

ESPON project 3.2

Spatial Scenarios and Orientations in relation to the ESDP and Cohesion Policy

Final Report
October 2006

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relation to the ESDP and Cohesion Policy

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Volume 1
Executive summary

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Abbreviations

ADS	Accelerator Driven Systems
ADS	Accelerator Driven Systems
AWU	agricultural working unit
BSE	Bovine Spongiform Encephalopathy
BSR	Baltic Sea Region
CAHP	European Population Committee
CAP	common agricultural policy
CBA	Cost-Benefit Analysis
CEECs	Central and Eastern European Countries
CHP	Combined Heat and Power
DGP	Direct Government Payments
EASR	European Association of Survey Research
ECSC	European Coal and Steel Community
EEA	European Arenas Association
EFTA	European Free Trade area
ENP	European Neighbourhood Policy
EPCC	European Program on Climate Change
ESPON	European Spatial Planning Observation Network
ETCI	European Territorial Cohesion Index
FDI	Foreign direct investment
FMD	Foot-and-Mouth Disease
FNR	Fast Neutron Reactors
FNR	Fast Neutron Reactors
FUAs	Functional Urban Areas
GDP	Gross Domestic Product
GHG	greenhouse gas
GIS	Geographic information system
GU	Geographic unit
GVA	Gross Added Value
HDI	Human Development Index
HDR	Human Developments Report
HST	high-speed train
HTGR	High Temperature Gas Reactors
ICT	Information and Communication Technology
IPCC	Intergovernmental Panel on Climate Change
ISDD	Index of Sustainable Demographic Development
JRC	Joint Research Centre
KTEN	Know trans-European Networks
LAU	local administrative unit
LDP	Local demographic polarisation
LEMA	Life Expectancy at Median Age
LEP	Local economic polarisation
LFAs	Less Favoured Areas
LTDB	Long-Term Database
MASST	Macroeconomic, Sectoral, Social and Territorial (model)
MDP	Medium demographic polarisation
MEDA countries	Mediterranean Partner countries
MEGAs	Metropolitan European Growth Areas
MEP	Medium economic polarisation
MFTA	Mediterranean Free Trade Area
MLE	Mean Life Expectancy
MOLAND	Monitoring Land Use / Cover Dynamics
MRDL	mean remaining duration of life
NSR	North Sea Region
NWE	North-West Europe
OGS	Open GIS Consortium
OLS	Ordinary Least-Squares
PACs	Potential Accession Countries
PIA	Polycentric Integration Area
PPM	parts per million
PPPs	Purchasing power parities
PRB	Population Reference Bureau

PUSH	Potential Urban Strategic Horizon (Area)
RCE	Regional Classification of Europe
SGM	Standard Gross Margin
SGM	Share of gross margin
SII	Summary Innovation Index
SPESP	Study Programme on European Spatial Planning
TENs	Trans-European Networks
TEN-STAC Network	Scenarios, Traffic Forecasts, and Analyses of Corridors on the Trans-European Transport Network
TFR	Total fertility rate
TIA	Territorial Impact Assessment
TPG	Transnational Project Group
UAA	Utilised agricultural area
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNPP	United Nations Population Prospect
USPTO	US Patent and Trademark Office
WTO	World Trade Organization

A. Executive Summary

1. ESPON 3.2 in brief

This project has created a large number of scenarios for the future territorial development of Europe (EU27+CH+NO) with a time horizon of 2030. Approximately **20 thematic scenarios** deal with some of the main driving forces in 9 different thematic fields. **1 integrated baseline scenario** shows the probable evolution of the European territory in a situation of no major changes (political or external). **2 prospective policy scenarios** explore the effects of EU policy: in the cohesion-oriented scenario policies are formulated with the goal of social, economic and territorial cohesion as top priority, in the competitiveness-oriented scenario the overall global competitiveness of the European economy is the major objective and policies are aligned to this objective. Finally, a **proactive scenario** provides an attempt at translating current policy goals into an image of how Europe *should* look like territorially in 2030 and outlines a how this image might be reached.

From the scenario exercise, it is clear that many of the issues identified in the European Spatial Development Perspective (ESDP) of 1999 are still valid. Some driving forces seem to have gained even more urgency today, but are largely ignored by many official territorial policy documents. All of these issues are elaborated in the thematic and integrated **scenario knowledge bases**. Of these driving forces, four stand out as particularly important for Europe's regions: **the ageing of Europe's population, the increasing impacts of climate change, a passage to a new energy paradigm and the rising importance of globalisation.**

One of the main outcomes of this scenario exercise is to re-emphasise that **cohesion and competitiveness are two policy choices which are contradictory at times.** However, and this is even more important, **the main challenges that await Europe's territorial development are not contained within this opposition.** On the contrary, whatever policy is chosen, the driving forces will inevitably have more influence in shaping our regions. Climate change will cause droughts and floods and reduce snowfall in the mountains; globalisation will push the metropolitanisation of tertiary economies such as Europe's even further leading to further concentration of activities in metropolitan areas; ageing combined with depopulation will cause certain regions to lose much of their productive base and make service provision difficult; and the foreseeable limitations in oil and gas availability will cause a fundamental change in energy production and consumption, notably in the field of transport. **The major task for policy makes is, therefore, not to try to stop any of these from happening, but rather to help European regions prepare and adapt in the best possible manner to these challenges.**

Another major insight provided by the scenarios is that **most territorial goals cannot be realised without substantive investments in non-territorial policies.** Allowing regions to upgrade their productive environment and enter into the knowledge economy involves important improvements in general education, research and innovation systems. Adapting to a new energy paradigm and more sustainable transport and settlement systems also implies significant advances in technology. Creating healthy consumer markets for European products also implies a redistribution of productivity gains to households.

