessibility is a construct of two functions, one representing the activities or opportunities to be reached and one representing the effort, time, distance or cost needed to reach them (Wegener et al., 2002):

$A1=\Sigma_g(W_j)f(c_{ij})$

where Ai is the accessibility of area i, Wj is the activity W to be reached in area j, and cij is the generalised cost of reaching area j from area i. The functions g(Wij) and f(cij) are called activity functions and impedance functions, respectively. They are associated multiplicatively, i.e. are weights to each other. That is, both are necessary elements of accessibility. Ai is the total of the activities reachable at j weighted by the ease of getting from i to j.

The accessibility model used here (based on Spiekermann and Wegener, 1996) uses centroids of NUTS 3 regions as origins and 70,000 raster cells of 10 x 10 km as destination zones. Destination activities are disaggregated from NUTS 3 regions to raster cells. The accessibility model calculates the minimum paths for the road network, i.e. minimum travel times between the centroids of the NUTS 3 regions and all raster cells. For each NUTS 3 region the value of the potential accessibility indicator is calculated by summing up the population in all 70,000 raster cells weighted by the travel time to go there.

Furthermore, calculations concern only internal accessibility. Taking into account external accessibility would provide different results.

economic indicators, such as GDP and income. Accessibility to population is seen as an indicator for the size of market areas for suppliers of goods and services. Accessibility to GDP is seen as an indicator of the size of market areas for suppliers of high-level business services. Potential accessibility is founded on sound behavioural principles, but contains parameters that need to be calibrated. Their values cannot be expressed in familiar units, so potential accessibility is expressed in percentage of the ESPON space average.

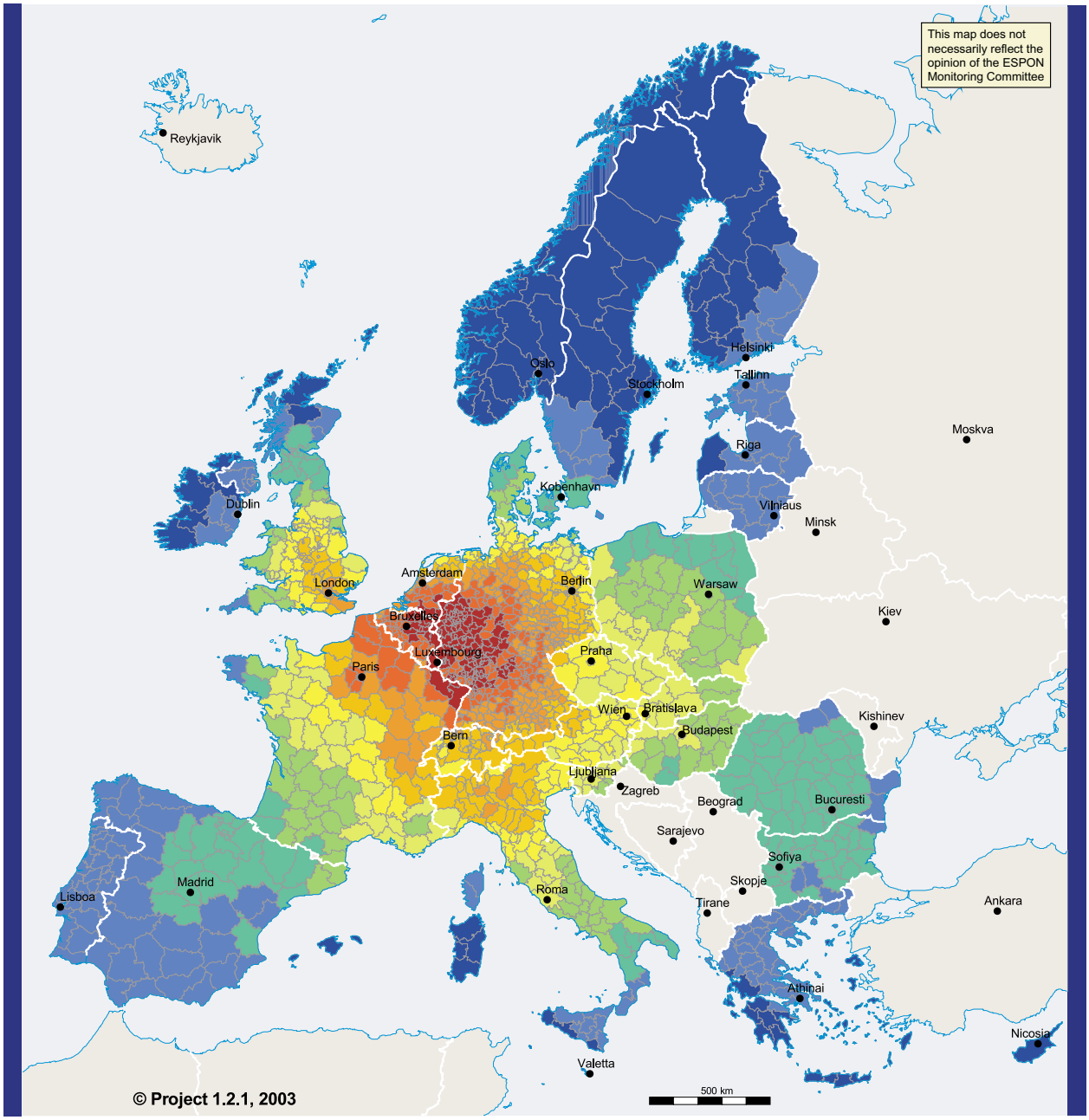
Potential accessibility by road

The indicator of potential accessibility by road to population has been calculated for all NUTS3 regions of the ESPON space (Map 11). The road network used for the calculation contains all existing motorways, dual carriageways and other expressways, E-Roads and the most important national roads, as well as car ferries and the Eurotunnel. The road network database contains information on the type of road, the inclusion in the TEN and TINA programmes, national speed limits and border delays. Travel time takes account of average speeds in relation to different speed limits in the various countries.

The map "Potential accessibility, road, 2001" shows clearly that the most accessible regions by road (accessibility index higher than 120% of ESPON space average) are almost identical with the Pentagon, with an extension eastwards to include east Germany. The regions with highest accessibility (accessibility index above 180% of the ESPON space average) are located in the Benelux countries and in the German Länder of Rheinland-Pfalz and Nordrhein-Westfalen. The least accessible regions (accessibility index below 40% of the ESPON space average) are all located in the European periphery (Nordic countries, north of Scotland, Ireland, Portugal, western and southern parts of Spain, Corsica, Sardinia, Greece, Cyprus, Malta, eastern parts of Romania, Baltic states). It is remarkable that the larger part of the accession countries of central and eastern Europe have an accessibility index similar to that of south-west France, northern Spain and Denmark, which is in all cases better than that of Portugal, Ireland, western and southern Spain.

Map 11

Potential accessibility by road, 2001



Accessibility index (EU27 = 100)

- 0 < 20
- 20 < 40
- 40 < 60
- 60 < 80
- 80 < 100
- 100 < 120
- 120 < 140
- 140 < 160
- 160 < 180
- 180 and more

Origin of data: Spiekermann & Wegener (S&W)

Source: ESPON Database

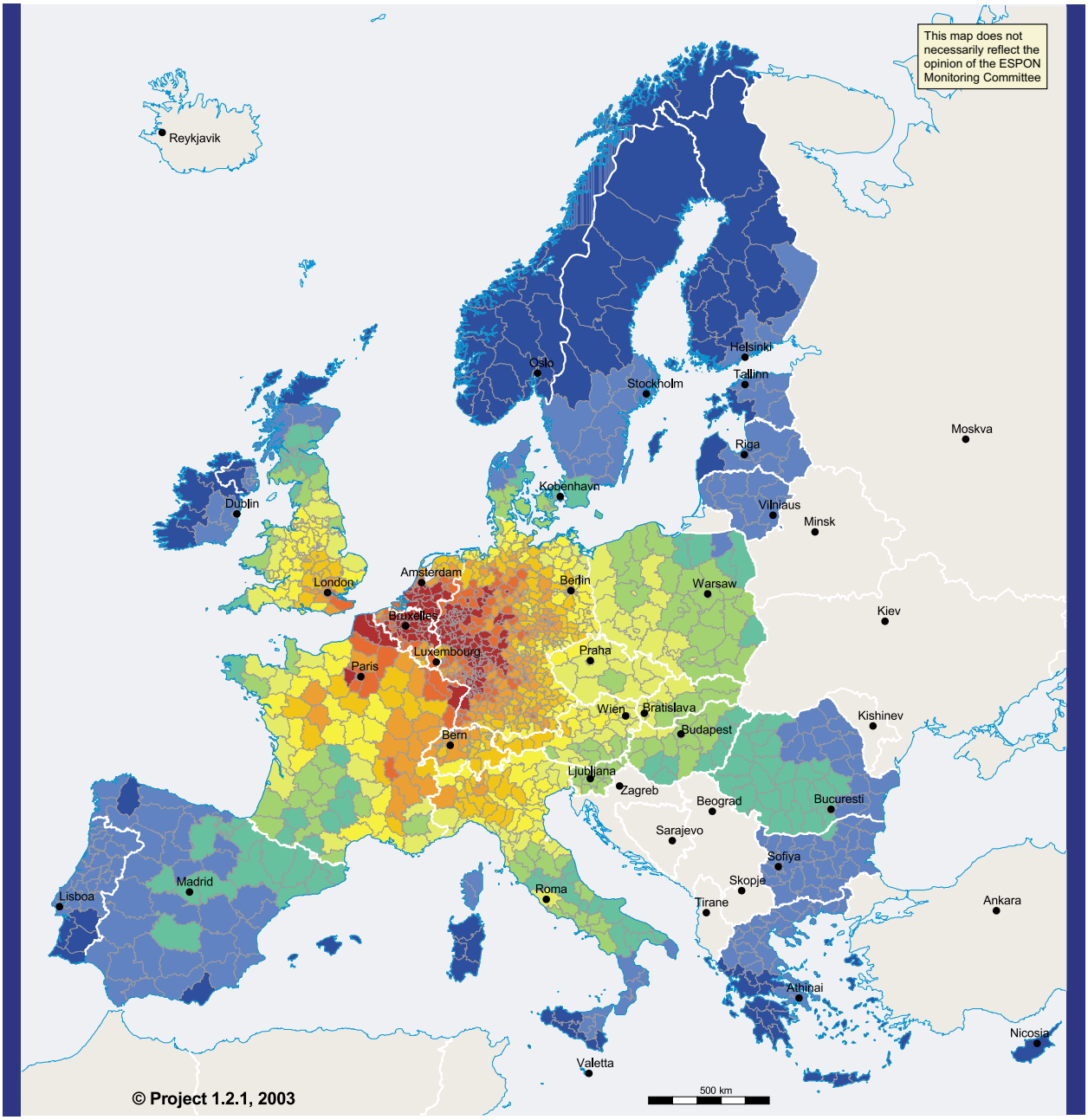
Potential accessibility by rail

The indicator of potential accessibility by rail to population has been calculated for all NUTS3 regions of the ESPON space (Map 12). The rail network used for the calculation contains all existing and planned high-speed rail lines, upgraded high-speed rail lines and the most important conventional lines, as well as some rail ferry and other secondary rail lines to ensure connectivity of the NUTS3 regions. The rail network database contains information on the link category, the length inclusion in the TEN and TINA programmes and travel time derived from rail timetables.

The map "Potential accessibility, rail, 2001" shows a pattern similar to that obtained for the accessibility by road. Here again, the most accessible regions (accessibility index above 120% of the ESPON space average) are largely contained in the Pentagon, with some extensions towards east Germany, as well as towards the Rhone valley and the Loire valley in France. Areas with low accessibility by rail in the European periphery (accessibility index below 40% of ESPON space average) are more extended than for road accessibility in the case of Spain, Bulgaria and Romania.

Map 12

Potential accessibility by rail, 2001



Accessibility index (EU27 = 100)

	0 < 20
	20 < 40
	40 < 60
	60 < 80
	80 < 100
	100 < 120
	120 < 140
	140 < 160
	160 < 180
	180 and more

Origin of data: Spiekermann & Wegener (S&W)

Source: ESPON Database

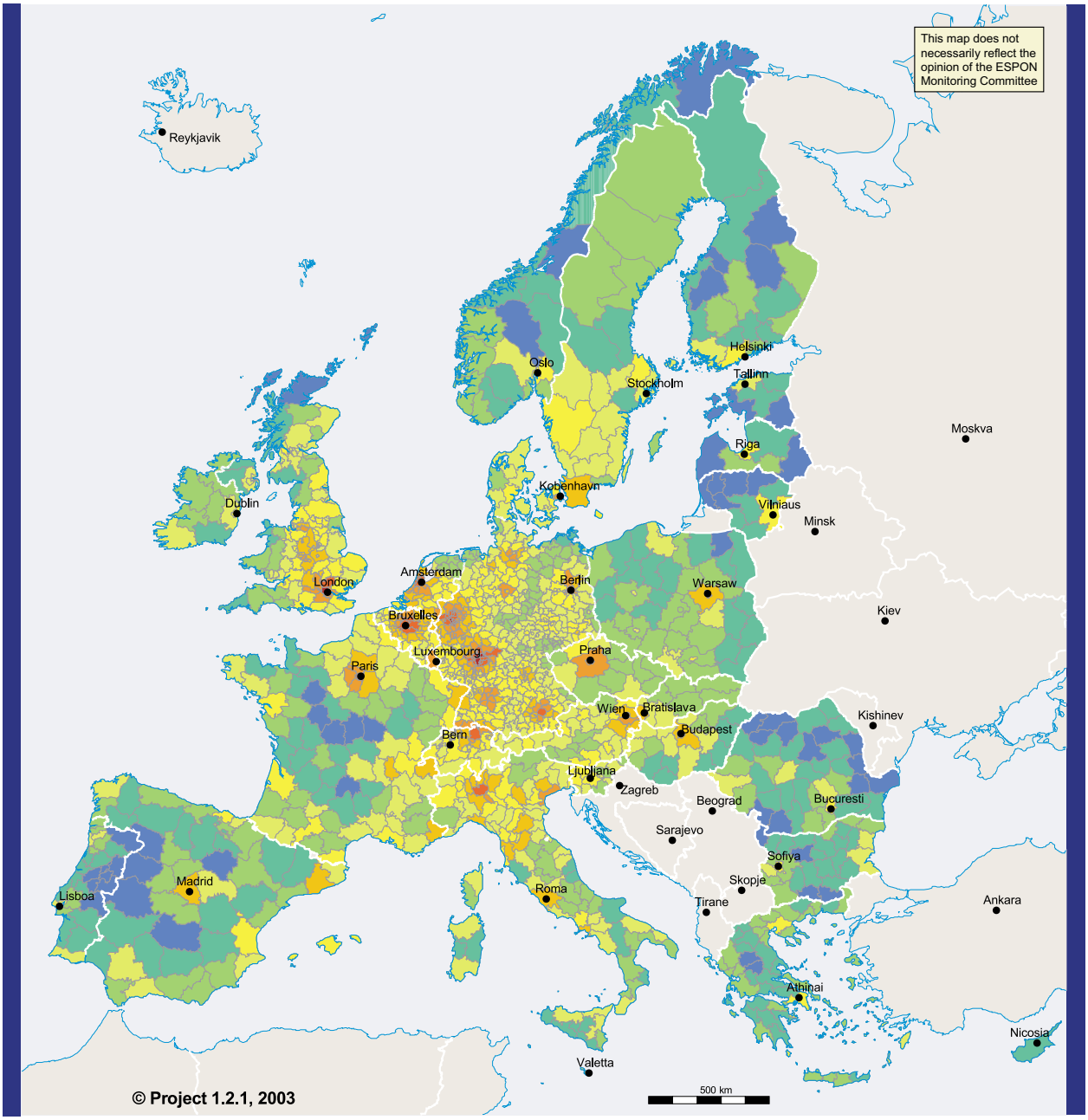
Potential accessibility by air

The indicator of potential accessibility by air to population has been calculated for all NUTS3 regions in the ESPON space (Map 13). The airports of the network are all contained in the TEN and TINA programmes. In addition, important airports in Eastern Europe and in other non-EU countries have been included to ensure the connectivity of these regions. The air network contains non-stop flights between two airports. Only regular scheduled flights are taken into consideration. For each link, the average flight time based on timetable information and the frequency of flights are taken into account. The frequency is used for time penalties for those links that do not have several flights per day.

Potential accessibility by air (Map "Potential accessibility, air, 2001") provides a completely different picture, compared to those on land transport accessibility. The map of Europe is converted into a patchwork of regions with high accessibility, surrounded by regions with low accessibility. Low accessibility is, however, not a concern only for those regions of the "traditional" European periphery, but also some regions located in the European core. Some regions of central France, southwest of Paris, are classified in the accessibility category below 40% of the ESPON space average. Other regions with low accessibility are mainly in the European periphery: Nordic countries, Baltic States, peripheral regions of Romania, border regions between Spain and Portugal, central Greece and northern Scotland.

Map 13

Potential accessibility by air, 2001



Accessibility index (EU27 = 100)

	0 < 20
	20 < 40
	40 < 60
	60 < 80
	80 < 100
	100 < 120
	120 < 140
	140 < 160
	160 < 180
	180 and more

Origin of data: Spiekermann & Wegener (S&W)

Source: ESPON Database

Relationships between accessibility and the weight of urban regions

An important relationship to investigate is between the size of urban agglomerations and their multimodal accessibility, in particular to determine the impact more polycentric urban systems have on accessibility and, therefore, on competitiveness. For this purpose, a map representing both the size of FUAs and their level of multimodal accessibility has been produced (Map 14 "Potential accessibility of FUAs, multimodal, 2001). It shows that FUAs located in the Pentagon generally have a high level of accessibility, irrespective of their size. The medium-sized and small FUAs of the Pentagon generally have an accessibility index above the ESPON space average or, in the worst case, slightly inferior (between 80% and 100% of the average). Outside the Pentagon, there are only a few large towns with an accessibility index above the ESPON space average (Barcelona, Rome, Nice, Berlin, Warsaw, Vienna, Bratislava, Budapest, Copenhagen, Manchester, and Liverpool). Capital cities such as Madrid, Lisbon, Athens, Stockholm, Helsinki, Tallinn, Riga, Vilnius, Bucharest, Sofia, and Dublin all have an accessibility index in the range 80%-100% of the ESPON space average. In the accession countries, in the Iberian Peninsula and in the Nordic countries, there are numerous medium-sized and small FUAs with a very low accessibility index (below 60% of the ESPON space average).

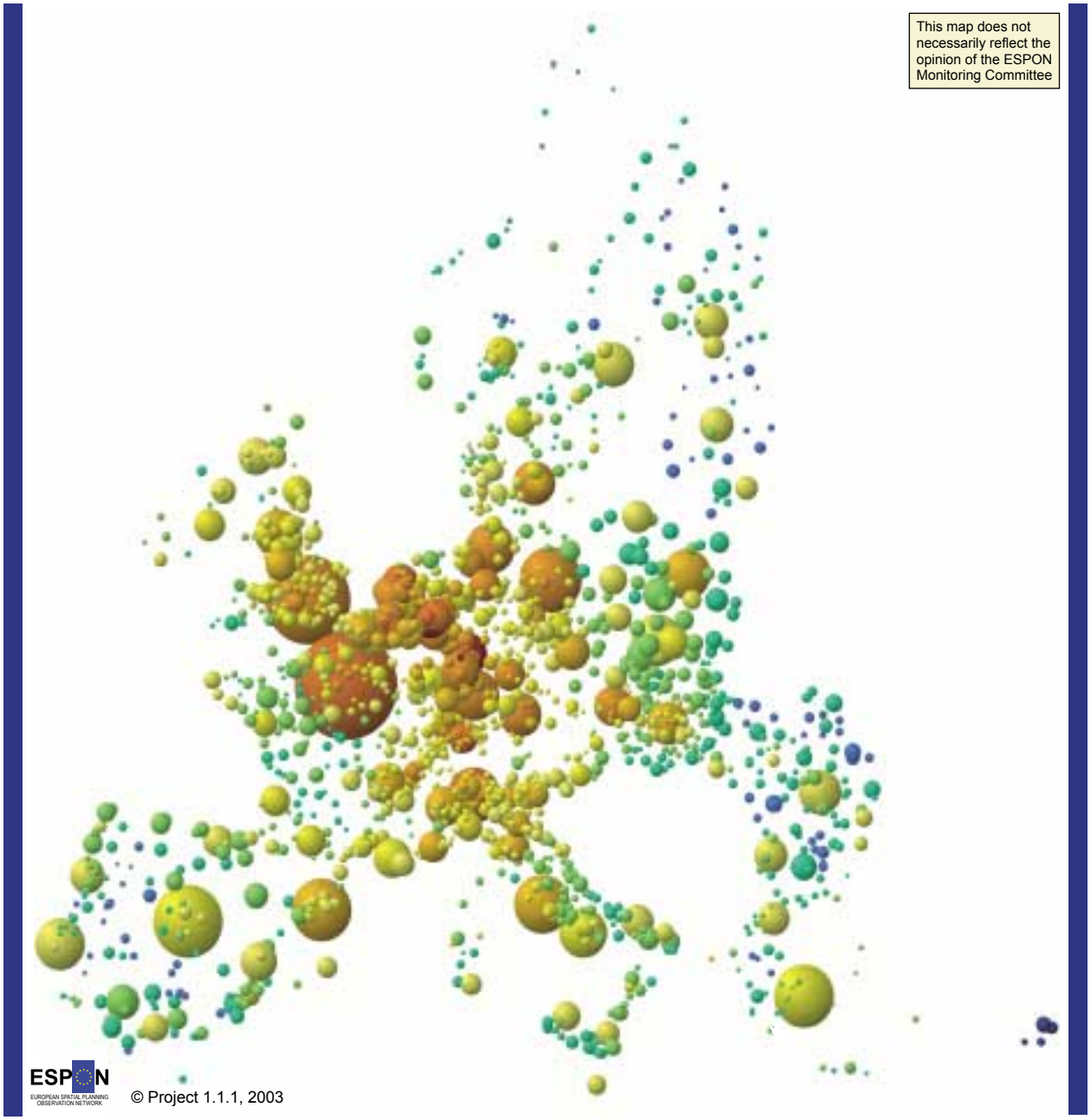
It should be emphasised that the picture is somewhat distorted because only people transportation is taken into account in the calculation of accessibility. The situation of peripheral metropolitan areas is rather different when considering goods transportation. In these cases the existence of a large port is more important than a large airport. For land transportation, low efficiency and long distances are always a handicap for peripheral regions. While personal mobility can be increasingly substituted by the electronic exchange of information, this does not hold true for goods transportation.