This also implies that centralised, **sectoral policies should take into account their potential territorial impacts.** This project provides several approaches to evaluate such

impacts. The scenarios attempt to show some of the complexities and contradictions inherent to territorially relevant policies. The team has also provided a prototype for a **territorial impact multi-criteria assessment model** which allows to transparently formalise the ex-ante evaluation of policies. On a sectoral basis, the models developed in the project, notably the **MASST economic growth model** and the **KTEN transport model**, represent state of the art tools to evaluate potential impacts of different policy choices.

In our role as coordinating project, we also present the latest version of the **ESPON Database and Mapkit**, as well as a first implementation of a **Long-Term Database** system which should allow ESPON to develop a sustainable territorial database with long time series, which takes into account changes in the definition of indicators and administrative boundaries.

2. Understanding potentials of change: the major trends and driving forces shaping European regions today

A major part of the scenario-building process was the creation of a 'scenario base'. This entailed the collection and analysis of up-to-date information concerning the different trends and driving forces that shape the European territory today. The scenario base includes both basic projections into the future of high-inertia trends and the identification of key issues that can act as triggers for spatial development. From this scenario base, it is possible to extract the most important themes relevant for future territorial development and identify structural challenges and potentials for Europe's regions.

The present summary provides a short overview of these issues and challenges. For more information, please refer to the scenario base in volume 2, chapter 2.

Towards a continental dimension

After the enlargement, the EU territory has nearly reached continental size. The EU-enlargement of May 2004 added 5% to the GDP of the EU-15 and 20% to its population, which means that the average GDP/head in the EU dropped by 12.5%. The enlargement fundamentally changed the scale of economic disparities within the EU.

Europe and its neighbours

The southern and eastern Mediterranean neighbours have considerably higher population growth rates than the European average and therefore a much younger demographic structure, while the eastern neighbours present extremely low fertility rates and a declining population. Economic disparities between Europe and its eastern and southern neighbours are significant. While there are signs of integration with the eastern neighbours, there is an increasing north-south divide across the Mediterranean maritime border.

Factors of accelerating globalisation

Globalisation affects the European economy in various ways. For example, imports of low-cost products in low and medium technology sectors are increasing, and foreign investments are being redirected towards emerging economies. This underlines the need to further specialise and innovate in advanced economic activities (R&D, new technologies and innovation, advanced services).

The neoliberal approaches to economic regulation adopted in the western world since the

beginning of the 1990s play also a significant part in the globalisation process. Pressure is being put to increase the return on investment and thus the profit rate, to the detriment of long-term investments. This partly explains the structural weakness of investments and of wage increases and, as a result, of growth in Europe.

Europe's modest economic openness

In terms of trade flows, European integration seems stronger than intercontinental globalisation. For the countries of the EU-25, the share of intra-European trade (in relation to total foreign trade) has grown from 52% by 1960 to 66% by 1990 and has remained stable at this level during the last decade.

Considering foreign trade specialisation, Western Europe and North America have a strong position not only in the exports of technological industrial products (chemicals, machinery etc.), but also in agricultural exports (together they represent half of world exports). The hegemony of Western Europe and North America is much higher in the trade of goods than in the trade of services.

Territorial impacts of accelerating globalisation

A number of regions have harnessed the globalisation process to strengthen their position. These include the first level (London, Paris) and second-level metropolitan areas, including those in New Member states (Warsaw, Prague, Budapest). Other central regions may benefit from globalisation processes, provided they have good environmental conditions, economies strongly supported by research and development, medium-sized cities with strong cultural, scientific or tourist potential.

A number of other regions are negatively affected by the globalisation process, namely those with heavy industries and textile and clothing industries, "fordist" regions and "Marshallian" districts.

The knowledge society and innovation gaps

The growing importance of knowledge and innovation for economic development is accelerating the structural change of the economy in the EU (and elsewhere). The innovation gap between the EU25 and the US is close to stable. Statistically, about 70% of the innovation gap can be explained by lagging EU performance in three indicators: USPTO patents, population with tertiary education and ICT expenditures.

There are wide differences in innovation among European countries which can be divided in four groups:

- Switzerland, Finland, Sweden, Denmark and Germany make up the group of 'leading countries'.
- France, Luxembourg, Ireland, United Kingdom, Netherlands, Belgium, Austria, Norway, Italy and Iceland all belong to the group of countries showing 'average performance'.
- Countries 'catching-up' are Slovenia, Hungary, Portugal, Czech Republic, Lithuania, Latvia, Greece, Cyprus and Malta.
- Countries 'losing ground' are Estonia, Spain, Bulgaria, Poland, Slovakia, Romania and Turkey.

Strong territorial concentration in a few leading regions is observed in the fields of R&D intensity, employment in high technology services and R&D infrastructure.

Breakthrough of new key technologies

The evolution of the European territory can be substantially influenced, in the coming decades, by the spread of a number of emerging technologies, such as:

1. Biotechnologies
2. Nanotechnologies
3. Energy technologies (sources and vectors)
4. Transport-sector technologies

Growing external energy dependence

The increasing external dependence of Europe for its energy supply implies that strategic issues at world level, such as global demand and oil and gas peaking, are of considerable importance for the future of Europe. The EU is relatively poor in conventional energy reserves, such as oil and gas, but also in nuclear resources (uranium).

Potential for renewable energy sources

The contribution of renewables to energy production across the EU is around 6%, of which hydropower represents 2/3. Some countries, such as Austria, Sweden, France and Italy have a large renewables sector. Some, such as Germany, have intensive programmes or legislation in favour of renewables and some have little exploitation of renewable resources. Outside the EU, both Norway and Switzerland have significant renewable resources, mainly hydropower. Installed capacity for wind energy has more than doubled during the 1990s and the same happened over the past five years with potential for further strong growth. There is also significant potential for solar, thermal collectors which produce low temperature heat for domestic applications. Photovoltaic electricity production is on a very small scale in the EU, mainly due to cost. The potential for biomass is very significant. It is used for the production of heat and/or electricity and will also be used more and more to produce biofuels for the transport sector.

Population ageing

Europe has, over the past three decades entered its 'second demographic transition' with populations failing to replace themselves, leading to an increasing proportion of elderly. If the trend continues the labour force will shrink: there will be insufficient entrants to replace those leaving, although a decrease in unemployment will compensate this partly. Measures to encourage higher activity rates amongst the potentially active population are limited by the fact that if job creation remains low, these new entrants will not find employment, or displace existing job holders.

European demographic developments are very region-specific. Some areas have relatively young populations, while others are experiencing severe depopulation and ageing.

A variable but growing number of immigrants in EU cities

Immigration from outside Europe is the sole means by which many national population levels are being maintained. All EU countries with the exception of Latvia, Lithuania and Poland currently have a positive crude net migration rate. Some member states are considered much more desirable as destinations (such as the UK and France) than others, resulting in imbalances across the EU.

Most cities and notably most capital cities have a much higher proportion of foreign nationals, foreign-born and second and third generation immigrants than other towns or

outlying rural areas. Access to employment is of key significance for social inclusion. Foreign born from other industrialised countries have a similar or higher employment rate and a lower unemployment rate than the EU average, while immigrants from other parts of the world have substantially lower employment and higher unemployment rates than the EU average. Immigrants from non-industrialised countries are also more often subject to poverty and social exclusion.

Territorial footprints of changing lifestyles

During the decades of high economic growth in the post-war period, the western world experienced mass consumerism as the dominant lifestyle. Recently, a number of factors have led to more differentiation of lifestyles in Europe: a more individualist form of consumerism has emerged in addition to the more homogenous globalised lifestyles. In the countries of Eastern and Central Europe consumption patterns increasingly resemble those of West Europe, but are still limited by low purchasing power.

Demographic changes, such as ageing and the increasing ethnic diversity have important impacts on the lifestyles. In terms of mobility, more numerous, but shorter holiday periods have become a general rule.

In the opposite direction, socio-economic dualisation and the crisis of the welfare state have led to growing uncertainties and fears. The perception of equality has been eroded potentially leading to more self-protective attitudes.

Traffic patterns: road dominating and congestion increasing

The past decade saw not only a worrying increase in traffic congestion in urban areas, but also a new phenomenon of congestion on the major arteries of the trans-European network, increasing the number of bottlenecks. All transport modes are affected: road transport, but also railway transport. The EU-enlargement and increasing integration accelerates this traffic growth, particularly for freight. At the same time, the provision of infrastructure has not kept pace because of, amongst other things, a lack of public financing and the current difficulty of mobilising private funds.

European transport suffers from an imbalance between transport modes, to the detriment of railways, maritime shipping and inland waterways. While this reflects the fact that some modes have adapted better to the needs of a modern economy, it is also a sign that not all external costs have been included in the price of transport and certain social and safety regulations have not been respected, notably in road transport.

Differentiated accessibility: macro versus local

In terms of Europe-wide accessibility, the most accessible regions by road and rail to the population include the Pentagon, with an extension eastwards to include East-Germany, as well as towards the Rhone valley and the Loire valley in France. The least accessible regions are all located in the European periphery. The picture is different at a more regional, daily life scale, however. Here, the Eastern member states often present a very low level of accessibility, mainly due to the poor state or even lack of infrastructures and services.

Environmental challenges

The environmental situation in Europe has generally improved, but a number of challenges persist which have a particularly significant territorial dimension. These are mainly:

- Water stress and quality
- Air pollution and greenhouse gas emission
- Loss of biodiversity, fragmentation, and a decrease of total area of natural value
- Climate change

Climate change has accelerated during the past decade; the most damaging impacts of which are flooding, drought and storms/hurricanes.

Evolution of urban Europe

At the macro-level, the European urban system constitutes the main motor of the core-periphery divide of the European space, reinforced by the increased metropolitanisation of economic activities. The "core" is specialised in highly developed R&D, financial and tertiary education activities, companies headquarters etc. It also benefits from a stronger networking / complementarity among Functional Urban Areas. This core tends to expand along major corridors in various directions. The peripheries of the EU territory contain comparatively few MEGAs, unequally distributed over different macro-regions, and not well connected to their local urban hierarchy.