Analysed on the basis of transportation of persons, Europe-wide accessibility shows a clear centre-periphery pattern as far as the accessibility by road and rail is concerned. Regions with the highest Europe-wide accessibility are located within the Pentagon. Accessibility by air shows a quite different pattern, with a number of regions of the periphery having high accessibility levels, provided they have a well-developed airport.

The multimodal accessibility of FUAs is primarily a function of their geographic location (centre versus periphery) and secondarily a function of their size. Analysis shows that the improvement of accessibility is an important prerequisite for the emergence of more polycentric urban systems.

Map 14

Potential accessibilty of FUAs, multimodal 2001



Origin of data: S&W

Source: ESPON Database

2.1.2. North-south and east-west patterns of major flows and corridors

Major flows of road and rail traffic follow various corridors. These are broadly orientated in a north-south direction, some running from north-west to south-east along the axis of the "Blue banana"[10] and others running from north-east to south-west. The morphology of flows varies, however, from country to country, following that of networks. It is possible to identify three main types of network corridor:

- centralized networks with a peripheral way, for instance the Iberian Peninsula;
- parallel networks, like in France, Italy, United Kingdom, Sweden, Finland; and
- networks with a square pattern, as for example the German network.

The others networks are combinations of the three main types. The third type is the most connected type of network. It is the least vulnerable because it has many possible paths. The vulnerability of the others is greater.

A general reorientation of economic flows in an east-west direction already began during the '90s. What is now expected is growing intensity and in some cases the changing composition of flows. Trade between the western and eastern parts of Europe will increasingly reflect the pattern of comparative advantage and consequently will increase. Some transport flows will also become modified due to the elimination of barriers between the present candidate countries. Barriers have several dimensions, from physical to cultural, but are generally lower along established trade and transport corridors. This leads to the assumption that development of the cities, city clusters and city networks located in corridors that mainly constitute axial extensions of the single Global Integration Zone of EU –15 will be reinforced.

The evolution of flows has to be considered in relation to the capacity of networks and hence with accessibility. A concentration of high-accessibility regions is to be found in north-west Europe, reaching from the south of England over the Benelux countries and the Rhein-Ruhr metropolis along the Rhine valley to Switzerland and northern Italy (the 'Blue Banana'), with another peak in the Paris region. In contrast, one of the main obstacles to the integration of the candidate countries in eastern Europe is the poor quality of transport infrastructure in these countries and between these countries and western Europe. This problem has already been address by the Transport Infrastructure Needs Assessment (TINA) programme of transport infrastructure corridors for the accession countries. From an economic point of view, TEN-T and TINA projects seem to support the integration of the accession countries into the European Union.

While north-south corridors of transportation still have a dominant position in Europe, EU enlargement will contribute strongly to the development of east-west corridors. The forecast increase of flows on major corridors will generate saturation effects. Therefore, it is important that the implementation of TEN-T and TINA Networks is accelerated.

10) The "Blue banana" is a synonym for the most developed and urbanised axis in Europe, running from London to Milan over the Benelux regions and the Rhine valley and to a large extend congruent with the Pentagon.

2.1.3. Restricted permeability of east-west cross-border and transnational corridors

Borders can be classified according to their permeability; the frequency of border crossings; and the administrative arrangements which facilitate the crossing of these borders.

On average there is an international road border crossing on each 60 km of border in the Enlargement Area. But this density is highly differentiated. There are 3 crossing points per 100 km of border between EU member states and accession states; 1.5 crossing points per 100 km of border among accession countries; and 0.75 crossing points per 100 km of border between accession countries and third countries. But there are extreme cases. On the borders between Greece and Bulgaria and between Romania and Ukraine, the density is only 0.4 crossing point per 100 km.

While in the past, a relatively dense network of roads and railways connected the accession countries with neighbouring third countries, according to estimates only 40 percent of existing roads and 50 percent of existing railways crossing these borders are currently used as international border crossings. Some roads can be used only by citizens of the two neighbouring countries or regions; some are open only for a few hours daily; some are open only on holidays or during special events; and others are never used, for example when rails have been removed.

Integration within the enlarged EU cannot be implemented if the level of border permeability remains insufficient. Increased permeability is needed not only along important transnational corridors, but also for the integration between border regions and for the normalisation of cross-border relationships.

2.1.4. Contribution to increased accessibility to Services of General Interest

Accessibility to Services of General Interest depends upon the infrastructure endowment of regions and upon existing transport services, taking into account all transport modes. Connectivity to hubs and major infrastructure access points is an important element for calculating this aspect of accessibility.

A close relationship exists between transport infrastructure endowment and territorial competitiveness. Infrastructure endowment can be measured by various types of indicator: the surface of the area or its population. The latter has been chosen here.

Density of motorways and expressways by population

The density of motorways and expressways with estimated speeds higher than 85 km/h has been calculated by population for all NUTS3 regions of the ESPON space. It has been mapped (Map 15 "Density of motorways and expressways by population") using relative values (percentage of the EU-27 average).

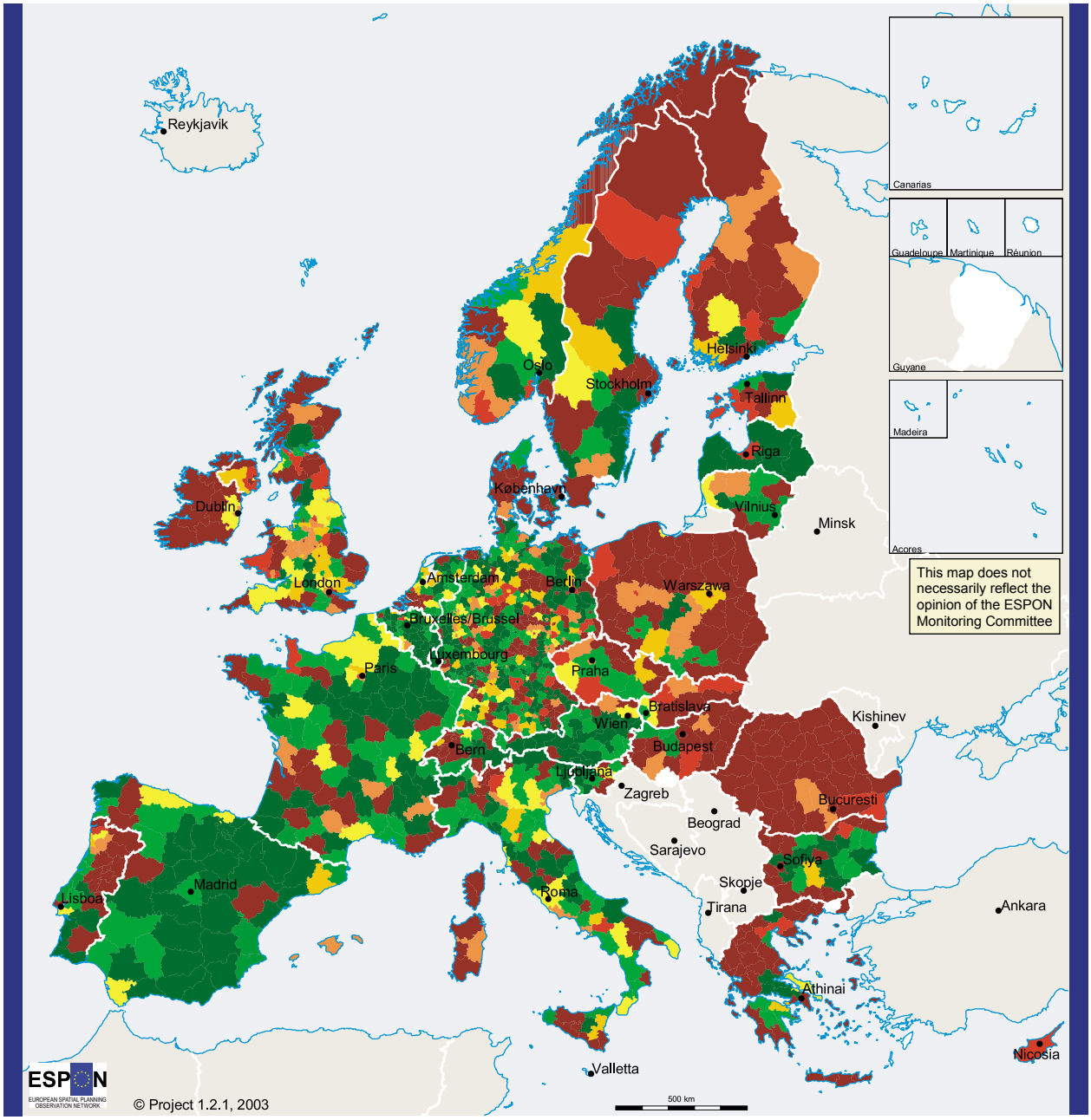
Large patches with a low density of motorways and expressways (less than 40% of EU-27-average) are to be found in the northern periphery (central and northern parts of Sweden and Finland) and in a major part of the accession countries (with the exception of Slovenia, central/western parts of the Czech Republic and eastern parts of Bulgaria). In the rest of the EU-15, the situation is more diverse. Patches with low density generally have a smaller size. They are to be found in the European periphery (northern Scotland, Ireland, Brittany, mountain areas of Portugal and Galicia, Corsica, Sardinia, large parts of Sicily and Puglia, northern parts of Greece and the Greek Islands), but also in a number of more centrally located regions (parts of south-west France and Massif Central, parts of central Italy, large parts of Denmark and numerous smaller areas of Germany). In the German case, the small size of the NUTS3 units may generate a false impression of lower motorway densities in some German areas.

In contrast, areas with a high density of motorways and expressways by population (higher than 140% of EU-27-Average) are generally not found in the periphery, with the significant exception of Spain. Here most parts of the territory belong to this category. The other major areas with a high density are situated in the northern half of France, the Benelux countries, Austria, southern Sweden, Latvia and the eastern part of Bulgaria and the central part of Greece, as well as in the coastal zones of Portugal.

In conclusion the less endowed areas, identified on the basis of motorways and expressways per head of population, are the accession countries and the northern periphery.

Map 15

Density of motorways and expressways by population



km of network 2001/population 1999 (ESPON Space=100)

- up to 20
- 20 up to 40
- 40 up to 60
- 60 up to 80
- 80 up to 100
- 100 up to 120
- 120 up to 140
- 140 up to 160
- 160 up to 180
- 180 and more
- no data

Origin of data: ASSEMBLING graph GISCO

Source: ESPON Database

Density of railway lines by population

The density of railways per head has been calculated for all NUTS3 areas of the ESPON space, without taking into consideration the quality of service. It has also been mapped (Map 16 "Density of rail lines by population) using relative values (percentage of the EU-27 average).

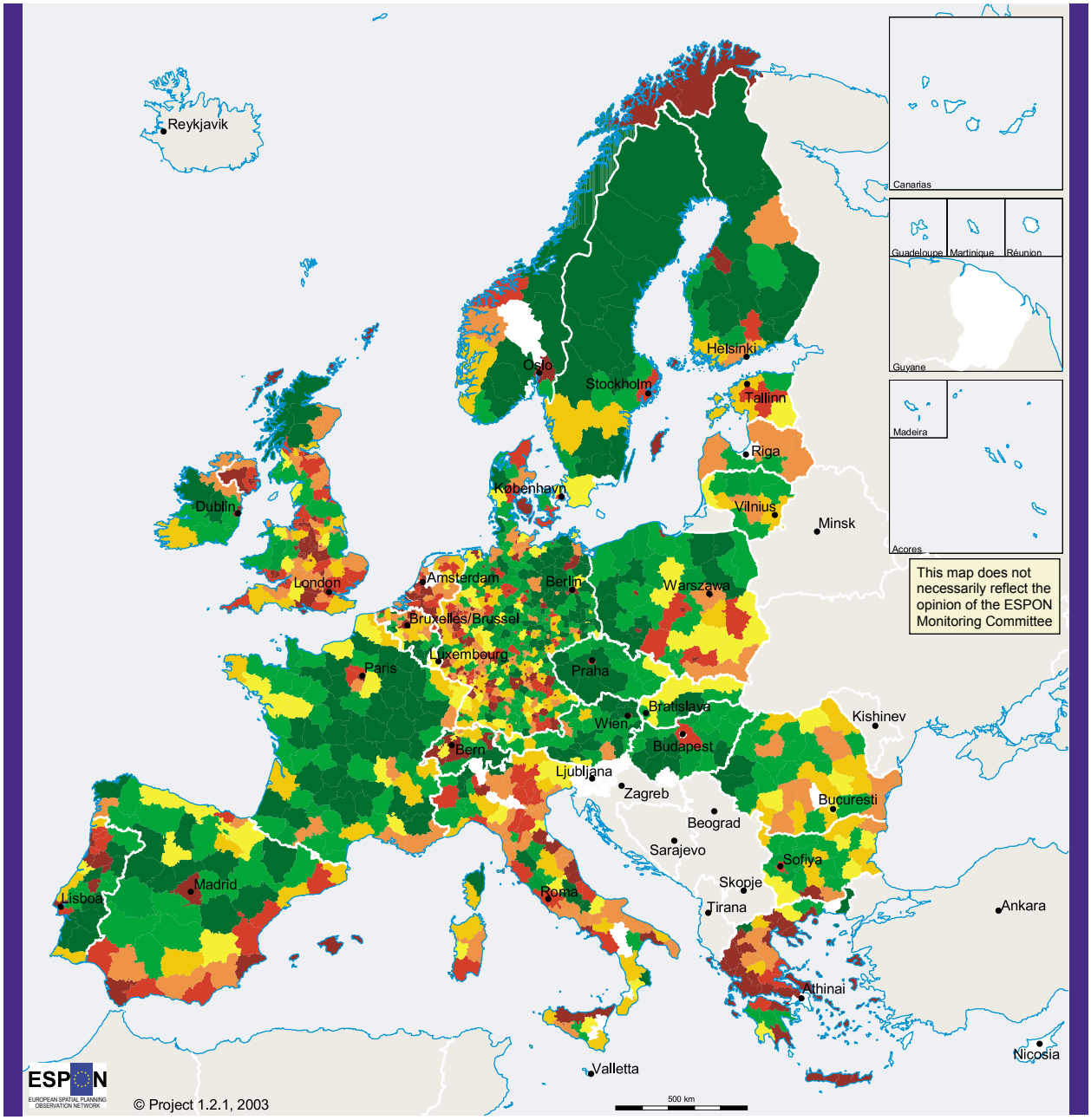
The situation of the northern periphery and of the accession countries is quite the reverse of that related to the motorways and expressways density. Large parts of these areas have a railway density per head above the EU-27 average, with some exceptions (Romania, southern Poland, Latvia and Estonia). In the EU-15, peripheral areas with significant above-average (higher than 140%) railway densities are to be found in northern Scotland, central/western Ireland, Galicia, Alentejo and large parts of central and northern Spain. Large parts of France also have an above-average railway density.

A striking fact is that areas with a low railway density almost exactly duplicate the "Blue Banana", with a prolongation towards the south covering central and southern Italy. Other areas with a low railway density are situated along the whole Mediterranean coast of Spain, in Sardinia, most parts of Greece, the northern half of Portugal, as well as in a number of smaller areas of west Germany.

The map reflects the fact that railways are generally much older than motorways and their density did not follow the large-scale urbanisation of the second half of the 19th century. Therefore, their density per head is higher is less urbanised regions.

Map 16

Density of rail lines by population



km of network 2001/population 1999 (ESPON Space=100)

- up to 20
- 20 up to 40
- 40 up to 60
- 60 up to 80
- 80 up to 100
- 100 up to 120
- 120 up to 140
- 140 up to 160
- 160 up to 180
- 180 and more
- no data

Origin of data: ASSEMBLING graph GISCO

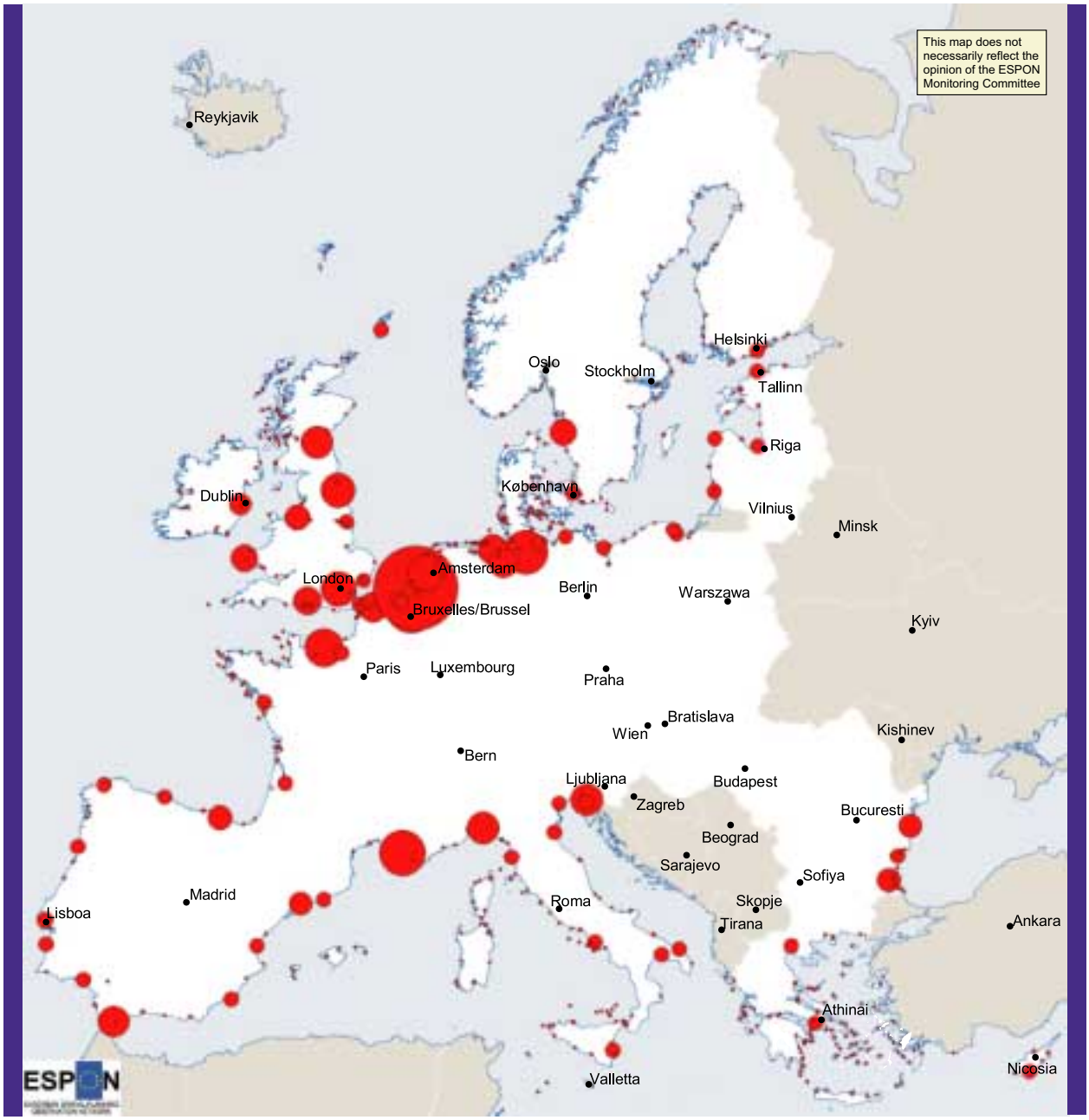
Source: ESPON Database

Commercial seaport infrastructure

Commercial seaports with more than 5 million tons turnover are rather well distributed throughout the various European seaboards (Map 17). If one takes into account their size and turnover, the picture is exactly the reverse. There is an overwhelming concentration of very large ports in the Channel and North Sea area (Rotterdam, Antwerp, Bremen, Hamburg, Le Havre) and only three of this category (Marseilles, Genoa, Trieste) in the northern Mediterranean. The Baltic Sea, the Atlantic coast, the rest of the Mediterranean and the western Black Sea only have medium-sized and small commercial ports.