At meso-level, polycentricity depends to a large extent upon national situations. In southern European regions, strengthening the role of large cities often occurs at the expense of polycentricity at national and / or regional levels. In the new member states, restructuring favours bigger cities, usually capitals, while cities with a large, obsolete industrial sector or those located in rural areas are often subject to decline.

At the micro-level, large cities, especially metropolitan areas, are still subject to population growth. Mobility at the regional scale comprises commuter flows related to home-work journeys, but also to education, culture and leisure activities. The development and modernisation of public transport cannot completely compensate for the growing demand in mobility. Increasing car traffic and emissions is an important issue. The social divide in cities is growing; cities become more fragmented; various forms of segregation are progressing.

Evolution of rural Europe

The fate of rural areas is tied to their location. Those in the proximity of major urban agglomerations often benefit from the presence and development of residential areas, industrial estates, and recreational amenities. They are affected by high socio-economic dynamics and pressures in terms of population density and urbanisation. Many coastal and mountainous areas have a well-developed tourist industry.

A dualisation process of agricultural production has taken place: areas with a highly productive agriculture and in which the processing industry plays an important role, which have a high or moderate socio-economic viability are opposed to areas with low productivity in which agriculture is traditional and which have a low socio-economic viability and where out-migration of young people results in ageing and depopulation.

In the CAP a shift from market price support to income support, coupled to public goods such as environmentally friendly land management, and public and animal health, is taking place. While the reform process brought about a significant reduction of export refunds and public intervention as compared to the earlier years of the CAP, there are still a number of markets which rely on these forms of support.

3. Coming to grips with the future: The scenario approach

In order to explore the future evolutions of European regions and the overall spatial structure of the ESPON space, the team, in collaboration with the ESPON Monitoring Committee, decided to elaborate three roll-forward scenarios, one baseline and two prospective policy scenarios. The latter were defined using two “axes” of policy making, not necessarily opposing each other, but implying different priorities (see figure 1). On one axis policy choices are led by the desire for cohesion in the EU, on the other axis they are determined by the desire for competitiveness, including of Europe as a whole. The combination of the two priorities in a non-contradictory way was defined as the “ideal” situation and thus defined the final image of the roll-back scenario which aims at exploring possible paths (and contradictions on these paths) towards this ideal. The integrated scenarios are presented in volume 2, chapters 4.1 – 4.2.

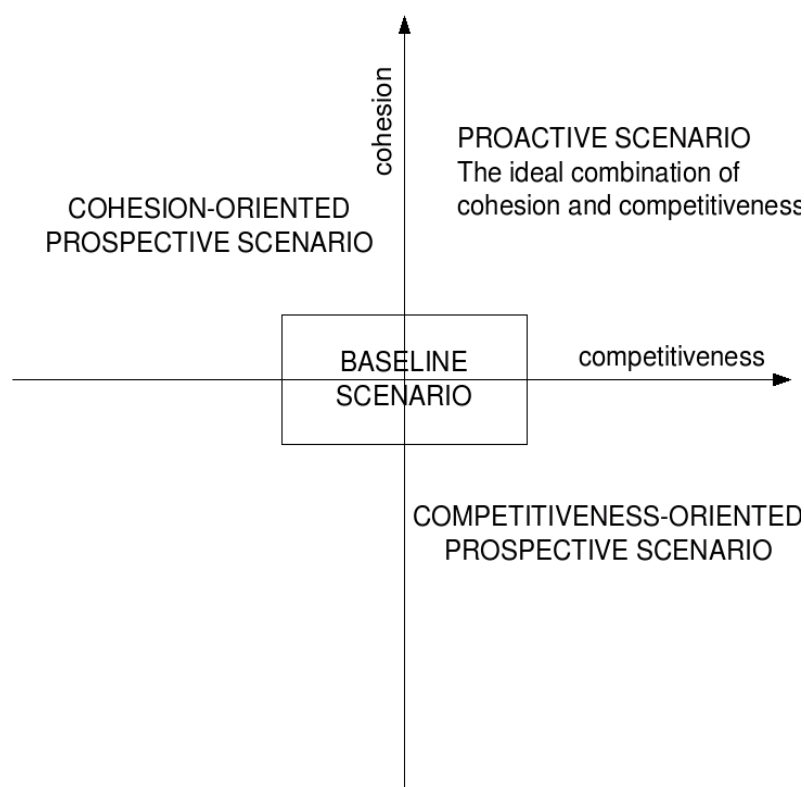


Figure 1 The axes defining the integrated policy scenarios

The contents of these integrated scenarios are inspired by previous work on thematic scenarios covering the themes demography, economy, energy, transport, governance, enlargement, climate change, rural development and socio-cultural evolutions. The individual thematic scenarios are presented in volume 3.

Wild Cards

The integrated scenarios were “tested” concerning their resilience with the help of four very simple and short “wild cards”, using high-impact events and exploring their impact on the territory. These results of these wild cards indicate, for example, that while the cohesion-oriented scenario seems to limit the overall economic growth of Europe, it does seem to provide a wider range of regions with the necessary resources to resist certain shocks. For more information see volume 2, chapter 6 and volume 4, chapter 6.

Downscaling the scenarios

All scenarios were drawn up in a pan-European perspective. The complexity of the issues had made it impossible to deliver the same level of integrated knowledge at the micro-level, i.e. at the level of regions. The team has however delivered a few examples of what such downscaling of the scenarios might look like. One translates the demographic indicators developed for the scenarios to the local level of the Paris metropolitan area, another applies the scenarios to the ‘accessibility to services’ indicator (developed in the aim of furthering the social dimension of a future indicator on territorial cohesion) to the *Grande Région*, and the third is a very exploratory application of some scenario data to the MOLAND land use model. All these examples show that there is a potential for translating the general ideas developed in the integrated scenarios to more local situations. For more details, see volume 2, chapter 5 and volume 4, chapter 5.

4. Exploring future paths: The integrated scenarios

4.1 Introduction

The future spatial development of Europe defies a unidimensional synoptic explanation or linear storyline; it is the result of a highly intricate system of converging, competing, independent and countervailing forces, and of political decision-making and happenstance. In the four ESPON 3.2 integrated scenarios, the future history of Europe up to 2030 is analysed by examining a number of key driving forces, some of which are the result of conscious policy decisions, some of which are not. Not all of these forces are consistent over time and generally their impact is geographically differentiated, meaning that certain areas are affected more than others and in different ways. The net effect of each scenario, therefore, is the expression of a complex interaction of the effects of policy measures, autonomous trends and place-specific attributes.

In order to reduce the inherent complexity of the scenarios, some of the most probable exogenous trends and developments are held constant. Climate change is assumed to continue according to predictions, globalisation and technological progress is expected to advance into 2030, and energy prices are expected to rise consistently. Large disruptive events such as a nuclear war, the collapse of the Internet and/or the global economy or a major natural disaster are not included in the main scenario storyline.

The scenarios are intended to investigate the likely impact certain policy decisions taken at the European level will have on the territorial structure. In order to measure this, two divergent policy packages regarding the economy (e.g. competitive and cohesive) are compared to a ‘baseline scenario’ which extrapolates the most probable developments in policy and autonomous trends. Afterwards, a ‘roll back’ scenario is drawn up which posits which kinds of measures are currently needed to arrive at certain policy targets for 2030. After briefly sketching out the context, these scenarios will be summarised in turn.

4.1.1 Scenario context

The new millennium began eventfully for Europe. In 2000 the EU drafted its 'Lisbon strategy' to become the world's top knowledge-based economy by decade's end, followed by the introduction of a common currency, the Euro, less than a year later. The auspicious mood would be soon overshadowed by the 9/11 terrorist attacks, global economic recession, soaring energy prices and the war on terror. This, however, did nothing to check the relentless pace of European integration and expansion: soon thereafter the Union underwent the most significant enlargement in its history and began drafting a Constitution.

These events were to shape the subsequent development of EU policy in the years to come. The Lisbon strategy, evaluated in 2004, had been making disappointingly slow progress and it seemed highly unlikely that its targets would be met. The Constitution was voted down in referenda in France and the Netherlands in 2005, raising concerns about the legitimacy of the European project. Meanwhile, mounting energy prices and questions regarding global supply exposed the lack of self-sufficiency in Europe and underlined the urgency of finding alternative sources. Finally, the 2004 enlargement fundamentally changed the spatial structure of the EU and produced some of the most significant socio-economic disparities in its fifty-year history. The Europe of the 21st Century was already looking quite different from that of the 20th.

4.1.2 Scenario hypotheses

Table 1 lists the main hypotheses used for the three prospective scenarios.

Baseline scenario	Competitiveness-oriented scenario	Cohesion-oriented scenario
<p>Demography</p> <ul style="list-style-type: none"> – Reduced population ageing as a result of lower fertility and mortality rates – Stable total European population (+ enlargement) – Increasing, but globally controlled external migration – Unchanged constraints on internal migration 	<p>Demography</p> <ul style="list-style-type: none"> ● Increase in selective external in-migration: economic sectors & destination ● Abolition of constraints to internal migration ● Increase in retirement age ● Encouragement of fertility rate through fiscal incentives 	<p>Demography</p> <ul style="list-style-type: none"> ● Restrictive external migration policies ● More flexible retirement ages ● Better balance of population structure through encouragement of higher fertility rates ● More flexible arrangements for child care
<p>Economy</p> <ul style="list-style-type: none"> – Slowly increasing total activity rate – Slowly growing R&D expenditure, but constant technological gap vis-a-vis the USA – Decreasing public expenditure 	<p>Economy</p> <ul style="list-style-type: none"> – Stronger reduction of total public expenditure compared with the baseline scenario – Further privatisation and liberalization of public services – ‘Flexibilisation’ of labour markets 	<p>Economy</p> <ul style="list-style-type: none"> – Maintaining the volume of the EU budget – Reinforcement of structural funds and concentration on weakest regions – Further harmonization of taxation and social security systems
<p>Energy</p> <ul style="list-style-type: none"> ● Steady increase of energy prices ● Stable or decreasing European consumption ● Increasing use of renewables 	<p>Energy</p> <ul style="list-style-type: none"> ● Steady increase of energy prices ● European consumption increasing ● Realisation of TEN – E: investment in infrastructure according to market demand 	<p>Energy</p> <ul style="list-style-type: none"> ● Steady increase of energy prices ● Realisation of TEN-E ● Promotion of decentralised energy production , particularly renewables
<p>Transport</p> <ul style="list-style-type: none"> ● Continued growth of traffic ● Constant increase of infrastructure endowment, but below demand needs ● Partial application of the Kyoto Agreement 	<p>Transport</p> <ul style="list-style-type: none"> ● Realisation of TEN-T: investment in infrastructure according to market demand ● Prioritisation of links between metropolitan areas 	<p>Transport</p> <ul style="list-style-type: none"> ● Development of TEN-T with priority given to peripheral regions at different scales ● Support to transport services in rural and less developed areas
<p>Rural development</p> <ul style="list-style-type: none"> ● Further liberalisation of international trade ● Progressive reduction of CAP budget ● Rapid industrialisation of agricultural production 	<p>Rural development</p> <ul style="list-style-type: none"> ● Rapid and radical liberalisation of CAP (reduction of tariffs, of budget and of export subsidies) ● Reduction of support to rural development policy 	<p>Rural development</p> <ul style="list-style-type: none"> ● Minor CAP reforms, but shift from pillar 1 to pillar 2. Priority given to less developed regions ● Priority given to environmental and animal health criteria ● Active policy for economic diversification in rural areas, including SMEs, tourism, residential functions etc.