Map 17

Commercial seaports infrastructure



Millions of tonnes 2000

- 200
- 50
- 10
- 5

Origin of data: European Commission

Source: ESPON Database

Commercial airports

As in the case of commercial seaports, the spatial distribution of commercial airports throughout the territory of EU-27 is rather well balanced if their size is left out of consideration (Map 18). Areas with relatively low airport density can be found in Spain (outside Madrid and the coastal regions), central France (outside Paris), Bulgaria and Romania (outside the capital regions) and the Baltic states (outside the capital regions). If airport traffic is considered the picture is rather different, with a strong concentration of very large airports in the Pentagon, followed by another concentration of large and medium-sized airports in the Mediterranean regions, in particular where tourism is important. In the accession countries and Nordic countries, large airports are primarily those of the capital cities. The largest number of small airports (traffic below 500 000 passengers per year) is to be found in the Nordic countries and in the accession countries, outside the capital regions.

Map 18

Commercial airports infrastructure

Millions of passengers 2000

- 64,5
- 16
- 5
- 0,5

Origin of data: European Commisson

Source: ESPON Database

Transport infrastructure contributes significantly to territorial competitiveness. The density of motorways and expressways per head shows a centre-periphery pattern. The less endowed areas are the accession countries and the northern periphery.

The situation of these regions is quite the reverse when considering the density of rail lines per head. A striking fact is that areas with low railway density almost exactly duplicate the "Blue Banana", with a prolongation towards central and southern Italy. Other areas with low railway density are situated along the whole Mediterranean coast of Spain, Sardinia, most parts of Greece, the northern half of Portugal, as well as in a number of smaller areas in west Germany.

Turning to the size and turnover of seaports, very large ports are concentrated in the Channel and North Sea area. On the basis of airport traffic, a strong concentration of very large airports is to be found in the Pentagon, followed by another concentration of large and medium-sized airports in the Mediterranean regions.

A more even distribution of the infrastructure endowment of regions would contribute to greater equilibrium in their territorial competitiveness.

Territorial disparities in connectivity to major networks and the role of secondary networks[11]

The connectivity to transport terminals has been calculated for all NUTS 3 centroids of the ESPON space, using the road transport network in 2001. A partial measurement of connectivity can be made for each type of network and terminal (motorways, railways, airports, seaports). These partial measurements can be aggregated for all available terminals and all transport networks, to give a synthetic measure of spatial connectivity to transport networks.

As far as connectivity to motorways is concerned (Map 19), there is a clear distinction between eastern countries and EU-15 countries, especially those in the EU core (The Netherlands, Belgium and the west of Germany). The latter is served by a dense motorway network. Connectivity in accession countries is much lower (with the exception of Slovenia and Bulgaria), in particular in their eastern regions. It has to be noted that nearly all country capitals in the EU are linked to a motorway network. This does not happen in certain isolated areas, particularly on the EU periphery and on the EU borders with the accession countries. Even between these countries (Poland, Romania and Bulgaria) some missing links remain to be established.

Considering the connectivity to railway stations (Map 20), the whole ESPON space is well served by stations with a service of 75 interregional trains per day. There are only few areas of significant size which are not well served. There is a strong coincidence between these areas and mountain areas on the one hand, as well as with remote rural areas in the Nordic and Baltic countries on the other hand.

Most coastal regions (except most Scandinavian ones which have only small fishing ports) have good seaport infrastructure. However, the size of their hinterlands is dependent upon the existing road network.

11) The ICON (Connectivity to transport terminals) evaluates the connectivity of any place as their minimum access time by road to the closest transportation nodes (e.g., the closest motorway entrance, the closest railway station, and the closest commercial port…) and the utility that the node provides in terms of service provision (facility to get access to all possible destinations).

Map 19

Cost to motorway entrances

Acess time

0' - 10'	1h 30' - 1h 40'
10' - 20'	1h 40' - 1h 50'
20' - 30'	1h 50' - 2h
30' - 40'	2h' - 2h 10'
40' - 50'	2h 10' - 2h 20'
50' - 1h	2h 20' - 2h 30'
1h - 1h 10'	2h 30' - 2h 40'
1h 10' - 1h 20'	2h 40' - 2h 50'
1h 20' - 1h 30'	2h 50' - 3h

Origin of data: ASSEMBLING graph GISCO

Source: ESPON Database

In EU core countries, major airports with good services are spread through. This is not the case for the peripheral EU countries like Spain, Sweden and Finland, nor for the accession countries, where the hinterlands are small and are surrounded by inefficiently connected regions. Extreme cases are the Scandinavian countries where only the metropolitan areas of each capital are well connected to well-serviced airports: the rest of the territory is hardly connected. It seems as if in accession countries main airports do not act as hubs for secondary hubs in the rest of the territory.

Summing up, serious deficits in connectivity exist in the southwestern, northwestern, northern and eastern European peripheries. The level of connectivity is in direct relation to the extent and quality of secondary networks, in particular road networks. This is an important message for regional and local policies. Connectivity is also low in regions where the major networks are weak (motorway networks in central and eastern Europe, airports in a number of large rural regions), which is a more structural problem.

The improvement of the connectivity of peripheral regions and countries is an important task for the years to come in the context of regional and spatial development policies. It is particularly important to ensure that the discrepancy in terms of connectivity between the central and the peripheral regions, notably those of the accession countries, does not further increase.

Map 20

Connectivity to rail stations

Acess time

0' - 10'	1h 30' - 1h 40'
10' - 20'	1h 40' - 1h 50'
20' - 30'	1h 50' - 2h
30' - 40'	2h' - 2h 10'
40' - 50'	2h 10' - 2h 20'
50' - 1h	2h 20' - 2h 30'
1h - 1h 10'	2h 30' - 2h 40'
1h 10' - 1h 20'	2h 40' - 2h 50'
1h 20' - 1h 30'	2h 50' - 3h

Origin of data: ASSEMBLING graph GISCO

Source: ESPON Database

2.1.5. Territorial impact of current EU transport policy (the SASI model)

Transport policies have important territorial impacts[12], in particular through the development of infrastructure and through pricing policy. Impacts are mainly identified on accessibility and regional economic development. The analysis of territorial impacts of the EU Transport and TEN policies has been carried out on the basis of 10 scenarios. The results of the application of the SASI[13] model are presented below. The ten policy scenarios are the following:

Transport scenarios

Policy scenario	Transport characteristics
A1 Infrastructure	Implementation of all rail projects 1991-2001
A2 Infrastructure	Implementation of all road projects 1991-2001
A3 Infrastructure	Implementation of all projects (road and rail) 1991-2001
B1 Infrastructure	Implementation of all most probable rail projects 2001-2021
B2 Infrastructure	Implementation of all most probable road projects 2001-2021
B3 Infrastructure	Implementation of all most probable projects (road and rail) 2001-2021
C1 Pricing	Reduction in the price of rail transport
C2 Pricing	Rise in the price of road transport
C3 Pricing	Social marginal cost pricing of all transport modes
D Pricing and Infrastructure	Implementation of all projects 2001-2021 and marginal cost pricing of all transport modes (B3 + C3)

Scenarios A1-A3 analyse the spatial impacts of transport policies already implemented. Scenarios B1-D analyse the likely effects of possible future transport policies.

Accessibility is improved in all A and B scenarios, as these assume infrastructure investments and improvements compared to their respective reference scenarios. Scenario C1, in which rail transport fares are reduced, results in an increase in accessibility. Scenarios C2 and C3, in which transport prices are increased, result in a reduction of accessibility. The relatively large differences in accessibility translate into only very small differences in GDP per capita. Despite the huge transport investments in some scenarios, no region gains more than a few percent in GDP per capita as a consequence of these investments. Further, this is over a period of one (in scenarios A1-A3) or even two decades (in scenarios B1-D). The huge investments for the Trans-European Transport Networks (TEN-T) have not brought much overall economic growth to the member states of the EU-15 in the past (scenarios A1-A3), nor are they likely to do so in the future (scenarios B1-D). The effects for the candidate countries (CC12) are much larger. In

12) Cf. ESPON project 2.1.1. "Territorial impact of EU Transport and TEN Policies" led by the Institut für Regionalforschung in Kiel (Germany)

13) The SASI model is a simulation model of socio-economic development of regions in Europe which takes into account as input variables the economic and demographic development of the ESPON Space as well as transport infrastructure investments and transport system improvements, in particular of the trans-European transport networks (TEN-T) and TINA networks. For each region the model forecasts the development of accessibility, GDP per capita and unemployment. In addition cohesion indicators expressing the impact of transport infrastructure investments and transport system improvements on the convergence (or divergence) of socio-economic development in the regions Union are calculated.

the future those for the candidate countries are even larger, because of the expected implementation of the TINA projects.

In both the past and the future, the effects of road infrastructure projects on development potential[14] (scenarios A2 and B2) are significantly larger than those of rail infrastructure projects (scenarios A1 and B1). In the years 1991-2001 only few new high-speed rail lines are opened in scenario A1, mainly in France and Spain. Therefore, the relative effect for the candidate countries is negative. Rail scenario A1 in the past decade favours mostly central European regions, whereas road scenario A2 has a clear cohesion effect (in relative terms). Because the effects of road infrastructure investments are much stronger, scenario A3 (Map 21), in which both road and rail projects are implemented, is very similar to scenario A2. The prospective infrastructure scenarios have a pro-cohesion effect (in relative terms) with the strongest effects in scenario B3, in which all road and rail TEN and TINA projects are assumed to have been implemented.

As far as pricing scenarios are concerned, a reduction of rail fares (scenario C1) has similar effects as building infrastructure. It benefits numerous regions with a peripheral character, but also a number of regions with a more central character. Therefore, it has a rather positive impact on cohesion, but with some exceptions. However, its overall impact on the economy of regions is modest.

The two pricing scenarios with cost increases (scenarios C2 and C3) generally have negative impacts on the economy of regions (GDP is decreasing everywhere), because they increase the cost of trade and mobility. The negative impact is generally stronger in less developed regions (northern periphery, western parts of the Iberian Peninsula, northern parts of Scotland and Ireland, southern Italy), although less negative impacts on development potential arise in the eastern part of EU-27 (accession countries) and in the inner part of the Iberian Peninsula and France. The two pricing scenarios with cost increases (scenarios C2 and C3) widen disparities in accessibility, but the effects in both relative and absolute terms are very small. These scenarios are generally not favourable to cohesion, with some exceptions

Summing up, transport investments have a positive impact on total GDP while increasing transport costs have a somewhat larger negative impact. Transport investments have a larger positive impact on total development potential (sum of development potential over all NUTS 3 regions) than on total GDP (approximately 3%). The negative impacts on development potential of increasing transport costs are about half as large (-1.5%). Transport investments have considerable positive effects on the development potential of many regions outside the Pentagon (defined by the metropolises of London, Paris, Milan, Munich and Hamburg). Large positive impacts are observed in northeastern Spain, the coastal regions of Italy (particularly on the east coast), other Italian regions and in southern Scandinavia. Positive impacts are also observed in the southern part of east-central Europe.

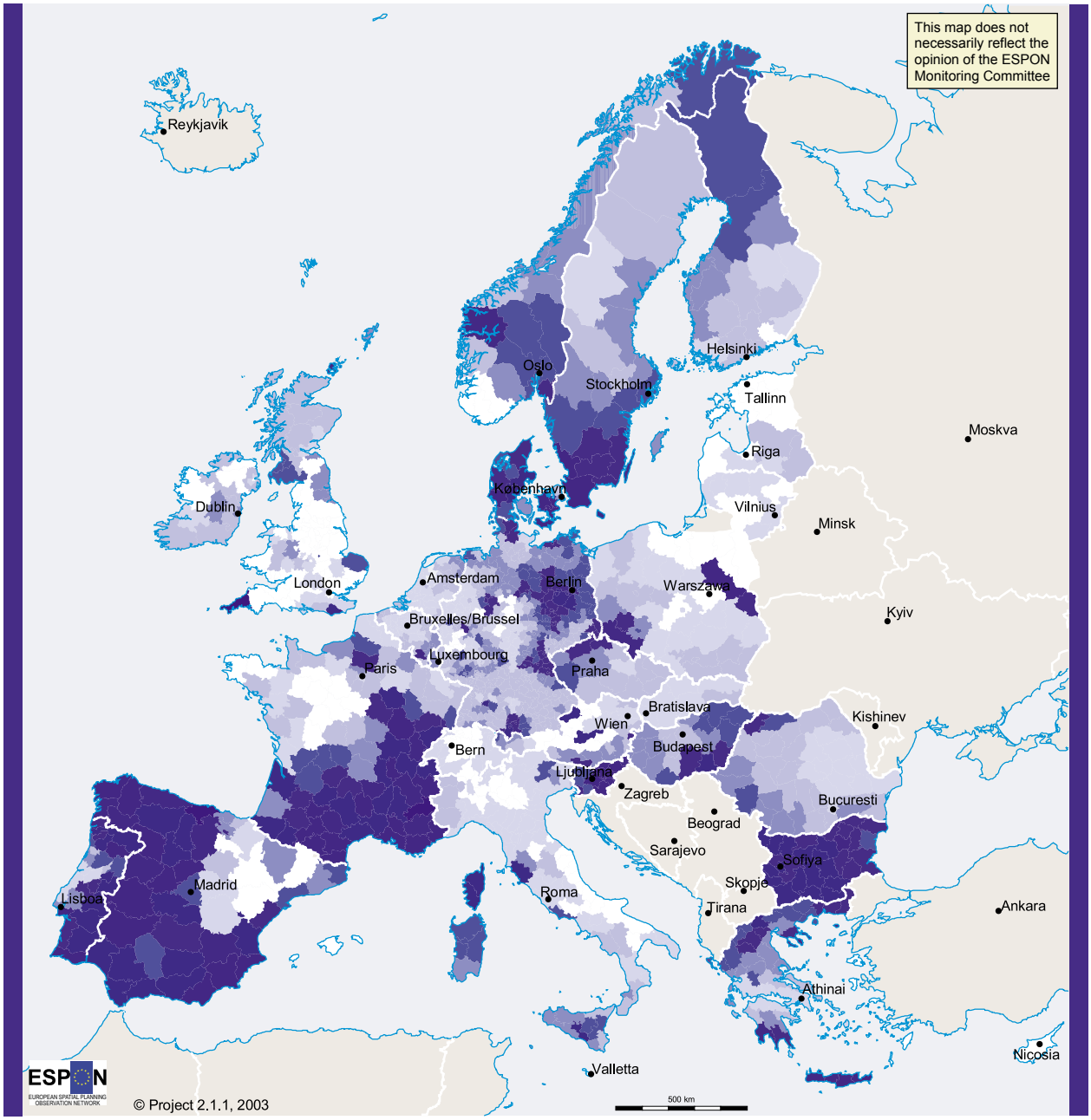
14) Polycentric effects of EU Transport and TEN Policies combines indicators for the dimensions mass, competitiveness, connectivity and development trend into a composite indicator of development potential.

The effects of the combined investment and marginal cost pricing scenario (Map 22) are similar to the impacts of investments, but with relatively improved positions in regions in east-central Europe and with a large share of positive impacts outside the Pentagon. Marginal cost pricing improves the relative position of some peripheral regions and most accession countries in terms of development potential. But it is rather detrimental to most peripheral regions. Transport investments improve the relative position of semi-central regions, mainly outside the Pentagon and of a number of most peripheral regions.

The combined investment and marginal pricing scenario mainly extends the regions with improved relative positions to areas in the eastern part of the Pentagon and east-central European regions outside the Pentagon. The results indicate that transport policy (investments and/or pricing) can potentially be used to encourage various forms of polycentric development. It must however be questioned how far it is realistic to assume the complete realisation of the TEN-T and TINA networks in a period of 20 years.

Map 21

Simulation of Scenario A3: Implementation of all Road and Rail Projects 1991 - 2001



Welfare Change in percent of GDP

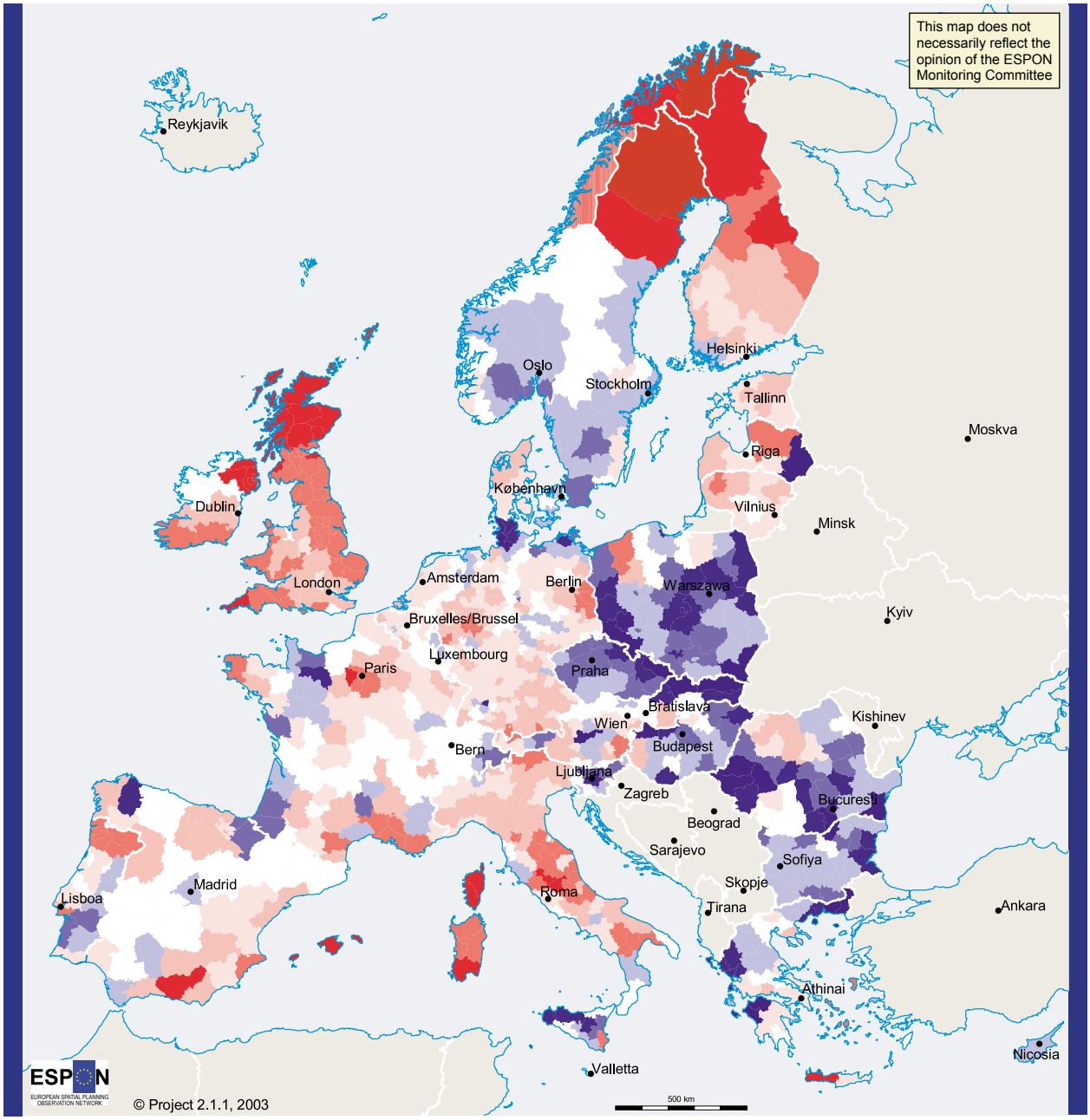
- -0.034 - 0.129
- 0.129 - 0.197
- 0.197 - 0.270
- 0.270 - 0.359
- 0.359 - 0.476
- 0.476 - 0.614
- 0.614 - 0.812
- 0.812 - 1.166
- 1.166 - 1.888
- 1.888 - 3.320

Origin of data: Eurostat, National Statistical Offices

Source: ESPON Database

Map 22

Simulation of Scenario D: Implementation of all Road and Rail projects 2001 - 2021 and Rise of Prices for all Modes of Transport



Welfare Change in percent of GDP

- -1.021 - -0.581
- -0.581 - -0.295
- -0.295 - -0.174
- -0.174 - -0.097
- -0.097 - -0.017
- -0.017 - 0.086
- 0.086 - 0.211
- 0.211 - 0.372
- 0.372 - 0.570
- 0.570 - 1.028

Origin of data: Eurostat, National Statistical Offices

Source: ESPON Database

2.2. Accessibility/Telecommunications[15]

The availability of information has become one of the most important driving forces of the economy in the context of globalisation and, therefore, of territorial competitiveness. As a result, the infrastructure and technologies enabling the movement of information have gained a strategic importance, similar to that of conventional transport infrastructure. However, a significant difference with transport infrastructure and systems is that telecommunication systems are subject to rapid change. The combination of the liberalisation of telecommunication markets in the 1980s and 1990s (a process which is continuing) and the development and deployment of new technologies has created a highly dynamic telecommunication environment in Europe. This dynamism means that the situation in respect of territorial patterns of investments and uptake are constantly changing.

It is important to understand the different territorial effects (and potential territorial effects) of the various telecommunication technologies, but also to understand the close relationships and synergies between these technologies. In this context, technologies related to the Internet play a dominating part and the territorial imbalances which may be generated in the process of adoption, in particular between urban and rural areas, create a differential in territorial attractiveness.

2.2.1. Territorial imbalances in ICT penetration

Terrestrial fixed line networks

Although the main focus of ICT policy relating to networks and services now tends to be the Internet and broadband, terrestrial fixed line networks remain important. Not only are they still crucial for most users of basic voice telephony, but the historical investment patterns in fixed telephone networks also have an impact on patterns of investment in newer technologies. Substantial investment in telecommunications networks – much of it supported by the Structural Funds – has largely removed supply-side bottlenecks in EU-15.

Some of the candidate countries have relatively few installed telephone lines, with Poland, Slovakia and Romania having fewer than 30 main telephone lines per 100 inhabitants. The figure for Romania is as low as 19 per100 inhabitants. However, the candidate countries do tend to have higher growth rates in the number of lines, suggesting some 'closing of the gap'. This is not surprising as fixed telephony may have reached saturation point in existing Member States, particularly in the light of the growth of mobile telephony. The 'gap' in fixed telephony may not close completely, however, as EUCCs may substitute investment in mobile telephony for investment in fixed telephony. A number of countries in both EU-15 and in EUCC are beginning to experience a decline in fixed telephony, as measured by main telephone lines per 100 inhabitants. It is likely that some EUCCs will not reach the level of fixed telephony experienced by EU-15 countries as alternative technologies will be used. There is reason to suppose that fixed voice telephony is becoming relatively less important. As a result the nature of network investment (and perhaps the focus of public support for investment) will differ from that of the recent past.

There are differences within countries in respect of uptake of fixed telephony. The largest city generally has a higher teledensity than the rest of the country. In some countries – notably Slovakia, Romania, Portugal, Malta and Latvia – the differential is substantial, with the largest city having a teledensity more than twice that of the rest of the country. However, there are exceptions, such as Poland.

15) Cf. ESPON Project 1.2.2. "Telecommunication services and networks: territorial trends and basic supply of infrastructure for territorial cohesion" led by the Centre for Urban and Regional Studies of the University of Newcastle upon Tyne

Digitalisation of switching and transmission

The most important technological advance in telecommunications networks over the past 20 years has been the digitalisation of switching and transmission. This has provided the basis for the wide range of advanced digital services with which we are now familiar. The first stage digitalisation process has been completed in most, but not all, of the EU 15, remaining to be completed in Greece, the Netherlands and Spain. A number of the candidate countries will have to make substantial efforts to complete the digitisation of the exchanges in their basic networks, with Romania, Bulgaria, Latvia and Lithuania having less than 50% of their main telephone lines connected to digital exchanges. Strategies are in place to digitise the networks in these countries, but the process may take some time. In Bulgaria there is a target of 60% digitalisation by 2005. In EU 15, exchanges tended to be digitised first in urban areas. Exchanges in many rural areas were only digitised several years later. A similar pattern is apparent in EUCCs.

Mobile telephony

In 1999, the penetration of mobile telephony across the regions of EU 15 displayed very wide disparities, with very high levels of penetration in the Nordic countries, Italy and Portugal, and very low levels of penetration in France and Germany. Interestingly, mobile telephony then appears to have broken with the conventional pattern of rich-poor disparity. In 2001, in the context of EU-27+2, Italy remains in the highest penetration category. Countries such as Greece, Slovenia and the Czech Republic are in the same category as Sweden, Finland and the rest of Western Europe (France and Germany have 'caught up'). Although most of the EUCCs are at the low end of the adoption spectrum, they are displaying the highest rates of growth in their subscription base.

Turning to the situation within countries, the position also seems to be quite positive in terms of territorial coverage. In all countries considered by the analysis, most of the territory is covered, the exceptions being very remote and mountainous areas and some border areas. This does not mean that there was no lag in rollout or uptake in mobile telephony, but it does suggest that the lag was of relatively short duration. It should be added that not all areas are covered by all operators, as licenses granted to operators have different requirements in terms of population coverage. Those operators with more limited coverage will tend to concentrate on urban areas and business users, thereby leaving differences in levels of choice in different regions.

Mobile is then a technology which is widely diffused in a very short space of time; not confined to the more prosperous regions; and facilitates a 'catch up' process in those countries and regions which have lagged in the provision and adoption of previous telecommunications services. To date, mobile has mainly been used for voice and, increasingly, text messaging. The speed of rollout of first and second generation mobile; its widespread territorial coverage; and its rapid uptake suggests that future mobile technology will provide opportunities for citizens and businesses in more sparsely populated areas to gain access to the Internet.

The Internet

The most important current differentiator for participation in the information society is use of the Internet (Map 23). The highest levels, with in excess of 50 Internet users per 100 inhabitants, are estimated as occurring in the capital city regions of the most Internet-adoptive countries (Vienna, Brussels, Uusimaa (Helsinki), Ile de France, London, Stockholm and Luxembourg). The highest levels are also found in a few other particularly prosperous and economically dynamic regions in Germany (Oberbayern; Bremen; Hamburg) and the UK (Berkshire, Bucks and Oxfordshire). Regions in Sweden, Denmark, the Netherlands,

Belgium, the UK, Germany and Austria dominate the highest levels of predicted Internet penetration. There is, therefore, a strong association between high levels of Internet penetration and the prosperous metropolitan regions of the 'Blue Banana' and the regions of the Nordic countries.

At the opposite end of the spectrum, the lowest levels of predicted Internet penetration (less than 15 Internet users per 100 inhabitants) are found in the two poorest regions of Spain (Galicia and Extramadura); regions of Portugal, except Lisboa and the Algarve; all regions of Greece, except Attiki (Athens) and Notio Aigaio (North Aegean); Slovenia; all regions of the Czech Republic except for Praha (Prague); all regions of Slovakia except for Bratislavsky (Bratislava); all regions of Hungary except for Kozep-Magyarorszag (Budapest); all regions of Romania and Poland; and in Estonia, Latvia and Lithuania. The estimated pattern of low Internet usage is, therefore, starkly defined in geographical terms. It encompasses the poorer parts of the Iberian Peninsula, most of Greece and most of the regions of the candidate countries, with the exception of some capital cities.

Rural areas are generally lagging behind metropolitan and urban areas in the current Member States. This gap is not new. A lag in take up of the Internet between urban and rural areas of about 1 year persisted throughout the second half of the 1990s. This urban-rural gap may be exacerbated by the differential rollout of broadband, which national studies suggest are currently favouring, and are likely to continue to favour urban areas, in the absence of suitable public policies. Urban areas users are more likely to use the Internet on a daily basis. Further, the gap is widening over time rather than narrowing.

A remarkably consistent pattern emerges across the different categories and uses of e-commerce. The Nordic countries and Germany are making the fullest use of e-commerce as a tool of business competitiveness, while firms in Greece, Italy and Spain are making very limited use of the new opportunities. Portugal is an unusual case in that although many of its firms are connected to the Internet, often by DSL or broadband connections, they appear to making little commercial use of these connections. This is evidence of a pronounced 'digital divide' between territories in Europe in terms of their business usage of the Internet, which is likely to have significant implications for regional development disparities.

The highest estimated incidence of firms with their own websites (in excess of 60% of total firms) are to be found in the following regions: Stockholm; Denmark; Ussimaa (Helsinki); Brussels and Antwerp; Utrecht, Noord-Holland and Groningen; Luxembourg; Ile de France; 9 regions of Germany, led by Hamburg, Bremen and Oberbayern; Vienna; and 10 regions in the UK, including London and most of the regions adjacent to it, Cheshire, and North East Scotland. Among the 'top half" regions, there are no regions from Portugal, Greece or any of the candidate countries. The lowest estimated incidence of firms with their own websites (less than 25%) are found in a number of Greek regions; many regions of Poland; and in all of Romania with the exception of Bucharest. Of the candidate countries, Bulgaria, the Czech Republic, Slovenia, Slovakia, Hungary, Cyprus, Malta, Latvia and Estonia tend to display a higher estimated incidence of firms with their own websites than do Lithuania, Poland and Romania[16].

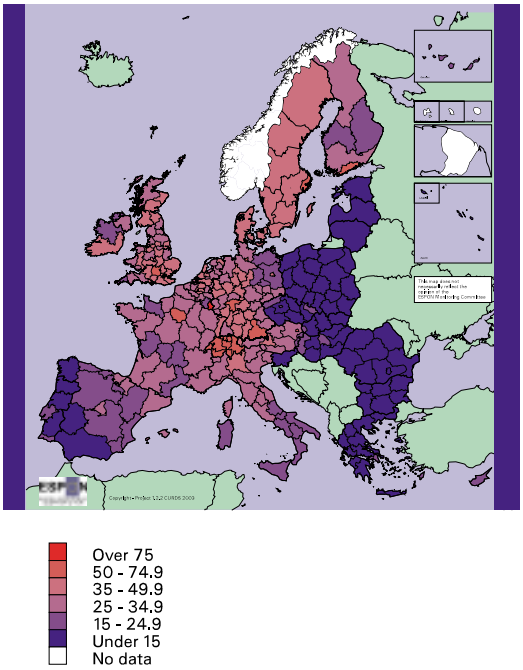
Broadband technologies

Overall rates of broadband penetration (uptake) remain relatively low in comparison to other more mature technologies. There are significant differences in the degree of broadband penetration across Europe. Generally speaking there is a north-south divide, with northern countries taking the first four

16)The map on the estimated number of internet users is based on predicted (i.e. not real data). The map represents "work in progress" and will be updated for the Final Report of the project.

Map 23

Estimated number of internet users per 100 inhabitants



places. There is also a west-east divide. The situation is, however, complex. Not all northern countries come in the top cohort and it is notable that the southern (cohesion) countries Spain and Portugal have a higher penetration than France and the United Kingdom. Similarly, some accession countries have higher rates of penetration than do member states. Malta, Estonia and Slovenia outstrip France, the UK and Italy, whilst Cyprus, Hungary, Lithuania and Latvia all have higher levels of penetration than Ireland and Greece. The other EUCCs (Bulgaria, Czech Republic, Poland and Romania) have not yet rolled out DSL or cable-modem broadband or have done so very recently and fall within the bottom quartile. In the Netherlands and Austria, for example, the relatively high rates of broadband penetration are associated primarily with cable modems rather than DSL.

The incumbents first invest in the largest urban areas and then roll out upgrades in smaller cities and towns. In some places firms are targeted first. New entrants follow a similar strategy, initially targeting the unbundled exchanges of the main cities.

It is important to consider telecommunications territoriality at the lowest possible spatial scale. When mapped at NUTS 2 level, regional bands show the highest penetration at regional level. However, when mapped at NUTS 5 level it becomes clear that there is no generalised regional effect. Densely populated areas fare better than more sparsely populated areas in all regions: the roll out of broadband follows the network of cities. Apparent regional variations in broadband coverage are explained primarily by their different composition in terms of urban and rural areas.

Some places will not obtain access to broadband technologies if development is left solely to the market. This is particularly true of those technologies currently being most rapidly rolled out – ADSL and cable modem. These appear to have an 'urban bias' in terms of the techno-commercial model adopted by telecoms providers. Alternative broadband technologies may hold out some hope for more rural areas, though it should not be assumed that there is automatically a market for these new technologies.

Telecommunication systems are subject to rapid changes. The combination of liberalisation of telecommunication markets and the development and deployment of new technologies has created a highly dynamic telecommunication environment in Europe. The sector of fixed line networks remains important for basic voice telephony, but also for investment patterns in newer technologies. Shortcomings in this sector are important in a number of candidate countries.

Within countries, differences in tele-density can be observed between the large cities and rural areas. Digitalisation of switching and transmission has been completed in most EU-15 countries. Substantial efforts still have to be made in the candidate countries. The penetration of mobile telephony is progressing rapidly with a number of peripheral countries (Nordic countries, Italy) having the highest rates. Although most candidate countries still have low rates of adoption, they are displaying the highest growth rates. In all countries, most of the territory is covered, the exceptions being very remote and mountainous areas and some border areas.

As far as usage of the Internet is concerned, important differences can be observed between the centre and the periphery, although large cities in the periphery have satisfactory levels of Internet usage. Rural areas are generally lagging behind. In the field of broadband penetration. Both a north-south and an east-west divide can be observed, with a number of exceptions. Some places will not obtain access to broadband technologies if development is left solely to the market.

2.2.2. Centre-periphery model for fibre-optic networks

One of the most important shifts in telecommunications network development in competitive market environments across Europe in the last decade has been that from a predominant reliance on the national networks of traditional incumbent operators to the emergence of a vast number of alternative infrastructures. These have been constructed by new entrant carriers, many on a 'pan-European' scale. The key spatial scale for backbone infrastructure deployment has moved from the national to European level. There is a broad 'three-level' core-intermediary region-periphery distinction at the European scale (Map 24).

First, the regions which have most networks 'noded' in them are to be found in a concentrated core area (Hamburg, London, Düsseldorf, Ile de France, Noord-Holland, Darmstradt, Région Bruxelles-Capitale, Oberbayern and Bremen). The 'core' FUAs of Europe tend to exhibit an almost homogenous pattern of territorial connectivity, with some of them approaching 200 network connections to other places. Nearly all the others have more than 150 links. There are a few exceptions – Köln in Germany has 10 networks passing through it, yet only 139 links to other FUAs. This makes it less linked than Brno and Bratislava.

Secondly, other relatively well 'noded' regions include the major city regions of the Nordic countries (Stockholm, Oslo og Akershus, Sydsverige, Denmark), and most notably, a general Mediterranean-bordering telecommunications 'development corridor' extending from Cataluna through all the regions of southern France to Piemonte and Lombardia in northern Italy. This axis also extends north through Alsace and into the German regions of Karlsruhe, Stuttgart and Mittelfranken. A number of pan-European operators already present in the concentrated core area have looked to extend their deployments towards the south and into the Iberian Peninsula. The 'orienting' or 'crossroads' role of the Rhône-Alpes region can be highlighted. Through its main node, Lyon, many pan-European networks are deployed towards southern France, northern Italy and Spain.

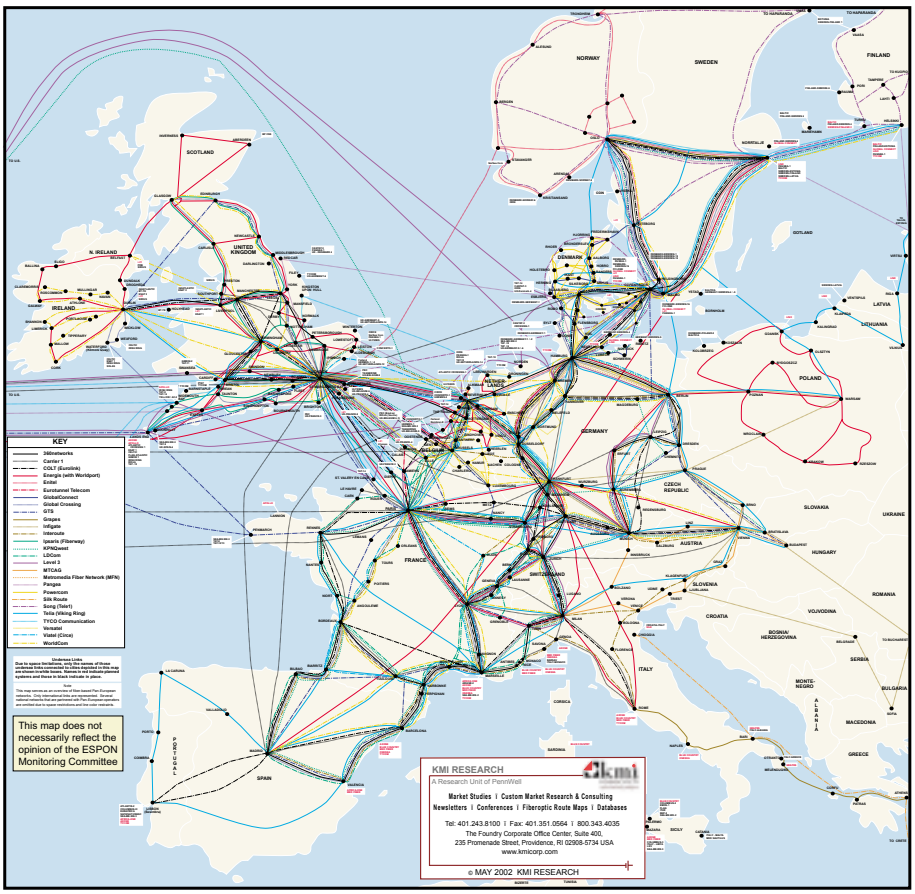
Thirdly, Greece, southern Italy, Portugal, Scotland, northern regions of the Nordic countries and Eastern Europe (beyond Prague and Budapest) have little representation. A Greek or southern Italian city present on 1 or 2 networks is thus only linked to 5 other places, eg Athens, Patras, Naples and Bari. Meanwhile, however, other peripheral cities both in Poland (Bydgoszcz, Krakow, Rzeszow) and the 'Celtic fringe' (Dundalk, Cardiff, Aberdeen, Inverness) are also only present on 1 network, but that network connects them to 83 other places.

In addition to these general trends towards a European territorial 'divide', some of the potentially more positive trends can also be highlighted, particularly around the notion of a polycentric form of territorial development of telecommunications.

In the first place operators are also investing in cities outside the traditional European core. Presumably they see these cities as new or potential nodes capable of generating international traffic and perhaps as 'gateways' to other parts of the expanded European Union and beyond. Examples of such cities are Prague, Budapest and Copenhagen. Potentially these patterns of new investment may contribute towards the policy goal of a more polycentric space, at least at the level of cities. Also, some more regionally focused pan-European networks have concentrated on connecting more peripheral cities. Finally, other pan-European companies have combined the deployment of a very extensive network infrastructure with a series of particular regional or national network loops. These link up a number of more peripheral cities to the overall infrastructure.

Map 24

Pan european fiberoptic network routes planned or in place



These trends explain the emerging importance of urban centres outside the core area of the EU for attracting bandwidth connections (eg. Prague, Toulouse, Leipzig, and, to a slightly lesser extent, Dublin, Oslo). Some 'new network cities' are surpassing some traditionally larger city regions and are a crucial part of a more polycentric European urban system. Some of these emerging urban centres may be viewed as 'gateway cities' for telecommunications bandwidth connections. They act as links between the core area and more peripheral areas (eg. Copenhagen for the Nordic region, Berlin for Poland, Vienna and Prague for south eastern Europe).

The emergence of a Pan-European scale in major telecommunication networks shows a territorial pattern with three categories of regions. Regions with the most noded networks are to be found in the Pentagon. Other relatively well noded regions include the major city regions of the Nordic countries and of the Mediterranean border from Catalonia to northern Italy. The less noded regions are to be found in the periphery. The emergence of urban centres outside the core area for attracting bandwidth connections has a strategic importance.

2.2.3 Territorial impact of ICT (the STIMA model)[17]

The STIMA Model (Spatial Telecommunications Impact Assessment) is a tool enabling the assessment of spatial economic impacts of ICTs investments. From a conceptual point of view, the framework of STIMA[18] is based on the idea that ICTs infrastructure and services are production factors which, together with the traditional labour and capital factors, explain GDP levels.

Assuming that the EU financial effort in the field of ICTs investments in the next 20 years will be equal to 2% of total investments by EU-15 Member States, the financial resources available will be around 20 billion euros. The hypothesis of 2% stems from consideration both of previous EU efforts in this field and of accession countries. On that basis, per capita GDP can be forecasted according to different ICTs scenarios.

Scenario A is based on indiscriminate policy (Map 25). The average per capita GDP growth rate is around 0.99% with a slightly higher effect on lagging regions (+1.06%) and a lower effect on non-lagging ones (+0.97%). GDP growth is equally distributed in most regions, with some peaks (positive and negative) explained by statistical effects. Most of the regions show per capita GDP growth rates between 0.5% and 1.2%. In terms of GDP, this scenario affects all regions in almost the same way. Changes in ICT accessibility and Internet endowment reinforce this conclusion: also these indicators show a well-distributed pattern throughout Europe.

Scenario B called the "efficiency scenario" is based on a strong discrimination in favour of more efficient regions towards which the main investments are directed (Map 26). Moreover, a second differentiation is made in terms of different policy mixes for the two kinds of regions (lagging behind and non-lagging). This scenario presents the highest average growth rate for GDP (approximately 1.10%). The non-lagging regions show a growth rate (1.11%) higher than the lagging ones (1.02%). The lagging regions grow

17) Cf ESPON Project 2.1.1. »Territorial impact of EU transport and TEN policies » led by the Institut für Regionalforschung; Christian-Albrechts-Universität Kiel (Germany)

18) From a methodological point of view, the STIMA model is based on the estimate of a quasi production function and allows the role that ICTs play in regional performance to be measured. The enabling factors regard the general level of economic development of the country analysed, the regulatory regime that characterises the ICTs market in that country, the economic structure and the innovative capacity of the local area.

less than in the indiscriminate scenario, while higher rates of GDP growth take place in advanced regions belonging to the Blue Banana (the Netherlands, Belgium, Luxemburg, French regions along the Rhine) and to the sunbelt (southern regions of France and Spain and northern Italy). A lower increase is shown by the weaker eastern regions of Germany, Scandinavia and the UK. ICT accessibility increases, especially in the Mediterranean lagging regions (south of Spain and Italy) and Portugal, while it shows rates similar to scenario A in more developed or central regions. This result implies a weak effect of accessibility on the GDP growth, while Internet increase explains much more of the GDP increase, because of the higher returns from the investments. Internet connections increase strongly in the non-lagging areas like Northern Italy, southern UK, The Netherlands and Belgium, where the presence of congestion may require higher investments A weaker effect is shown on lagging areas.