<p>Socio-cultural sector</p> <ul style="list-style-type: none"> ● Heterogeneous and insufficient policies related to integration ● Growing ethnic, religious and social tensions 	<p>Socio-cultural sector</p> <ul style="list-style-type: none"> ● Reactive management of social problems in large cities ● Increase of surveillance and security systems 	<p>Socio-cultural sector</p> <ul style="list-style-type: none"> ● Promotion of regional and European identities ● Proactive socio-cultural integration policies, in particular in cities ● Increased fiscal and/or social investment in quality of life issues
<p>Governance</p> <ul style="list-style-type: none"> – Increasing cooperation between cross-border regions – Increase in multi-level and cross-sectoral approaches, but limited to specific programmes (rural development); 	<p>Governance</p> <ul style="list-style-type: none"> ● Abolishment of barriers to cross-border co-operation ● Less public intervention ● Wider application of the Open Method of Coordination ● Increased role of private sector in decision making 	<p>Governance</p> <ul style="list-style-type: none"> ● Active multi-level territorial governance, particularly in areas supported by structural funds ● Strong role of public actors in territorial governance ● Stronger role for the European Commission
<p>Climate change</p> <ul style="list-style-type: none"> ● Moderate overall climate change until 2030 (+1°) ● Increase in extreme local events ● Moderate emission levels due to new technologies ● Few (too few) structural adaptation measures 	<p>Climate change</p> <ul style="list-style-type: none"> ● Constant to increasing emission levels ● Mitigation measures based on flexible schemes & stimulation of alternative technologies. ● Adaptation measures only where cost efficient 	<p>Climate change</p> <ul style="list-style-type: none"> ● constant emission levels ● strict mitigation measures (taxes, road pricing as far as non detrimental to peripheral regions) ● wide range of adaptation measures (EU hazard funds, large investments)
<p>Enlargement</p> <ul style="list-style-type: none"> ● Bulgaria & Romania by 2007 ● Western Balkans (with Croatia acceding first) By 2020 ● Turkey by 2030 ● Continued combination of deepening and widening 	<p>Enlargement</p> <ul style="list-style-type: none"> ● Continuing enlargement to widen the market ● Romania, Bulgaria in 2007 ● Western Balkan, EFTA/EEA countries in 2015 ● Turkey in 2020, ● Strengthening of the neighbourhood policy (Maghreb, Ukraine, Russia etc.) 	<p>Enlargement</p> <ul style="list-style-type: none"> ● Deepening preferred to widening ● Break on further enlargement (except Bulgaria & Romania) ● Only lip service to neighbourhood policy

Table 1 Overview of hypotheses for the baseline and prospective scenarios (unless otherwise stated, the hypotheses of the baseline scenario are also valid for the two other scenarios)

4.2 Baseline (trend) scenario

4.2.1 The scenario

By the latter half of the decade, it was clear that the multiplicity of problems the Community was facing required a comprehensive approach at the European level. In order to deal with problems on several fronts, most EU sectoral policies were largely continued. Renewed efforts were required for the Lisbon strategy, demanding extra investments in R&D and education. Meanwhile the socio-economic rift between the old and new member states demanded that regional policy also be continued with vigour. To this end, investments were made in new infrastructure to improve the accessibility of these regions. Finally, after the accession of Bulgaria and Romania, the focus would be on integration rather than further expansion, at least in the following decade. No major changes were made to European immigration policy either: the EU would continue to facilitate movement between member states, but be more circumspect regarding immigration from abroad. One policy area which did undergo major reform is the Common Agricultural Policy (CAP). Partly under pressure of international organisations such as the WTO, this was subjected to extensive budgetary cutbacks and saw a substantive shift towards rural development.

By 2015 new spatial developments were becoming perceptible. Over the past ten years, Europe had enjoyed moderate economic growth as a whole, generally keeping pace with the US and Asia. Economic performance was strongly diversified within the EU however. Metropolitan regions were the main engines of growth, and it is here that the change in land use was the most pronounced. As agricultural land transformed into (sub)urban development, more remote natural areas transformed into farmland. A clear catching-up process of the new member states was evident: many regions in East Europe were exhibiting growth rates twice that of the EU15. The infrastructure investments had widened the radius of high-accessibility areas in Europe, particularly the connections between major cities. As time wore on, a greater emphasis was placed on mass transit, due to the escalating energy prices. At any rate, the Pentagon was expanding. Still, given the low starting point of the new member states, there was still much more catching up to do. Unemployment, for example, continued to be higher than in the EU15, and life expectancy lower. It was nevertheless clear that the overall standard of living and life expectancy in Europe continued to be among the highest in the world. The number of Europeans remained stable, due to relatively low fertility rates and immigration levels. Consequently, the composition of the population grew markedly older, especially in relation to the rest of the world. This ageing process was most pronounced in East Germany and Northern Italy.