In Scenario C (Cohesion Policy), the financial resources are devoted to lagging regions, which record the highest growth rates, compared to the other scenarios (Map 27). The average growth rate in per capita GDP amounts to 0.30%. Non-lagging regions have no GDP increase, while the lagging regions have an average increase of per capita GDP of 1.34%. Thanks to the concentration of investments, not only GDP but also ICT accessibility and Internet connections increase in Objective 1 areas.

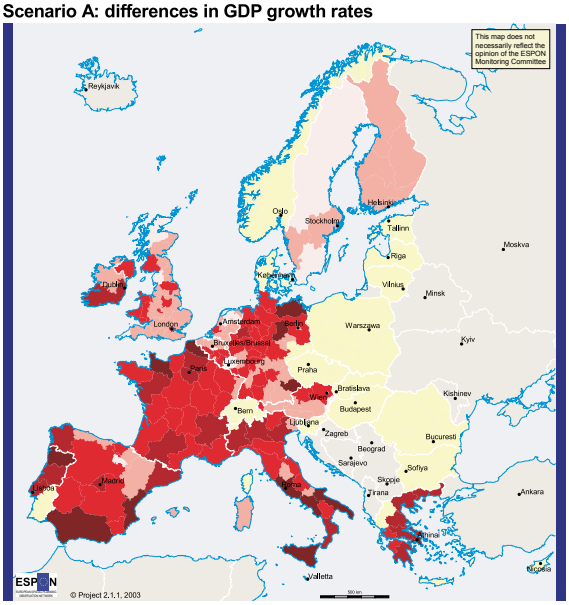
Despite the differences among policies, the impacts of ICTs investments are also influenced by regional characteristics. According to the different reactions to ICTs policies, four different categories of regions can be identified: two clusters composed by lagging regions and two clusters of non-lagging regions. The first cluster contains lagging regions that improve their status only in scenario C. These probably weaker regions need specific cohesion policies to show an increase in per capita GDP. On the contrary, in the second cluster there are lagging regions whose GDP shows an increase in all scenarios. Consequently these regions can be labelled "lagging regions reacting to all ICTs policies". These are probably developing regions, ready to take the opportunity given by new technologies. The third cluster contains non-lagging regions whose GDP is not much improved by ICTs policies. However, these are developed regions that may be already endowed with infrastructure and skills. Finally, the last cluster contains non lagging regions that show a strong increase in GDP in scenario B. These regions react in particular to efficiency policies, probably because these policies eliminate some congestion effects and allow a better exploitation of the current endowment of ICTs and skills.

Summing up, the role of ICT is very important for the creation of GDP, its growth and distribution. Therefore, the EU policies in this sector are extremely relevant, both for efficiency (GDP growth) and for cohesion (GDP distribution). ICTs investments have different marginal efficiencies, depending on the infrastructure or services (ICTs factors) on which they are spent. The choice of infrastructures and services has a critical role on the territorial impact of ICTs policies.

The ICTs policies suggested by the eEurope Action plan could lead to very different scenarios, depending on their regional implementation. The three scenarios described above show the scale of possible impacts on regional income distribution. In addition, within different typologies of regions (objective 1 regions or more advanced regions), different reactions to a specific ICTs policy exist. Within lagging regions, some areas are able to take advantage from all policies applied, while others react exclusively to cohesion policies. Similarly, there are non-lagging regions that react dynamically to ICTs policies, while others seem more static.

Map 25

Scenario A: differences in GDP growth rates

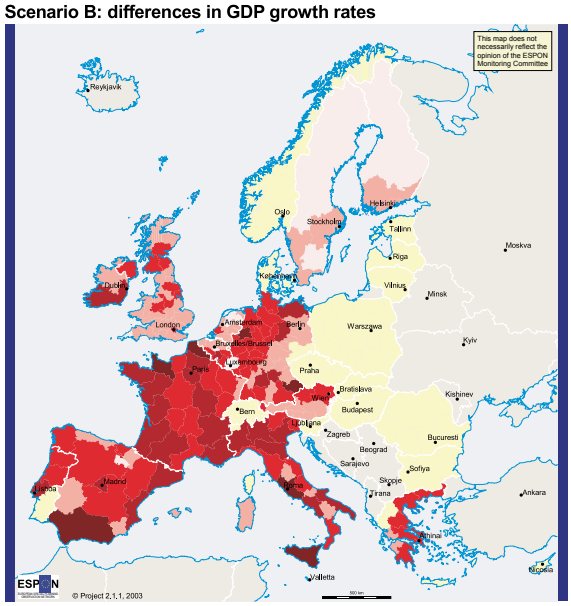


Scenario A - pc GDP growth rate (differences from the EU mean)

- -0.7 - -0.3
- -0.3 - 0.0
- 0.0 - 0.2
- 0.2 - 0.3
- 0.3 - 0.7
- no data

Map 26

Scenario B: differences in GDP growth rates

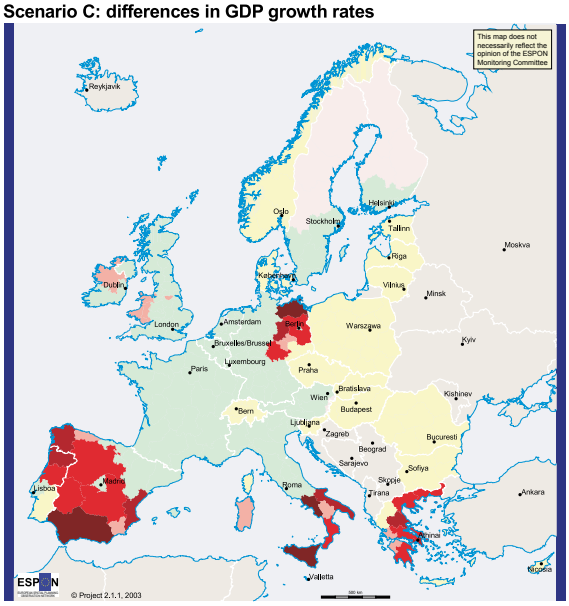


Scenario B - pc GDP growth rate (differences from the EU mean)

- -0.7 - -0.3
- -0.3 - 0.0
- 0.0 - 0.2
- 0.2 - 0.3
- 0.3 - 0.7
- no data

Map 27

Scenario C: differences in GDP growth rates



Scenario C - pc GDP growth rate (differences from the EU mean)

- -0.7 - -0.3
- -0.3 - 0.0
- 0.0 - 0.2
- 0.2 - 0.3
- 0.3 - 0.7
- no data
- not applicable

2.3 Accessibility / Energy[19]

2.3.1 Territorial patterns of the energy sector

At the present stage of the study of this topic only national data are available.

Energy supply

With the exception of Norway, the United Kingdom and, more recently, Denmark, European countries are net importers of energy. The European Union imports about 50% of its primary energy consumption and the dependency rate increased from 51.6% in 2000 to 52.4% in 2001. "Candidate countries" as a whole have a much lesser dependence rate, due to the low dependency level of Poland, Romania and Czech Republic, but several countries do not cover 50% of their energy needs.

In 2000, five countries out of EU-29 had primary energy production above EU-15 average: the UK and Norway had a dominating position, followed by France, Germany and Poland. Most countries are highly dependent on fossil fuels, mainly imported oil, gas and coal. In 2000, the countries least dependent on fossil fuels, such as Sweden, Norway or France, had well developed sources of nuclear or hydro electricity.

The indicator of primary energy supply per capita shows a significant difference between EU and candidate countries, with the exception of Portugal which has low values similar to those of the candidate countries. The indicator reflects differences in welfare of population, the way energy is used (efficiency degree) and the importance and structure of the industrial sector as opposed to the service sector.

Most countries have reduced their dependence on fossil fuels since 1995 by developing alternative sources. Only Austria, Bulgaria, Cyprus and Estonia have raised their dependence between 1995 and 2000. Diversity of supply contributes both to security of supply and to the stability in the broad cost of energy (because alternatives are available). Diversity thus carries benefits for individual consumers and for the national economy. In the case of fuels used for electricity generation, the Shannon-Weiner measure of diversity increased between 1995 and 2000 for a large majority of the 29 countries (exceptions are Austria, Greece, Luxembourg, Sweden, Czech Republic, Hungary and Slovakia). In 2000, countries such as Finland and Slovenia, with higher values of the Shannon-Weiner measure, have energy systems less dependent on a reduced number of fuels.

As far as electricity generation is concerned, balance in the respective shares of coal, gas and nuclear power has increased. Further diversification is likely to occur if renewable sources take a larger share in generation capacity. In 2000, the proportion of electricity generated by renewable sources is significant in countries such as Austria, Luxembourg or Norway, although it must be understood that the nature of renewable sources in this context is very different among countries.

Energy demand

In respect of primary energy consumption in 2000, Germany is the largest consumer followed by France and the UK. In the EU countries, a growth of primary energy consumption of about 6% took place between 1995 and 1999, while in the candidate countries the trend was the opposite, with a decline of about 8%.

19) Cf. ESPON project 2.1.4. « Territorial trends of energy services and networks and territorial impact of EU energy policy » led by CEEETA (Portugal)

The current European Union has a structure of final energy consumption by source quite different from Candidate Countries. Oil is the most significant energy source in EU-15, representing about 46%, while in the Candidate Countries the energy consumption is more differentiated among sources, also showing greater diversity among countries.

Although final energy consumption by the domestic and services sectors has increased slowly between 1995 and 2000, these sectors are responsible for nearly 40% of final energy consumption in the European Union in 2000 and for 47% in Candidate Countries in 1999. This makes them the largest energy consuming sectors, ahead of the industrial sector and transport sector, in average terms. It is important to notice that final energy consumption by the transport sector had the most significant growth between 1995 and 2000, about 12% in European Union and 17% in Candidate Countries.

Considering that final energy consumption per capita reflects the welfare of the population, the structure of the economy and the energy efficiency of industrial equipment and buildings, the Scandinavian countries, as well as Luxembourg, have the highest per capita energy consumptions in the country sample selected. Total final energy consumption per capita in the more developed countries is about twice as high as in the Candidate Countries, which is mainly due to higher consumption in the industry and transport sectors. The evolution of electricity consumption per capita shows a general trend of growth in the period 1995 to 2000, with a few exceptions, such as Norway, Bulgaria and Romania.

In 2000, the average final energy consumption per GDP was approximately 0,13 toe per thousand Euros in EU-15 and 0,44 toe per thousand Euros in the Candidate Countries. Large differences exist between countries ranging from 0,09 toe/1000Euros in Switzerland to 0,6 toe/1000Euro in Romania. Besides economic inequality between countries, the difference in this indicator may also reflect differences in energy consumption patterns as well as inefficiency within energy transformation.

Countries vary considerably in the amount of energy each person uses at home. This variation is a combination of many factors, such as climate, household size, comfort levels, energy efficiency and energy prices. Those countries with the lowest levels of household energy use per person, such as Portugal and Spain, have experienced increases in energy use per person between 1995 and 2000.

2.3.2 Territorial impact of EU energy policy and TENS

The primary aim of the European Community's energy policy, as set out in the November 2000 Green Paper on the security of energy supply, is to ensure a supply of energy to all consumers at affordable prices while respecting the environment and promoting healthy competition on the European energy market. The European Union is facing new energy challenges for which it must have an appropriate energy strategy.
Security of the Union's energy supply and protection of the environment have been highly important in recent years. In particular, the signature of the 1997 Kyoto Protocol on Climate Change boosted the importance of the environmental dimension and sustainable development in Community energy policy. The Union's external energy dependence is continuing to grow (it currently meets 50% of its energy requirements through imports). As the Green Paper states, if nothing is done this rate of dependence will grow to 70% by 2030, which would further weaken the Union's position on the international energy market.

The creation of a single market is a part of energy policy and has long been a priority of the Community. In 1996 and 1998, in an important move forward in the construction of the single energy market, Directives were adopted on common rules for electricity and gas. These Directives ensured the free

movement of electricity and gas within the Community. Liberalisation of the electricity and gas markets, which were opened up to major consumers in 1999 and 2000 respectively, has enjoyed some success, though the degree of liberalisation still varies greatly from one Member State to another. The call made at the Lisbon European Council of 23 and 24 March 2000 for the energy markets to be opened up more quickly provided a new major impetus in this area. In March 2001 the Commission adopted a set of measures to open up the gas and electricity markets fully by 2005.

The completion of the internal market for energy is accompanied by measures to strengthen economic and social cohesion, such as the creation of trans-European energy networks. The decisions on the guidelines contain a list of projects of common interest in the trans-European electricity and natural gas networks. Under these guidelines, some 74 projects of common interest have been identified, representing a total investment of EUR 18 000 million. The funding of these projects is largely the responsibility of the operators in this sector. In a number of cases the Union's financial instruments, consisting essentially of EIB loans and ERDF aid, have been mobilised.

The introduction of trans-European energy networks also has an impact on relations with third countries. Interconnections have been made with certain Mediterranean countries, the countries of Central and Eastern Europe and Norway. The CENTREL electricity grid, which covers Poland, the Czech Republic, Slovakia and Hungary, was connected to the UCPTE grid (the main European electricity grid) in 1995. The extension of the UCPTE grid to the Balkan States and its interconnection with the countries of the CIS is the subject of studies being funded by the Community, as are gas links between Eastern and Western Europe.

Energy from renewable energy sources (RES) is playing a key role in the diversification and sustainability of energy sources and the campaign to combat climate change. The Altener programme, set up in 1993 and renewed in 1998, promotes RES in the European Union. The 1997 White Paper provides a strategy and a Community action plan for RES. The prime objective set by the White Paper is to double the proportion of renewable energy sources in the EU gross domestic energy consumption from 6% in 1997 to 12% in 2010. A "take-off" campaign to get RES off the ground is an integral part of the action plan and strategy for 2010 and must act as a catalyst for the development of key renewable energy sectors, for which quantitative targets have been set for 2003.

For the first time, the Green Paper on security of energy supply stresses the fundamental importance of influencing demand rather than concentrating solely on energy supply. In the context of the Kyoto Protocol, improved energy efficiency has become even more than before an important element of Community strategy. In April 2000, the Commission adopted an action plan to improve energy efficiency in the European Community. The SAVE programme encourages energy efficiency measures, and will be the main instrument for coordination of the plan.

As 40% of energy is consumed in the transport sector, which in turn is responsible for 28% of CO2 emissions, the Green Paper stresses the importance of taking transport policy measures to reduce energy consumption. In this connection, the White Paper "European Transport Policy for 2010: time to decide", adopted in September 2001 by the Commission is with its 60 proposals a key instrument to change the present modal split.

Alongside legislative measures or measures designed to encourage changes, technological progress is an important mean of achieving the objectives of the Community energy strategy. The Commission supports research, development and demonstration projects in the field of non-nuclear energy under the ENERGY sub-programme of the Fifth Framework Programme for research and technological development.

Nuclear safety is of particular concern to certain countries, particularly in Eastern Europe. It has a prominent place in the negotiations underway with candidate countries. The TACIS, PHARE and to some extent SURE programmes are involved in measures to improve safety in third countries.

Besides investments in energy facilities, the territorial impacts of EU energy policy are mediated by energy processes. Therefore, it is important to develop a methodology that can evaluate the effects of energy prices on regional GDP. The quantification of environmental impacts is equally important. At the present stage of the study, an input-output framework appears as the most suitable method to quantify the territorial impacts of energy policy.

Summing up, European countries (with the exception of Norway, the UK and Denmark) are net importers of energy. Most countries have reduced their dependence on fossil fuels since 1995 by developing alternative sources. As far as electricity generation is concerned, balance in the respective shares of coal, gas and nuclear power has increased. Further diversification is likely to occur if renewable sources take a larger share in generation capacity.

In the EU countries, a growth of primary energy consumption of about 6% took place between 1995 and 1999, while in the candidate countries the trend was the opposite, with a decline of about 8%. EU policies related to energy are rather diversified, ranging from the creation of a Single European Market for energy to the development of the TEN-E through the promotion of renewable energy sources. The study of the territorial impacts of these policies is in progress.

3. CAP reform from a spatial perspective

Among EU policies, CAP and Rural Development Policy (RDP) are among those that have significant spatial impacts. However, the evolution of CAP in the past ten years and the related liberalisation of the sector have reduced this impact in relative terms. A key factor that needs to be borne in mind is that the CAP is only one of many external factors influencing farm-level decisions and agricultural and rural development. It is difficult to separate out, among all of the other factors and in particular market forces, those changes which can be attributed solely to the existence of the CAP and RDP.

The location of a region also plays a significant role in explaining the level of CAP support it received in 1999. In the case of Pillar 1 support, decreasing peripherality (increasing accessibility) was positively associated with higher levels of support. Hence, the more accessible regions in the EU received higher levels of Pillar 1 support. However, the opposite effect for Pillar 2 support was found: the least accessible regions received, on average, higher levels of support. From a spatial policy perspective, these findings confirm that although Pillar 1 measures are aspatial, they have very discernible spatial impacts.

3.1. Impacts of Pillar 1

The results of the analysis suggest a conflict between the strategic objective of improving social cohesion and the distribution of Pillar 1 support. CAP Pillar 1 support in 1999 was higher in areas where population growth had been most rapid. In addition, regions with larger farms received higher levels of CAP support. Thus, 42% of regions receiving the lowest level of support fell into the smallest farm size category while

64% of those regions receiving the highest level of support fell into the two largest average economic size categories.

Only market price support was distributed in a manner inconsistent with economic cohesion objectives. Crop-related direct income payments tended to be higher in areas with low GDP per capita and high unemployment rates. A similar pattern is evident in relation to direct income payments associated with livestock production (although this relationship is only statistically significant when considering support per UAA).

The introduction of direct payments has led to a more equitable distribution of support between regions of Europe. However, direct income payments remain problematic for two reasons. First, the levels of payments have not been sufficiently linked to the income reductions associated with the lowering of commodity price supports, leading to over-compensation of some farmers. Secondly, there has not been a clearly articulated rationale to support an indefinite continuation of this one-off policy change.

3.2. Impacts of Pillar 2

The results in terms of Pillar 2 support are more ambiguous but, including support from funds for Rural Development, are positively associated with the rate of population growth. However, the situation is more complex because support varies between commodities and, in general, does not differentiate between production conditions. The relative importance of various Pillar 2 measures varies widely between member states. Less Favoured Areas (LFA) payments would tend to be higher in regions with lower per capita GDP and higher unemployment rates. On the other hand, higher levels of agri-environmental payments accrue to richer areas of the EU, whilst the poorer regions of the south and the accession countries prioritise agricultural development measures. In other words, the distribution of agri-environmental payments does not seem consistent with economic cohesion objectives. Results from regression analyses show a positive association between the level of agri-environmental support received by a NUTS 3 region and its level of per capita GDP.

3.3. Assessment of the Implications of Proposed Policy Reforms

Simulations (CAPRI model) of the potential impacts of the proposed policy reform provide the following results. For cereals, regional impacts are found to vary considerably, affecting especially northwest France, all of Germany, northern Italy, southeast England, Denmark, southern Sweden and Finland, and the north-eastern corner of Greece. Spain and Italy are favoured by a special agreement in Agenda 2000 concerning reference yields, which results in substantially higher premia for cereals. CAP payments would change by slightly more than 25% in relatively few regions, such as the Low Countries and parts of northern Germany and northern Italy (increase) and southern France and Austria (decrease). Farm incomes would be only marginally affected, with changes of more than 5% apparent only in a small number of NUTS3 regions in France (mainly in the south) and Austria (both falls) and in some or all of Northern Ireland, Belgium, northern Italy, Denmark and Sweden (all rises).

The CAP reform proposals would increase CAP direct payments more in those NUTS3 regions with higher GDP per inhabitant, i.e. the generally more prosperous areas. In this respect the reform would work against cohesion. CAP premiums would increase more, compared to the benchmark scenario, in those areas with more slowly growing populations in the late 1990s. MTR CAP reform, if anything, would increase farming prosperity (GVA + CAP direct payments) in areas with higher unemployment. The proposals' effects on farm profitability would however have very little effect on economic and social cohesion at NUTS3 level.

The current policies of CAP hardly seem adequate for the structural problems of the CEECs. Decline in livestock production and a modest growth in cereal and oilseed production would be the effect of accession. Rural regions in the enlargement area are affected especially by transformation problems. They show sharp economic spatial disparities and have few urban centres. To a certain extent, the mix of sharp declines in production and employment levels, poor infrastructure and poor transport accessibility could lead to a massive wave of out-migration from rural regions. This would lead to the collapse of their socio-economic viability. Yet, in many accession countries the formulation of rural development policies is at a rather early stage and they are still mainly targeted at the agricultural sector and the basic rural infrastructure.

The ESPON studies show that the CAP and the Rural Development Policy belong to those EU policies having rather strong spatial impacts. Under CAP Pillar 1, market price support has been distributed in a manner inconsistent with economic cohesion objectives. The introduction of direct payments has led to a somewhat more equitable distribution of support between regions of Europe, but remains problematic in various respects. In general, Pillar II resources for the Rural Development Policy are more favourable to economic and social cohesion, but much depends upon the use of resources made by the member states. Simulations of the Mid-Term CAP reform indicate that the reform proposals might work against cohesion. Particular concern is expressed about the impacts of the application of the CAP in accession countries.

4. The spatial dimension of Structural Funds allocations

4.1. Structural Funds in EU-15

As far as the objectives of structural policies[20] are concerned, there is little evidence of the adoption of an explicit spatial approach in the current programmes. However, territorial cohesion has in a number of cases been inferred as one of the policy objectives of the programmes. Territorial cohesion and balance are often mentioned in the programmes among the objectives. The theme of polycentric development is not so apparent in the strategies of the programmes. The theme of rural development still features as an important policy aim.

As far as the geography of Structural Fund spending 1994-99 is concerned, cohesion countries and Objective 1 regions generally received more Structural and Cohesion Fund money than did other regions. Moreover, bearing in mind that Objective 3 programmes and many Community Initiatives covered urban and densely populated areas in particular, which were sometimes not eligible for Objectives 1, 2 or 5b, the number of benefiting regions was even higher. The rural regions received mostly A-Funds (Agriculture, Fishery and Rural Development), since they were generally eligible for Objective 5b. The leading objective for Structural Fund spending was strengthening Regional Development and the Productive Infrastructure (R-Fund). Less expenditure was made by the S-Fund (Social Integration, Human Resources and Training).

From the review of past and current Structural Fund programmes some concerns emerge relating to the extent to which these programmes may have contributed, and/or are contributing, to the objectives of territorial cohesion and polycentric development. There is evidence to suggest that Structural Fund programmes can contribute to achieving (depending largely on national policies) increased territorial

20) Cf ESPON Project 2.2.1. « Territorial effects of Structural Funds » led by NORDREGIO. Stockholm. Second Interim Report.

cohesion and polycentric development. The potential contribution of the Structural Funds to achieving these spatial policy aims will depend on the geographical level in question. This is illustrated by looking at the geography of Structural Fund spending according to the types of Functional Urban Areas. A first assessment on where Structural and Cohesion Fund assistance has been used during the 1994-99 period, shows that more than half has been spent in what is categorised by ESPON 1.1.1 as local or regional functional urban areas. Less than 20% went to the middle level, approximately 10% to the macro level and approximately 15% to areas that are not categorised as functional urban areas.

4.2. Territorial impacts of pre-accession aid

The pre-accession funds[21] provided in the central and eastern European accession countries often do not explicitly address the objectives of territorial cohesion, balanced, spatial competitiveness and spatial integration. In the case of Phare, many of the programmes and projects are developed in the context of overall national and not regional spatial development needs. Most of them refer to EU accession and national development criteria, rather than to spatial development issues. Other than that, project selection was often demand side driven and determined by the project proposals of sectoral ministries. Regional potentials and bottlenecks are, therefore, not necessarily explicitly targeted.

Between 2000 and 2002, pre-accession aid spending has concentrated on measures to improve environmental quality. In many regions 50% or more of the funds' resources were allocated to environmental projects, especially in the Czech Republic, Slovenia and in some regions of Hungary and Romania. Rural regions were eligible, as well as large urban areas. Measures addressing environmental quality are mainly located in the intensely industrialised regions of the Czech Republic and Hungary, together with Slovenia and southern regions of Bulgaria, characterized by the great importance of tourism. The measures do not address economic problems in a direct way, but contribute to the quality of places and thus indirectly to their economic potential as well.

High shares of the pre-accession aid funds (up to 50% and more of total funds) are also allocated to projects improving the geographic position of most regions. Regions benefiting from this spending are found in nearly all accession countries. This mainly arises from investments in transport infrastructure. In most countries, solving accessibility problems is one of the main challenges to achieving a competitive regional structure. This justifies the full use of pre-accession aid, especially ISPA and, after accession, of the Cohesion Funds in their respective fields of action.

The pre-accession funds do not explicitly address spatial objectives such as territorial cohesion, integration and balanced spatial competition. These objectives are affected indirectly by spatial priorities, set by the national governments and the effects of each project on spatial development. Due to the lack of explicit spatial aims, allocation of the funds' resources was spatially more dispersed in the past, rather than addressing the spatial potential and bottlenecks identified by means of indicators. This holds true especially for the PHARE programme, the themes of which are not clearly defined with respect to spatial development. However, ISPA and SAPARD strategies are more linked to spatial objectives, like rural restructuring or completing TINA and TEN corridors, and thus improve the position of the affected regions.

Looking to the future, the 10 new member states, as well as Bulgaria and Romania, have drafted National Development Plans (NDP), which will become the basis of EU co-financed Structural Funds programmes

21) Cf. ESPON Project 2.2.2. « Pre-accession aid and impact analysis » led by the Institute for Regional Development and Structural Planning in Erkner (Germany). Second Interim Report.

in 2004-2006. Therefore, from a European viewpoint it seems to be essential to co-ordinate the plans of neighbouring countries. This particularly affects the Central European Triangle. Between the countries and the NDPs of this central region – possibly also including the eastern German regions near the border – a common trans-national approach has to be found mobilising potential and overcoming bottlenecks in a closely co-ordinated way.

Furthermore, funding should be concentrated on the growth poles of the second and third rank, strengthening growth potential even in peripheral regions. The Central European Triangle might be the core region, from which economic spill-over effects to the rural periphery can be encouraged by Structural Funds' aid. Finally, in order to ensure the complementarity of national and EU policies, ways have to be incorporated in the political process to achieve consistency between accession countries' spending and EU funds.

4.3. Territorial impacts of support to cross-border cooperation in the context of enlargement

The large variety of support schemes for cross-border cooperation[22] and their combinations, and the even larger variety of their respective regulations, make cross-border co-operation a rather complicated enterprise. 16952 kilometres of border are included in 52 cross-border programmes in 7 different combinations, controlled by 3 different directorates of the European Commission (Interreg: DG Regio; PHARE CBC: DG Enlargement; CARDS and TACIS: DG International Relations).

In total, 4022 km of all borders in the region of Central and Eastern Europe (including Balkans) are between accession countries. Since 1995, it has in principle been possible, to utilise PHARE-CBC resources not only on the borders with the EU, but also on borders between accession countries. This facility, however, has been utilised differently, depending on the political relations between the respective countries. Common programmes and EU financing is sometimes easier, if an EU member state is also taking part in the framework of trilateral arrangements.

The largest part, 8622 km of the borders in the region of Central and Eastern Europe (including Balkans) are between accession countries and other countries or between third countries not yet taking part in the accession process. On these borders, so far, no EU support to cross-border co-operation has been available. Though some EU support existed in all countries of the region (TACIS or CARDS) and there are already TACIS CBC and CARDS CBC arrangement as well, cross-border cooperation is not a priority. Notwithstanding this, there are several cross-border cooperation initiatives along these borders, which have no financial means. But there are other borders where not even basic communications exist between the two sides. Examples include the Croatian-Serb border; the Albanian-Montenegrin border; the Croatian-Republika Srbska border in Bosnia-Herzegovina; and the Dnestr border between Moldova and the Ukraine.

For the borders between EU member states and accession countries (2997 km), INTERREG instruments are available for common development programmes on the EU side and PHARE-CBC instruments in the accession countries. The annual PHARE CBC appropriation in the years 2001-2003 was 163 million Euro (10 percent of the PHARE budget). The INTERREG allocation for the neighbouring current EU member states amounts to 146 million Euro annually. It is less than the PHARE CBC budget, but the current 23 EU border regions would receive 16 billion Euro in Objective 1 and 2 regions and they are benefiting also from the LEADER+, EQUAL and URBAN Community Initiatives. For them a special programme was

22) Cf. ESPON Project 1.1.3. « Options for spatially balanced developments in the enlargement of the European Union" (ODEN) led by the Royal Institute of Technology. Stockholm. Second Interim Report.

prepared to compensate the eventual adverse effects of enlargement. After the first wave of enlargement in 2004, 24 new INTERREG programmes are to be established on the new internal and 14 on the new external borders.

Here, the basic problem is not the unequal amount of resources on the two sides (in many cases, the PHARE CBC support is larger than the INTERREG appropriation). The difficulty is rather the different procedures, programming methods and time schedules for INTERREG and PHARE-CBC. Another problem is that borders with EU member states enjoy a privileged position in PHARE-CBC financing, while this privileged and priority treatment does not always coincide with the priorities of national regional policies in the accession countries.

INTERREG and PHARE-CBC programmes refer to the whole border between two countries, except special (e.g. trilateral) programmes aiming at the development of the border regions where the borders of three countries meet. There are many reasons why most of these INTERREG- PHARE-CBC programmes could not become really "common" programmes. One reason is certainly organisational and procedural. The regulations of INTERREG and PHARE CBC differ substantially in respect of decision making and financing. INTERREG is a decentralised initiative, while PHARE CBC is operated in a strongly centralised way. INTERREG programmes are approved as six-seven year programmes, while in the case of PHARE CBC, appropriations are decided annually by the Commission.

Under these conditions INTERREG / PHARE-CBC programmes could be hardly anything more than parallel programmes on two sides of a border. There are, however, not only procedural difficulties, but substantial differences in the contents of the programmes. Most of the EU regions on the EU external borders are Objective 1 or at least Objective 2 regions, where there are other, substantially larger financial sources of development support than INTERREG. Therefore, INTERREG resources are used not for investments serving the provision of basic needs and services, but for secondary development projects , aiming at cultural, recreation, leisure time and tourist developments(riding trails, so called "vine routes", cultural centres, etc.). On the other side of the border, PHARE-CBC is frequently the only source of external support, which is generally used for the provision of basic infrastructure , like feeder roads, water supply and sewage and waste disposal facilities. Therefore, the possibilities for common projects are rather restricted. It would be better if each side developed and submitted projects, according to its specific needs, in contrast to the situation in which preferences and priorities of one side are imposed on the other.

After enlargement, the European Union will face new problems along its new external borders. The EU will have as neighbours four former Soviet republics (Russia, Belarus, the Ukraine and Moldova) and three former Yugoslav republics (Croatia, Serbia- Montenegro and Macedonia). The EU will also have to face the issues raised by the Kaliningrad enclave. TACIS and CARDS appropriations serving cross-border co-operation should be substantially increased. TACIS and CARDS management and regulations within the European Commission should be revised in order to enable the implementation of coordinated and synchronised development programmes on both sides of borders. Especially the new members attach specific importance to the cross-border co-operation with their eastern and southern external neighbours.

The ESPON studies provide evidence suggesting that Structural Funds programmes in the EU-15 can contribute to achieving increased territorial cohesion and polycentric development, depending largely on national policies. Pre-accession funds did not explicitly address spatial objectives. Their impacts depend upon the spatial priorities set by the governments. In the eastern parts of Europe, cross-border cooperation suffers from insufficient coordination between Interreg and PHARE-CBC resources. After enlargement, a significant number of borders between the EU-15 and the accession countries, as well as between the accession countries themselves, will become internal EU borders. New EU external borders will emerge with Russia, Belarus, Ukraine, Moldova, Croatia, Serbia-Montenegro, Macedonia. A model for a stronger coordination with resources as TACIS and CARDS will be necessary.

Part III:

Innovation in spatial analysis

In the implementation of the ESPON programme a special attention is given to a scientific coherence between the individual projects. Guidance is given by one of the projects in defining a common platform of core indicators, typologies and methodologies and to the establishment of an ESPON data base with datasets collected and used by the individual projects as well as a collection of the key maps produced in the research activities. A number of guidance papers in support of a scientific coherence can be closer examined at the ESPON web site.

A significant part of the added value of the ESPON programme is its capacity to go a step further in exploring and implementing innovations in spatial analysis. This includes that the programme brings together for the first time various scientists, politicians and decision makers related to spatial planning in an interdisciplinary way.

The first published result of the ESPON Programme 2006 is the ESPON Data Navigator. The data navigator gives an overview on the main European data sources and related contact points which offer support for the spatial planning research activities of ESPON covering national and regional as well as European and transnational levels. Therewith a very helpful pan-European[1] tool for the ESPON project participants as well as for the public is established. Another important step is the preparation of the ESPON Data Base[2]. This data base goes further than all existing regional or sectoral European data bases. It's a data base focusing on data and indicators concerning spatial planning aspects. Like the Data Navigator this data base covers the EU, and the accession countries as well as Norway and Switzerland. It is the first time that such a data base is established.

To support scientific coherence, another important mile stone, especially in the elaboration of policy recommendations, was the commitment on a common terminology and methodology shared by all ESPON projects. An important starting point for all ESPON projects and the whole of the ESPON exercise is the interpretation and operationalisation of spatial development goals. This operationalisation of political aims and goals is needed for a data-based statistical and empirical judgement of the coincidences and discrepancies of development trends compared with development goals. It is a central part of the methodology used by the TPGs to define operational models of policy goals and to confront statistical data about the real world with these models of the reference model world.

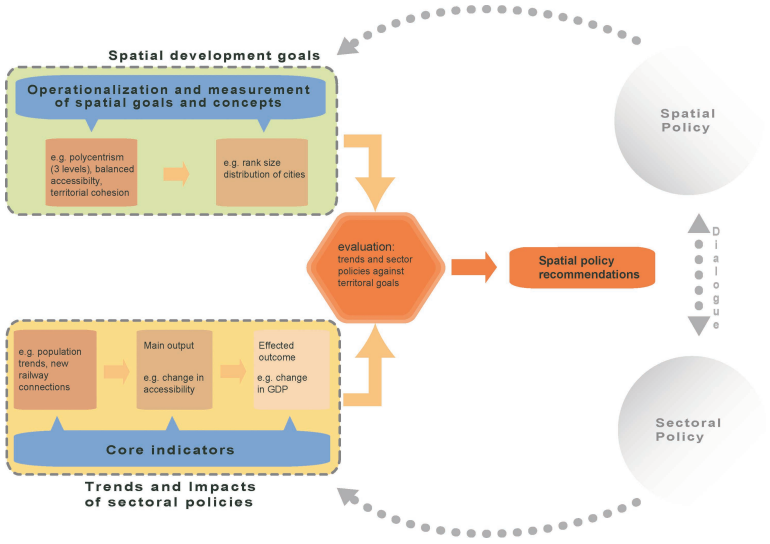
One important aspect for the work in the programme is that all participants agreed on a 3-level approach for their analytic work (micro level = local/regional; meso level = national/transnational; macro level = European/global) to base their results on clearly defined and unambiguous concepts. For the ongoing work inside the ESPON this was a groundbreaking decision because, as many in depth discussions have shown, spatial goals and concepts like polycentrism or peripherality have different meanings on these different spatial levels which can easily lead to ambiguities and confusions whenever conclusions and arguments do not clearly indicate to which spatial level they refer.

1) Including all accession countries, Norway and Switzerland

2) The ESPON Data Base is not yet available for public access. A process of clarifying copyright questions is going on as the aim is to make the ESPON data sets available for policy makers and researchers.

As an effect of all these elements of coordination it can be stated that ESPON is not just a collection of some 15 research projects proceeding independently and parallel but that a lot of efforts have been laid on the goal to develop a common approach with a common language that helps to achieve integrated "ESPON results" rather than a collection of single "project results".

The confrontation of spatial development goals with spatial development trends and spatial policy impacts can be illustrated with the following figure:



Special and theme specific innovations are found in two areas, which should exemplarily reflect the work realised during the first half of the life of the programme:

- the topics and issues analysed, with new issues and concepts being studied in their spatial dimension, such as the occurrence of natural hazards, Europe in the world and territorial cohesion; and

- the methods and instruments of territorial analysis, such as multiscalar analysis or hyperatlas.

A number of examples are provided below of innovative elements produced so far by the ESPON programme in these two areas.

1. Innovation in topics and issues analysed

1.1. Natural and technological hazards as constraints on territorial competitiveness

The occurrence of natural and technological hazards is more and more frequent[3]. They cause significant material damage and endanger human life. Their cumulative effect is a constraint for territorial competitiveness. However, prevention and reduction of potential damage is possible through appropriate spatial planning measures. This explains why the analysis of the occurrence of natural hazards is relevant in the context of spatial development policies.

3) Cf. ESPON Project 1.3.1. "The spatial effects and management of natural and technological hazards in general and in relation to climate change" led by the Geological Survey of Finland (GTK)

Natural and technological hazards are of various types. Their occurrence is difficult to predict. Spatial development policies can include measures likely to contain and reduce the potential impacts of natural hazards on assets and people's security.

Major floods have had tragic consequences in recent years. Flood risks (Map 28) are concentrated in southeastern France, northern Italy, central and southern Germany, the Netherlands, eastern England, Hungary and northwest Romania.

A large number of regions, in particular in the Mediterranean Basin, have faced drought in the past decades. Rainfall deficiency is the primary cause of drought and directly influences soil moisture, groundwater recharge and river flow, although the hydrological system will delay and smooth the effects. The severity of a drought is not simply a function of the size of the rainfall deficit, but depends on the timing of the deficit. Droughts, for example in the growing season, can have serious financial implications over large areas.

The occurrence of large forest fires is closely related to drought. Therefore, large scale forest fires are concentrated in southern parts of Europe, for example in Romania, Bulgaria, Hungary, Greece, Italy, Portugal, southern France and Spain.

The European regions most exposed to winter storms are generally coastal regions, in particular fringing the Atlantic and the North Sea. Severe winter storms can also cross the whole continent and cause significant damage in inland regions.

Most earthquakes occur along the margins of plates. Where one plate comes into contact with another, shear stresses can develop. There are, however, examples of significant earthquakes apparently not associated with plate boundaries. The earthquake activity zone affecting Europe is sometimes called the "Mediterranean and trans-Asiatic" zone. Earthquakes in this zone have foci aligned along mountain chains. This active zone has not changed significantly throughout human history.

Volcanic eruption hazards are localised phenomena. Active volcanoes are well known and are not very numerous in Europe.

Nuclear power plants are classified into five groups showing the number of operational reactors, giving an indication of the potential hazard intensity. Nuclear power plants are widely spread throughout Europe. Risks linked to specific technologies and to obsolescence are more concentrated.

Large dams present significant risks for areas located downstream, in particular when they contain large towns. Risk may be generated by earthquakes, construction deficiencies, heavy rainfall and obsolescence. 486 major dams have been identified in Europe.

Oil spills are hazardous, both physically and chemically. For example, oil can physically coat and clog biological features (feathers and gills) that are designed to cope with water. Chemically, oil contains a range of toxins that can either poison living organisms directly in high concentrations or build up slowly in low concentrations, gradually disrupting their biochemistry and increasing their vulnerability to other natural or man-made hazards. Exposure can be both rapid through the massive release of oil associated with the bigger oil tanker accidents, or chronic through the build-up of toxins in the marine community after years of oil dumping. Chemical toxins that are not rapidly

broken down become concentrated in ecosystems, rendering those organisms at the top of food chain (including humans) most vulnerable to chronic pollution. Oil spills are also heavily detrimental to tourist activities in coastal areas.

A synthetic indicator needs to be superimposed on the separate assessments for individual hazards, in order to reveal the areas most threatened by multiple hazards.

Natural hazards are of various types: flooding, drought, forest fires, winter storms, earthquakes, volcanic eruptions, heavy rainfall and risks related to nuclear power plants, to large dams, to oil spills. Their occurrence is not easily predictable. Spatial development policies can identify measures likely to contain and reduce the potential impacts of natural hazards on assets and people's security. Individual indicators are being developed to measure the degree of exposure of European regions to the various types of natural and technological hazards. A synthetic indicator needs to be superimposed on the separate assessments for individual hazards, in order to reveal the areas most threatened by multiple hazards.

1.2. Europe in the world

In the context of globalisation, the positioning and relationships of Europe with the other continents gains increasing importance. In the ESPON programme, a first attempt has been made to illustrate the positioning of Europe in the world context, using a series of indicators involving demography, wealth, trade flows and air traffic[4].Two very important points for the ESPON programme are emphasized by the analyses carried out so far.

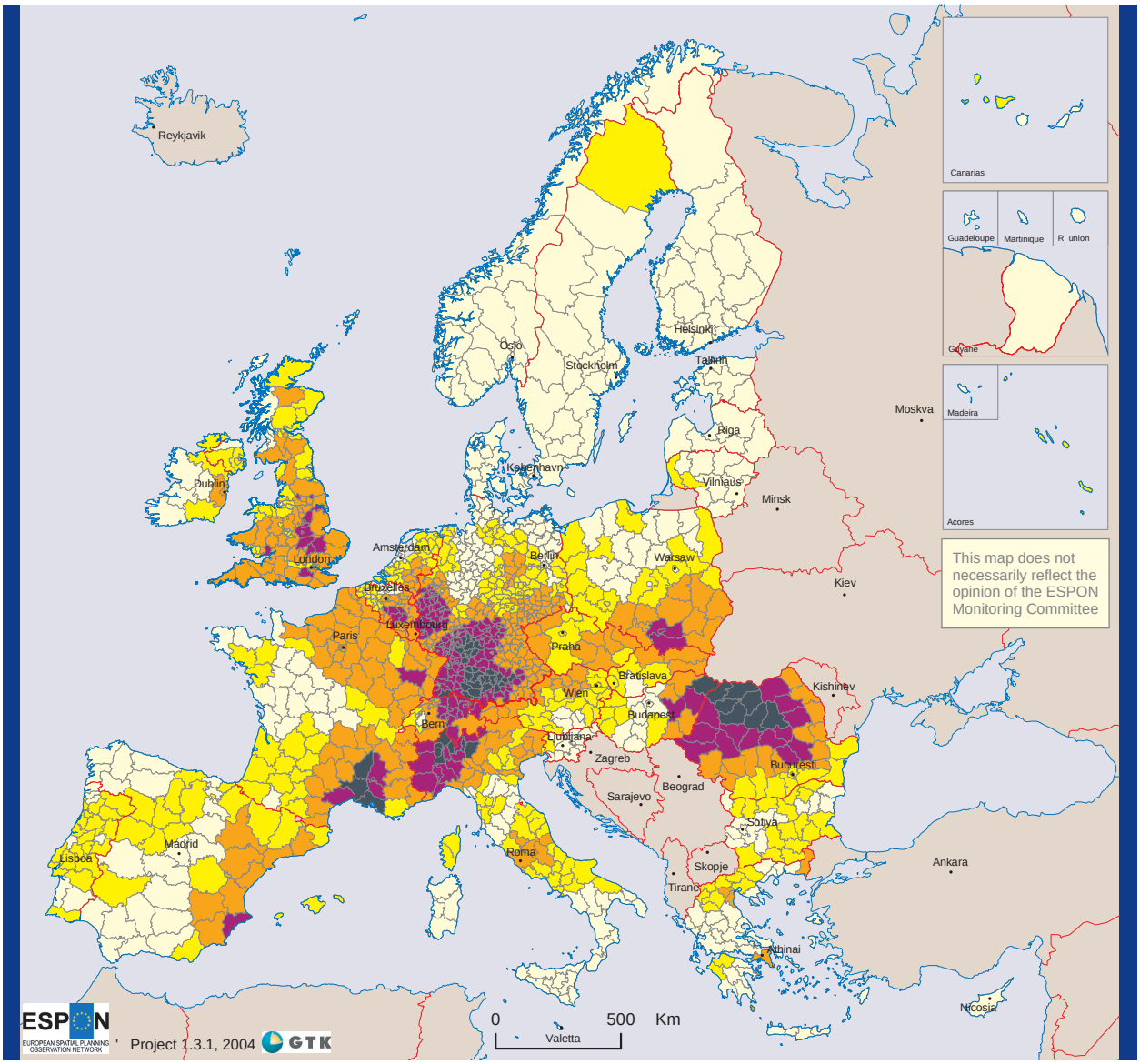
First, the formulation of an effective statistical and cartographic framework for future ESPON research on Europe in the world is a very important issue. The choice of both the geographical projection and the aggregation level have a very strong influence on the perception of spatial dynamics and interactions which link Europe to the world. The research demonstrates that the ESPON programme should not use classical map projections, which give a false impression of European "centrality". Moreover, the ESPON programme should not use the classical divisions of the world into continents and should adapt the aggregation of regions proposed by the United Nations to the specific needs of European policy (Map no. 29).