By 2030, other territorial developments began to emerge. Climate change was making some areas in Europe increasingly inhospitable, particularly rural Spain, which struggled with perennial water shortages. Meanwhile, at the epicentre of continental Europe (e.g. Germany, France, Switzerland and Austria), melting glaciers and increased precipitation increased the frequency and destructive power of floods. The chequered implementation of Natura2000 resulted in checking, but not reversing, the decline in biodiversity. By 2030, population ageing had produced some strains on the labour market, particularly in East Europe, but also in Italy and parts of the Iberian Peninsula. Despite this, the new member states had continued their catching-up process, but progress tapered off as wage levels approached the EU15, and most growth was concentrated in metropolitan areas. New labour markets became available with the accession of the Balkan states in 2020 and Turkey in 2030. All in all, there are some indications that socio-economic disparities in Europe had decreased somewhat at the macro level (East versus West Europe), had grown even more acute between metropolitan regions and peripheral rural regions. Finally, the gap

between rich and poor within cities had widened, producing social strife and sometimes erupting into violence.

4.2.2 The final image

Figure 2 illustrates the *attraction and polarisation of metropolitan areas* in 2030. From this figure, we can see a remarkable concentration of strong metropolitan areas in the former pentagon, but also in less central regions (mainly capital cities and other European engines). The former pentagon of the early 2000s, grouping the *areas of concentration of flows and activities* has expanded, mainly along the main transport corridors, in the direction of important MEGAS like Barcelona and Madrid, Rome, Glasgow, Copenhagen, Stockholm and Oslo, Berlin and Warsaw, Prague, Vienna and Budapest. The basic characteristics of settlement systems in terms of *polycentricity* have not fundamentally changed. Various types of areas have run significant risks of economic decline in relation with progressing globalisation and European integration. The trend towards *marginalisation of various rural areas*, already observed in the early 2000s, has generally continued, but with regional variation. In some areas, the number of available jobs declined significantly. In others, population ageing and even depopulation reached a critical level. Accelerating globalisation has affected a significant number of industrial regions with low or intermediate technologies, exposing the *risk of declining activities*. The most severely affected areas lie in central and eastern Europe. *External immigration* (legal and illegal) has continued, with immigrants settling mainly in metropolitan areas, including central and eastern European cities. The *areas with a high potential for tourism and retirement* have specific geographical attributes (coastal, lake and mountain regions), while other *ageing areas* are mainly found in remote rural regions without specific attractiveness. Various regions are subject to the *impacts of natural hazards of various nature*. The least affected regions lie in northern Europe.