Second, the delimitation of Europe's area of influence according to various matrixes of flows is of crucial importance to the elaboration of long-term spatial strategies. The research developed in ESPON is limited to air traffic and trade flows, but it would be valuable to combine it with other criteria, such as tourism, migration and cultural expenditure. Those measures of European influence (like % of flows directed toward Europe) can be combined with other indicators of development (urbanisation, GDP/inh, age structure, etc.) This would help to define the human and economic resources of peripheral regions connected to Europe and which kinds of partnership should be formed, based on the specific character of each area.

4) Cf. Claude Grasland, Christian Grataloup « Twelve maps towards an ESPON vision of Europe in the world » (2003) and ESPON Project 3.1. ". « Integrated tools for European spatial development » led by BBR Bonn. Third Interim Report.

Map 28

Large river flood events recurrence in Europe (NUTS 3)



Flood recurrence

- Very low
- Low
- Moderate
- High
- Very high
- Non ESPON space

Origin of the data: ' EuroGeographics Association for the administrative boundaries
Large flood areas ' Dartmouth Flood Observatory
Flood areas ' ESA ; Earth observation ; Earth online
Rhine Atlas 2001 IKRS;CIPRI CBR

Source: ESPON Data Base

This map shows the hazard recurrence based on average number of large flood events on NUTS 3 level during 19872 002. Each NUTS3 region has been given an average of the large flood event that fall inside it. To the first class "Very low hazard intensity" only the regions without large flood events are included.

Flood intensity
Average value of flooding events on NUTS 3 area
Very low hazard 0
Low hazard 1
Moderate hazard >1 ; <=2
High hazard >2 ; <=3
Very high hazard >3

In the context of globalisation, the positioning and relationships of Europe with the other continents gain increasing importance. The identification of European positioning and relationships in the world context makes appropriate mapping approaches necessary. The work carried out so far in the ESPON programme demonstrates, for instance, that classical map projections, which give a false impression of European "centrality", should not be used. A first attempt has been made to illustrate the positioning of Europe in a world context using a series of indicators involving demography, wealth, trade flows, and flows of air traffic.

1.3. Operationalising territorial cohesion

Territorial cohesion[5] is rarely questioned as an aim, but raises many debates about its role and implications. The approach adopted in the ESPON programme is, therefore, to clarify the concept, not to define it or discuss its validity. The aim is to support a translation of the concept of territorial cohesion, which allows its use as a policy tool and in policy recommendations.

1.3.1. Potential, position and integration

Operationalising territorial cohesion is based on the different and complementary conditions that allow cohesion to develop in a territory and to play its anticipated role in sustainable development. Each of the three sets of conditions integrates an aspect of the territorial dimension.

Potential encompasses all factors that provide opportunities for the sustainable (possibly endogenous) development of the territory concerned. It does not depend on what happens in other territories. The notion is close to that of "endowment" and expresses the fact that territorial cohesion can only be achieved by territories that have enough resources to develop their own identity, and to act as partners in a process that will bring added value. Potential also reflects what the Second Cohesion Report considers as "factors determining real convergence"(i.e. economic performance, demography, investment, infrastructure endowment, human resources, R&D and innovation and the knowledge economy). Potential includes resources available in the area as well as constraints (some factors such as a coast or a mountain area may be seen as both at the same time). These resources / constraints may be either natural (resources, hazards); generated / influenced by human activities (spatial structure, infrastructures, gateways, level of services, environmental quality, capital; or linked to the social fabric and structure (level of education, employment, internal cohesion, governance).

Position with regard to other areas expresses the fact that cohesion does not only rely on the unique situation of territories, but also on their relative situation. Position varies depending on the spatial context. The location of an area cannot be fully assessed without taking into account the features of areas that are nearby and/or have relations with the area concerned (complementary or competitive). A feeling of relative equity is also needed in order to foster cohesion. Position encompasses aspects that were studied in the SPESP under "geographical position", but adds other dimensions that are not necessarily linked to space and distance. These are more in the nature of "equity" or "homogeneity", such as the relative situation of the territory in matters such as GDP, population and employment. This allows the link to be made with economic and social cohesion.

5) Cf ESPON Project 3.1. « Integrated tools for European spatial development » led by BBR Bonn. Second Interim Report. See as well the Third report on economic and social cohesion, European Commission (2004).

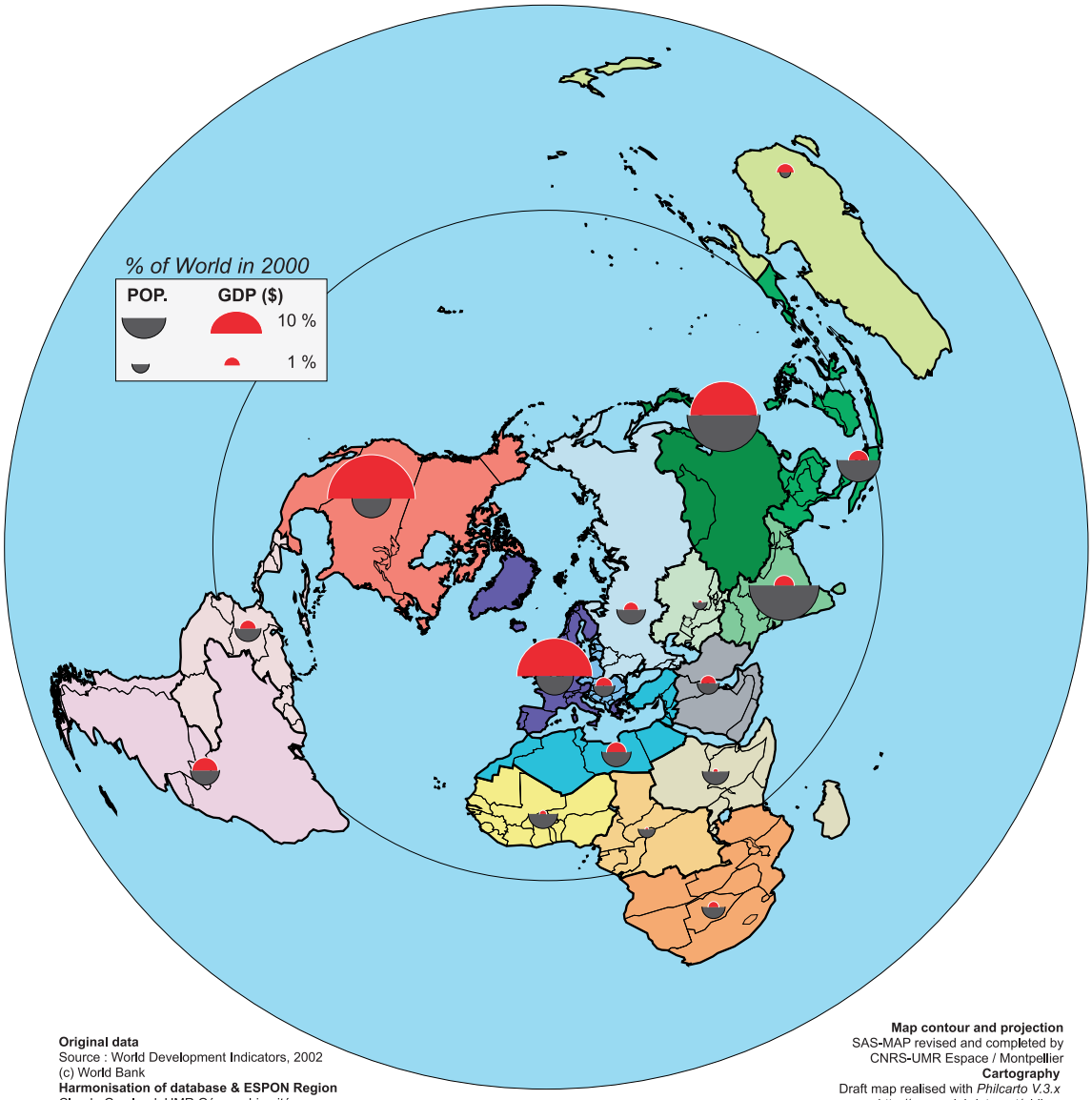
Map 29

Proposal of a World division in region for ESPON research

This map does not necessarily reflect the opinion of the ESPON Monitoring Committee

European Spatial Planning Observation Network
ESPON 3.1 / Workpackage "Europe in the World"

THE WORLD IN 17 ESPON REGIONS



Original data
Source : World Development Indicators, 2002
(c) World Bank
Harmonisation of database & ESPON Region
Claude Grasland, UMR Géographie-cités

Map contour and projection
SAS-MAP revised and completed by
CNRS-UMR Espace / Montpellier
Cartography
Draft map realised with *Philcarto V.3.x*
http://perso.club-internet/philgeo

- Western Europe
- East-Central Europe
- South and East Mediterranea
- Eastern Europe
- Middle-East
- Northern America
- Central America
- Southern America
- Eastern Asia
- South-Eastern Asia
- Southern Asia
- Central Asia
- Oceania
- Southern Africa
- Central Africa
- Western Africa
- Eastern Africa

Position thus covers different facets:

- accessibility to other areas in terms of transport, telecommunications, etc;
- presence of borders and discontinuities between the area and other areas;
- potential of neighbouring areas in terms of complementary/competitive resources;
- convergence / divergence in time of the evolution of the area with regard to other areas, which can be measured in terms of spatial potential; and
- proximity of other convergent / divergent areas, which indicates if the situation is stable or could evolve.

Integration focuses on the relationships between the parts of the territory under consideration. These can be in the form of material or immaterial flows and exchanges, including co-operation. Integration can enhance the potential of a territory, but may also strengthen disparities (e.g. pump and tunnel effect[6] mentioned in the ESDP). Although necessary to territorial cohesion, integration is not in itself a guarantee of cohesion. Integration depends on potential and position, but also on other parameters such as the global context and the historical pattern of relationships. The three sets of conditions are interlinked and complementary. What the ESPON programme seeks to do is delineate them fully enough to express them by different types of indicators and to build typologies on this basis.

1.3.2. Components of a territory

Another step toward operationalising territorial cohesion is to distinguish two components of territory. Territory not only implies places, but the people who live in them with their different social organisations and ways of building their own identities. Accordingly, territory includes both **"space"** and **"society"**. The latter, being focused on the relationship between people, includes institutions and organisations and types of settlement. This distinction helps to relate the associated concepts of social integration / cohesion to territorial cohesion. It also can be used to identify indicators and build typologies. Each aspect of cohesion may be split into sets of conditions that have more to do either with space or with society.

1.3.3. Scale for territorial cohesion

The **scale** at which territorial cohesion is defined has considerable importance in policy terms. The territorial scale needs to correspond with the level at which action can be led by political / administrative actors. The subsidiarity principle, as well as the objective of vertical cooperation recommended by the ESDP, has significance here. Scale must be distinguished from the unit of measurement. Scale identifies the territory whose cohesion is being considered, while the units are the sub-territories where conditions for cohesion at that scale are measured. At the European scale, which is the main focus of the ESPON framework, cohesion may be measured in terms of countries, regions or even transnational spaces. According to the scale being examined, not all components of territorial cohesion have the same importance or at least the same role in the whole. There can be different combinations of indicators or different formulas for typologies according to the scale. The question whether territorial cohesion at one scale necessarily enhances territorial cohesion at another scale has no obvious answer. It may even be that it strengthens barriers between the components at a larger scale. Territorial cohesion at the scale of the unit of measurement (internal cohesion) can be considered as a factor contributing to the potential of this unit. This allows it to

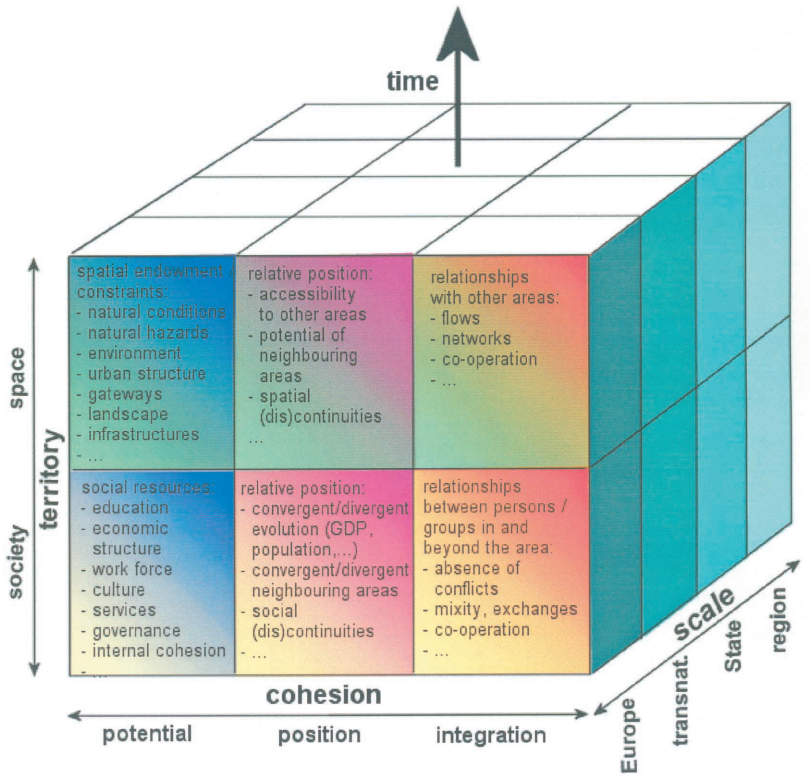
6) "Pump effect" refers to a new infrastructure leading to the aspiration of the socio-econmic substance outside of a region, while "tunnel effect" refers to a new infrastructure crossing a region without bringing economic benefits.

be examined in conjunction with position and integration (of this unit) when assessing territorial cohesion of the whole.

1.3.4. Time dimension

Time introduces a dynamic prospect and is particularly important when working with scenarios. The time dimension may also be integrated in some measurements of conditions for cohesion, for example, in the evolution of disparities.

These four dimensions are represented in the so-called "hyper-cube" of territorial cohesion. This representation principally aims to see how the different "bricks" comprising the concept of territorial cohesion may be assembled. Among the six rectangles corresponding to (spatial / social) (potential / position / integration), two correspond to associated concepts, which are spatial integration and social integration. This means that indicators / typologies defined for those concepts should help to operationalise the concept of territorial cohesion, of course combined with other indicators / typologies in an appropriate way.



The approach adopted in the ESPON programme is to operationalise the concept of territorial cohesion, not to define it or discuss its validity. The aim is to support the translation of the concept into operational tools and relevant political recommendations based on the concepts of potential, position and integration. Operationalising territorial cohesion also distinguishes two components of territory: space and society. The scale at which territorial cohesion is envisaged has a considerable importance in terms of policies. Finally, the time dimension introduces a dynamic prospect and is particularly important when working with scenarios. These four dimensions can be represented in the "hyper-cube" of territorial cohesion.

2. Innovation in methods and instruments of spatial analysis

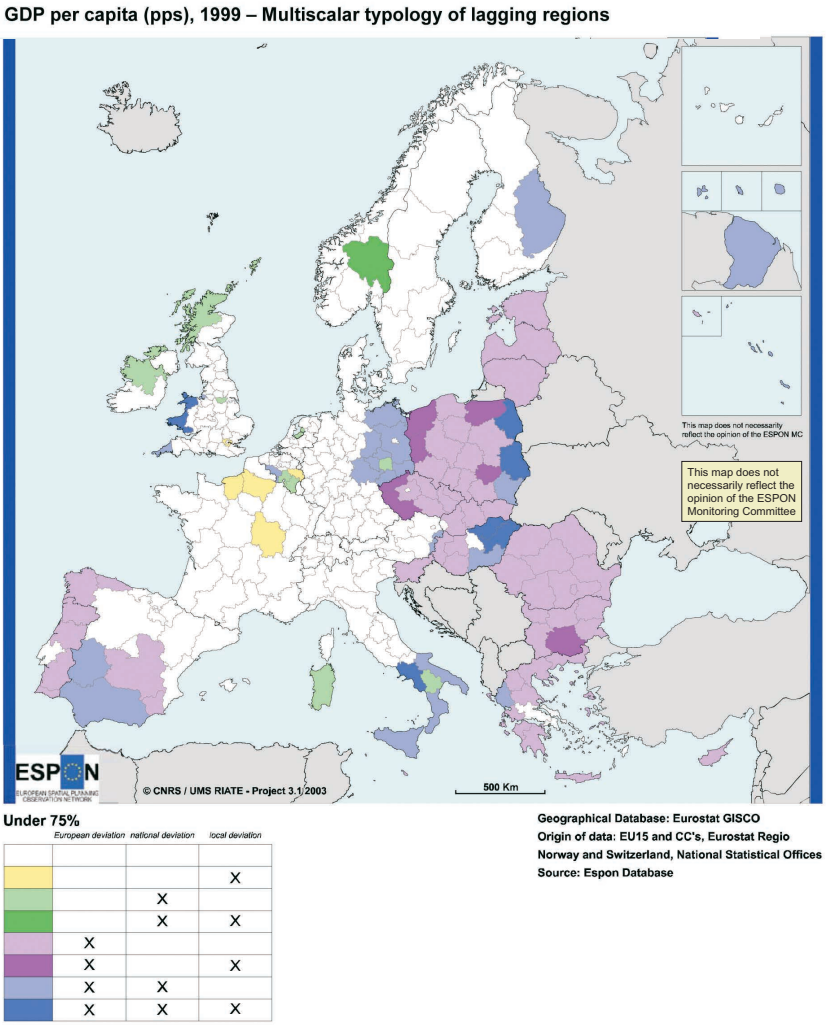
2.1 Multiscalar indicators of deviation[7]

Definition of lagging regions

Subsidiarity is an issue of considerable relevance to European spatial planning, because there are contradictions between European policies and national policies and between the overall dynamics of the European territory and local trends. For this reason, the definition of "lagging" regions is very important for spatial planners and policymakers in the context of social and territorial cohesion. The current definition of lagging regions is very limited, being based on a single criterion: the emblematic value of 75% of the mean of GDP per capita of the EU.

The multiscalar approach evaluates the same index at various scales. In terms of territorial cohesion, it is very important to evaluate the level of development of a region at three levels: European, national and local. If we use the criterion of 75%, only four regions can be considered as "lagging"

Map 30



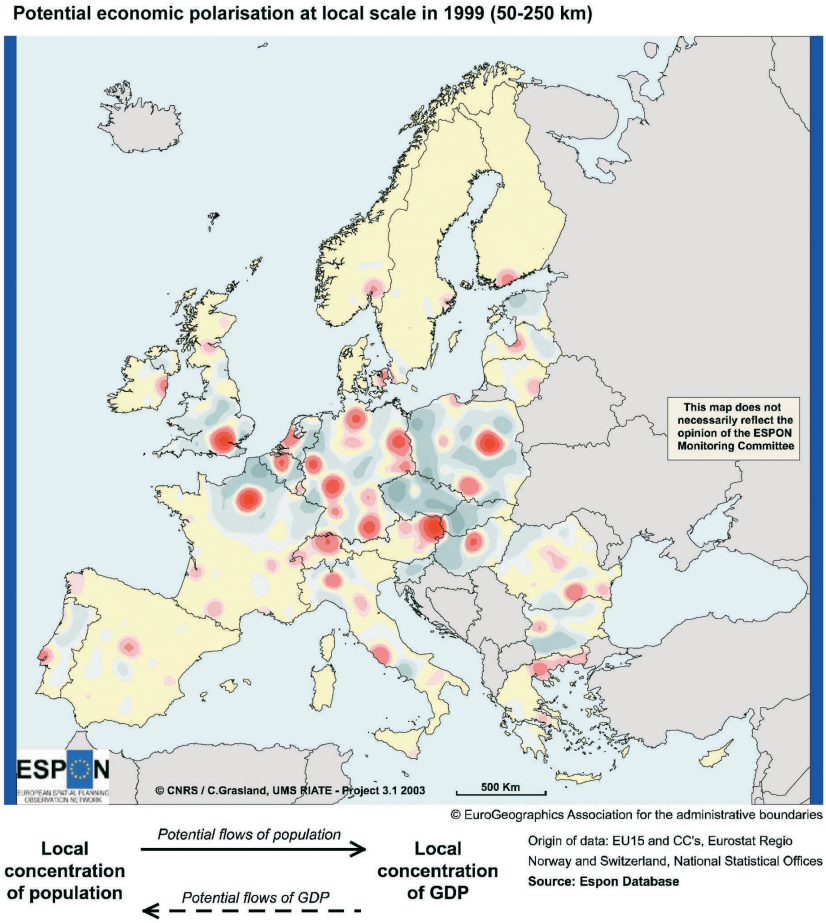
7) Cf ESPON Project 3.1. « Integrated tools for European spatial development » led by BBR Bonn. Third Interim Report.

at all levels: Eszak-Magyarorszag (HU), Campania (IT), Lubelskie (PL) and Podlaskie (PL). Many other regions are "lagging" in terms of one or two criteria, which implies specific policies at various levels. For example, the Austrian region of Burgenland can be considered as "lagging" at European and national level, but is "advantaged" at local level because of its common border with the poorest regions of Hungary and Slovakia. This situation is very different from the region of NE Bulgaria which is "lagging" at European and local level (because of a common border with the richer regions of Greece), but can rely on specific advantages at national level (capital region with Sofia). The typology presented in Map 30 and the associate graphic representations of "lagging profile" could be a powerful tool for the improvement of regional policies, particularly if it was applied to more relevant indicators than GDP/inh.

Polycentric development and simulation of potential economic convergence flows

The unequal distribution of population and wealth can produce various consequences. In a neoclassical framework, regional economic disparities are supposed to be reduced by the mobility

Map 31



of people (from poor regions to rich regions) and the mobility of capital (from rich regions to poor regions). This framework has been criticised, especially in the case of conditional convergence with the appearance of "clubs". But it remains an interesting basis for the simulation of the potential consequences of economic disparities in Europe.

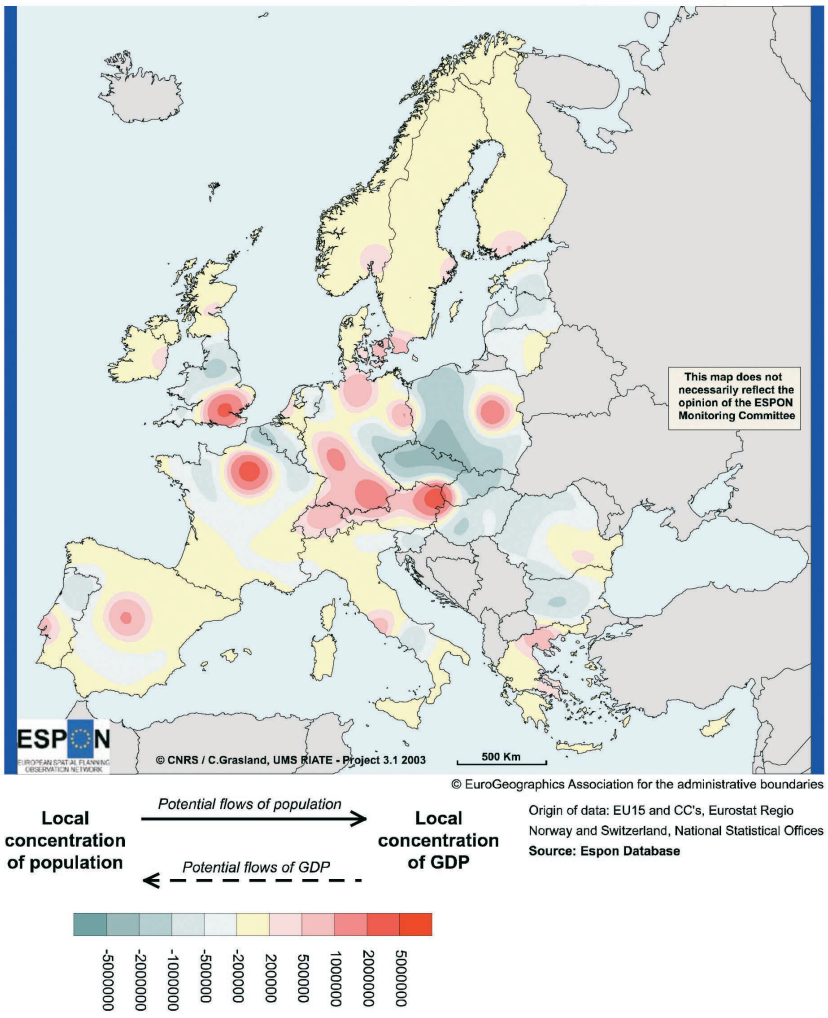
A tentative application of this theory has been made by using the GDP/inh. of European regions in 1999 at two different scales:

- the potential economic polarisation at local scale (50-250 km) presented in Map 31 indicates the existence of a very polycentric pattern, related to the distribution of a regular pattern of metropolitan areas richer than their neighbouring regions; and

- the potential economic polarisation at medium scale (100-500 km) presented in Map 32 presents an upper level of polarisation with a dramatic reduction of economic polarisation around selected macro-regions.

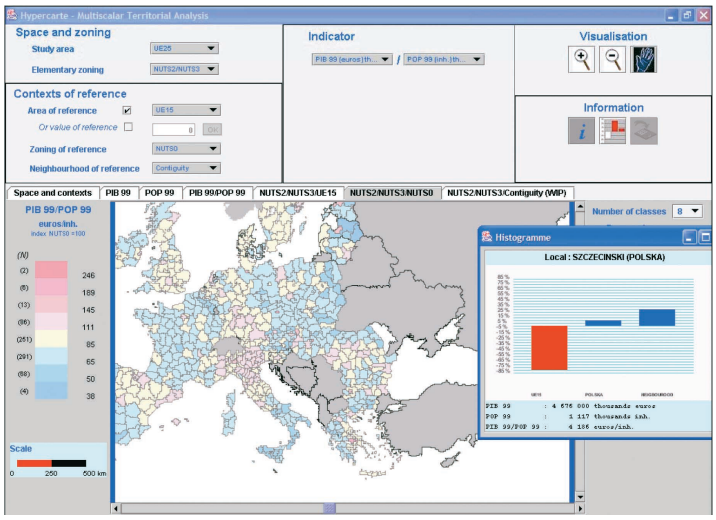
Map 32

Potential economic polarisation at medium scale in 1999 (100-500 km)



2.2 The ESPON Hyperatlas

ESPON Project 3.1. on interactive web cartography[8] has developed generic software with applications for multiscalar territorial analysis and interactive information on territorial units. The objective is to propose an operational version of an interactive spatial analysis tool. This should be able to compute and then map indicators of multiscalar deviation and the discontinuities between contiguous regions.



Transnational cooperation in territorial analysis promoted by the ESPON programme generates synergy among researchers and contributes, therefore, to innovations in methods and instruments of spatial analysis. A significant example is the development of multiscalar analysis, which is particularly useful because regional and spatial development policies are applied simultaneously at various scales. It has already been applied to the definition of lagging regions; in the analysis of spatial autocorrelation, gradient and discontinuities; and in the simulation of potential flows of economic convergence. The development of an interactive web hyperatlas will make it possible to easily compute and map online the indicators of multiscalar deviation.

8) Cf. ESPON Project 3.1. « Integrated tools for European spatial development » led by BBR Bonn. Third Interim Report.

Part IV:

Progress and outlook for the ESPON programme

1. Progress of the ESPON programme until autumn 2003

By August, 2003, a number of projects had delivered their Third Interim reports. These have been given particularly emphasis in the present progress report. Projects which started at a later stage and had only delivered their Second Interim Report by August, 2003, have been less thoroughly examined, as less substantial results are available. They will be given a more prominent position in the next progress report.

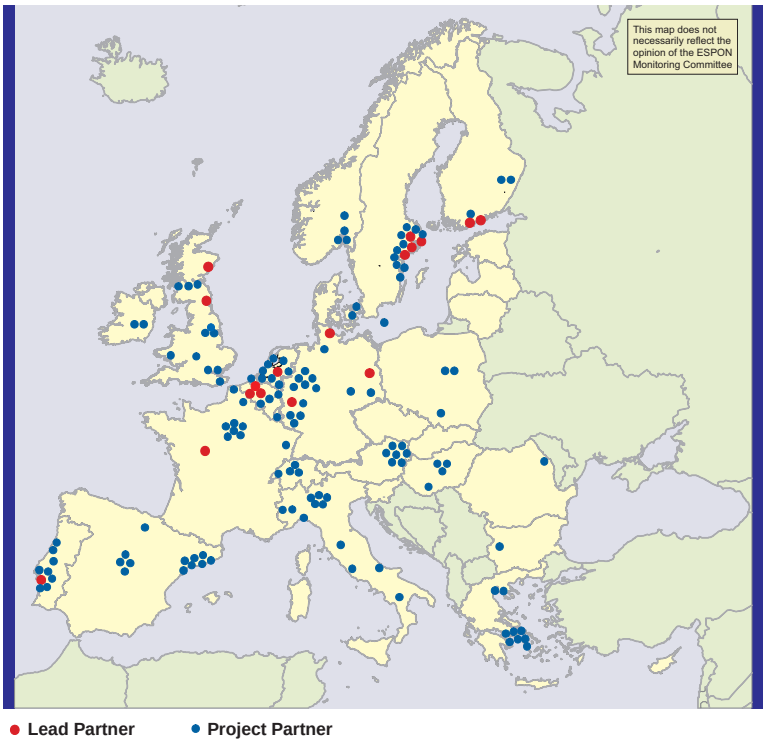
The whole programme involves strong co-ordination between Transnational Project Groups (TPGs). All groups work within co-ordinated categories and contribute to joint results. The Coordination Unit informs and briefs all Transnational Project Groups and ESPON Contact Points (ECPs) on the programme's methods, processes, milestones and obstacles. In addition, seminars are held twice a year. These directly inform the Monitoring Committee about the ongoing research and involve the exchange of ideas among researchers and policy makers on the emerging results. Two ESPON seminars have been organised by the ESPON CU. The first took place in Mondorf les Bains (Luxembourg) on 21-22 November, 2002. The second seminar was held on Crete (Greece) on 5-6 May, 2003 and the third in Matera (Italy) on 6-7 October 2003.

The mid-term evaluation of the ESPON programme was carried out between June and December 2003, by independent assessors. It shows "a programme that has a strong trans- European dimension with great potential to improve understanding of the territorial perspective in EU policies. The programme offers good value in terms of providing the indicators, typologies and models required to support regional policy. It has progressed significantly towards ambitious goals in a short space of time with very limited resources".

The main evaluation issues which have been addressed focus on the continuing relevance of the programme strategy; the progress towards the achievement of aims and quantified objectives (effectiveness); and the quality of implementation vehicles. The mid-term evaluation has also drawn conclusions and made recommendations for improvements in each of these areas. The recommendations concentrate, among other things, on the need to improve the availability of adequate data for transnational analyses and to make better connections between the ESPON network and people and organisations carrying out spatial development. Networking and building a European spatial development community should be further developed and encompass not only the operation of the ECPs and TPGs, but a much larger community of actors related to the development of the enlarged European territory.

Map 33

ESPON Projects by August 2003: Location of lead partners and project partners



2. Outlook for the second ESPON period until October 2006

In all 20-25 projects are being carried out by Transnational Project Groups of researchers and consultants. More than 100 partners are already involved in the ESPON networking process. In addition, a network of ESPON Contact Points support and promote the process at national level.

The ESPON programme will further develop over the coming years by deepening existing work and launching additional projects. The box shows the themes of ongoing and tendered projects in spring 2004.

2.1. Completing on-going projects

A number of projects (those which delivered their Third Interim Reports in August 2002) will be completed in September 2004. The other current projects will be completed during 2005. Guidelines and observations were recently provided by the Monitoring Committee to the Lead partners concerning the work to be carried out during the last stage of the projects. Particular attention was paid to the presentation of results which should be suitable for use by planners and decision-makers.

2.2. Starting a project on long-term scenarios

As a follow up to ESPON Project 3.1, a new project 3.2 on "Spatial scenarios and orientations in relation to the ESDP and EU Cohesion Policy" has started in February 2004. The preparation of scenarios (to 2015 and 2020 and beyond) is expected to employ an innovative, creative and multi-methodological approach. It will be focused on the policy orientation of the ESDP and Cohesion policy,

under the heading of balanced and sustainable development. Undertaking this task against the background of results from ongoing ESPON projects, it will cover:

- the development of scenarios on territorial development in order to "learn from the future" by elaborating clearly distinctive and contrasting scenarios for the territorial development of an enlarged European Union (EU-27) and the neighbouring states of Norway and Switzerland;

- the exploration of major driving forces and their territorial trends and impacts, based on the results from other ESPON projects;

- the adoption of a prospective focus (roll-forward scenarios), which anticipates and forecasts mega-trends, structural changes and territorial imbalances, as well as the adoption of a proactive approach (roll-backwards scenarios), which on the basis of political visions for territorial cohesion, balance and polycentric development, determines necessary decisions in different policy areas;

- the formulation on the basis of the scenarios of recommendations to assist policy development which promotes the ESDP policy orientations and Territorial Cohesion, taking into account spatially relevant policies; the role of territorial governance; European strategies, such as the European Strategy for Sustainable Development; and the Lisbon Summit, with reference to content, instruments and institutions;

- the continuation of creating scientific coherence within the ESPON programme and the further development of innovative ESPON tools through a close co-ordination with other projects mentioned in the programme.

2.3. A series of new ESPON projects to be launched

The ESPON programme foresees additional projects being carried through before the programme terminate by the end of 2006.

A series of new ESPON projects is considered for the tendering procedure in spring 2004:

- Project 2.3.1: "Application of the ESDP in Member States"
- Project 2.3.2: "Governance of spatial and urban policy"
- Project 2.1.5: "Territorial impacts of Fisheries Policy" (new)
- Project 3.3: "Territorial dimension of the Lisbon/Göteborg strategy" (new).

In addition, the ESPON Programme envisages the following projects for tendering by summer 2004. However, the Monitoring Committee will, based on the ESPON results provided by then, define the exact scope of the projects:

- Project 1.3.3: "The role and spatial effects of cultural heritage and identity".
- Project 1.2.3: "Spatially relevant aspects of the information society".

Further themes for a limited number of further projects might be decided later on by the ESPON Monitoring Committee, before the current programme ends in 2006. This might include themes such as

a deepening of the theme "Europe in the World" and "Integrated analysis of ESPON results in relation to trans-national and national territories".

The ESPON web site offers full details about the work done so far and on the actual state of affairs concerning projects and tendering procedures. It is the main window for further information about the ESPON programme.

Please enter www.espon.lu for further information.

Appendix 1

List of current ESPON projects (March 2004)

1. Thematic projects

ESPON Project 1.1.1:

THE ROLE, SPECIFIC SITUATION AND POTENTIALS OF URBAN AREAS AS NODES IN A POLYCENTRIC DEVELOPMENT (2002-04)

Lead Partner: Nordregio - Nordic Centre for Spatial Development, Stockholm (Sweden).

ESPON Project 1.1.2

URBAN-RURAL RELATIONS IN EUROPE (2002-04)

Lead Partner: Helsinki University of Technology - Centre for Urban and Regional Studies, Helsinki (Finland).

ESPON Project 1.1.3

ENLARGEMENT OF THE EUROPEAN UNION AND THE WIDER EUROPEAN PERSPECTIVE AS REGARDS ITS POLYCENTRIC SPATIAL STRUCTURE (2002-06)

Lead Partner: Swedish Institute of Technology (KTH), Stockholm (Sweden).

ESPON project 1.1.4

THE SPATIAL EFFECTS OF DEMOGRAPHIC TRENDS AND MIGRATION

Lead Partner: Swedish Institute for Growth Policy Studies (ITPS), Stockholm (Sweden).

ESPON Project 1.2.1

TRANSPORT SERVICES AND NETWORKS: TERRITORIAL TRENDS AND BASIC SUPPLY OF INFRASTRUCTURE FOR TERRITORIAL COHESION (2002-04)

Lead Partner: University of Tours, Tours (France).

ESPON Project 1.2.2

TELECOMMUNICATION SERVICES AND NETWORKS: TERRITORIAL TRENDS AND BASIC SUPPLY OF INFRASTRUCTURE FOR TERRITORIAL COHESION (2002-04)

Lead Partner: University of Newcastle, Centre for Urban & Regional Studies (CURDS), Newcastle (UK).

ESPON Project 1.3.1

THE SPATIAL EFFECTS AND MANAGEMENT OF NATURAL AND TECHNOLOGICAL HAZARDS IN GENERAL AND IN RELATION TO CLIMATE CHANGE (2002-04)

Lead Partner: Geologian Survey of Finland, Espoo (Finland).

ESPON Project 1.3.2

TERRITORIAL TRENDS OF THE MANAGEMENT OF THE NATURAL HERITAGE (2002-04)

Lead Partner: Royal Haskoning, Utrecht (The Netherlands).

2. Policy impact projects

ESPON Project 2.1.1

TERRITORIAL IMPACT OF EU TRANSPORT AND TEN POLICIES (2002-04)

Lead Partner: Christian Albrecht University of Kiel, Institute of Regional Research, Kiel (Germany).

ESPON Project 2.1.2

TERRITORIAL IMPACT OF EU RESEARCH AND DEVELOPMENT POLICY (2002-04)

Lead Partner: ECOTEC Research and Consulting Ltd., Brussels (Belgium).

ESPON Project 2.1.3

THE TERRITORIAL IMPACT OF CAP AND RURAL DEVELOPMENT POLICY (2002-04)

Lead Partner: University of Aberdeen, Arkleton Centre for Rural Development Research, Aberdeen (UK).

ESPON project 2.1.4

TERRITORIAL TRENDS OF ENERGY SERVICES AND NETWORKS AND TERRITORIAL IMPACT EU ENERGY POLICY

Lead Partner: CEEETA, Lisbon (Portugal).

ESPON Project 2.2.1

TERRITORIAL EFFECTS OF STRUCTURAL FUNDS (2002-05)

Lead Partner: Nordregio - Nordic Centre for Spatial Development, Stockholm (Sweden).

ESPON project 2.2.2

TERRITORIAL EFFECTS OF THE "AQUIS COMMUNITAIRE", PRE-ACCESSION AID AND PHARE/TACIS/MEDA PROGRAMMES

Lead Partner: Institute for Regional Development and Structural Planning, Erkner (Germany).

ESPON Project 2.2.3

TERRITORIAL EFFECTS OF STRUCTURAL FUNDS IN URBAN AREAS (2002-04)

Lead Partner: ECOTEC Research and Consulting Ltd., Brussels (Belgium).

3. Coordinating cross-thematic projects

ESPON Project 3.1

INTEGRATED TOOLS FOR EUROPEAN SPATIAL DEVELOPMENT (2002-04)

Lead Partner : Bundesamt für Bauwesen und Raumordnung (BBR), Bonn (Germany).

ESPON Project 3.2

SPATIAL SCENARIOS AND ORIENTATION IN RELATION TO THE ESDP AND COHESION POLICY (2004-2006)

Lead Partner : University Libre de Bruxelles- IGEAT, Bruxelles (Belgium)

4. Data

ESPON Project 4.1

DATA NAVIGATOR

The Data Navigator is a data inventory that gives an overview on the principle sources and contact points, structures and links, which offer potential statistical support to the tasks of the ESPON covering national and regional as well as European and transnational levels.

Appendix 2

Glossary of abbreviations

Abbreviation	Term
AC	Accession Country
AWU	Agricultural Working Unit
CAP	Common Agricultural Policy
CU	Co-ordination Unit
DOM	Départements d'Outremer (French Overseas Districts)
ERDF	European Regional Development Fund
ESDP	European Spatial Development Perspective
ESF	European Social Fund
ESPON	European Spatial Planning Observation Network
EU-15	Present 15 EU Member States
EU-27	Present 15 EU Member States + 12 Candidate Countries (including Romania and Bulgaria)
EU-27+2	EU-27 + Switzerland and Norway (building together the ESPON study area)
EUCC	Candidate Countries to the European Union
FUA	Functional Urban Area
GDP	Gross Domestic Product
GIZ	Global Integration Zone
ICT	Information and Communication Technology
IR	Interim Report
LFA	Less Favoured Areas
LP	Lead Partner
MA	Management Authority
MC	Monitoring Committee
MEGA	Metropolitan European Growth Area
MTR	Mid-Term Review
R&D	Research and Development
RDR	Rural Development Plan
RTDI	Research, Technological Development and Innovation
SPESP	Study Programme on European Spatial Planning
TEN-E	Transeuropean Energy Network
TEN-T	Transeuropean Transport Network
TINA	Transport Infrastructure Needs Assessment
SWOT	Strengths, Weaknesses, Opportunities and Threats

Appendix 3

List of maps in this report

List of other illustrations in this report