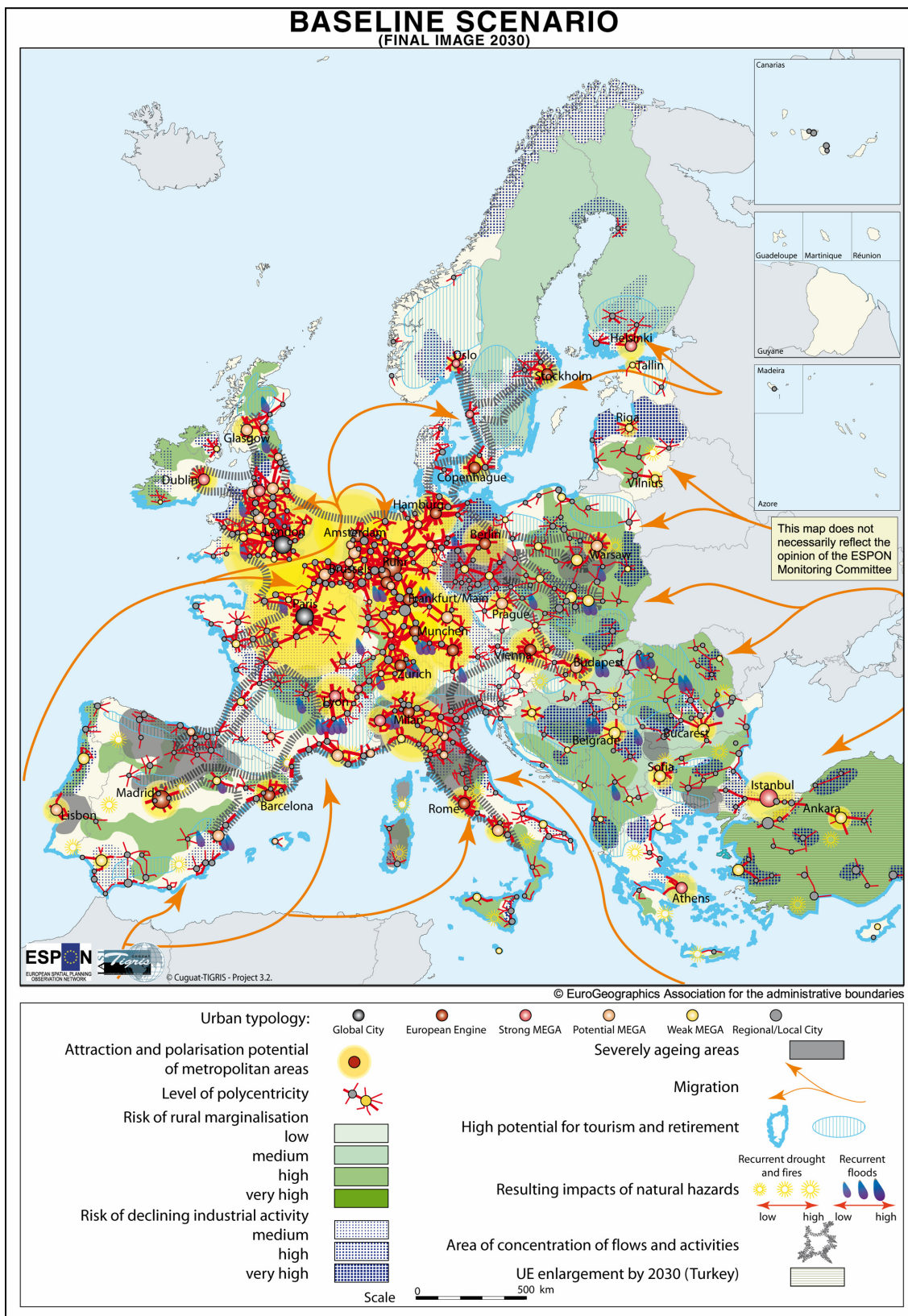


Figure 2 The final image 2030 of the baseline scenario

4.3 Danubian Europe: the cohesion-oriented scenario

4.3.1 The scenario

With the 2004 enlargement, the EU placed the final nail in the coffin of Cold War Europe, welcoming ten new member states into the EU, a majority of which had been under communist control for decades. At the same time, it inherited the most considerable socio-economic disparities of its history. If Europe was to maintain its integrity as a coherent whole, it would need to address this issue head-on. This constituted the main territorial challenge but also the main opportunity of the new century: to fully integrate the various parts of Europe, north and south, east and west, core and periphery. Recent history, particularly the example of EuroTiger Ireland, has demonstrated that, with sufficient EU support, it was possible to achieve growth rates rivalling that of the USA and Asia. Cohesion is also important as a matter of principle: Europeans should have the right to live and work in their own region, and not be forced by the caprices of market forces to migrate to some other area, where they are must adapt to other language and customs.

Regional policy is the main vehicle of change in the cohesive scenario. Structural funds are targeted to the most needy regions in order to produce the highest rates of growth in these regions. Considerable investments are made to connect peripheral areas with transport infrastructure, particularly rail, due to the rising price of fuel. Since these less-affluent areas are more dependent on agriculture, only minor reforms are made to the CAP budget. As in the baseline scenario, however, the emphasis shifts from production to rural development, sustainability and diversification. Strengthening the spatial structure of Europe also entails investing in measures to mitigate and adapt to the effects of climate change. No new enlargements are foreseen after the accession of Bulgaria and Romania; the emphasis is on a full integration of the new member states. To support this aim, a proactive social policy is put into place at the EU level. This entails stimulating domestic fertility rates via measures such as childcare support and tax incentives, introducing stricter immigration controls for non-EU countries, and promoting the integration of minorities into mainstream European society.

By 2015 some slight changes to the territorial structure of Europe began to make themselves seen. Economic growth in Europe progressed, albeit more gradually than in the baseline scenario. The high growth rates of the new member states was not altered significantly in this scenario, but the dominance of metropolitan areas as growth centres was less pronounced. In relative terms, more remote regions such as rural France, Austria and Northern Scandinavia improved their position at the expense of regions like Paris, the Randstad and the Cote d'Azur. Finally, despite the restraints on external migration, fertility is on the rise and population ageing less acute than in the baseline scenario, with the exception of Italy and Ireland.

By 2030 more long-term territorial effects became apparent. The magnitude of climate change, despite the environmental legislation to counteract it, was the same as in the baseline scenario. Due to the implementation of adaptation measures, however, the effects were much less severe. Floods were just as frequent, but displaced fewer families, drought just as common, but destroyed fewer crops. In addition the depopulation of rural areas was also less marked, these areas benefiting from rural development activities that had helped to reinvigorate their economy with sectors such as recreation and tourism. In all, disparities between East and West and cities and countryside had decreased with respect to the baseline scenario. The lack of any significant enlargement, however, has intensified disparities between the EU and its neighbours.

4.3.2 The final image

Figure 3 reveals a less concentrated, but more widespread pattern regarding *attraction and polarization potential of metropolitan areas in 2030*. Urban settlements are characterized by a more *polycentricity*, stretching over larger parts of the territory than in the baseline scenario. The number of areas at *risk of marginalization* and of *declining activities* is comparable to that prevailing in the baseline scenario, but their size is reduced and intensity lower. The *areas with high potential for tourism and retirement* as well as those with *severe population ageing* remain similar to the baseline scenario. The resulting *impacts of natural hazards* (drought, fires, floods) are much lower than in the baseline scenario. Another basic difference with the baseline scenario is the emergence of several *peripheral integrated zones*. The *area of concentration of flows and activities*, the successor of the former pentagon of the early 2000s, has a wider reach than in the baseline scenario and includes a larger number of cities in the close peripheries.

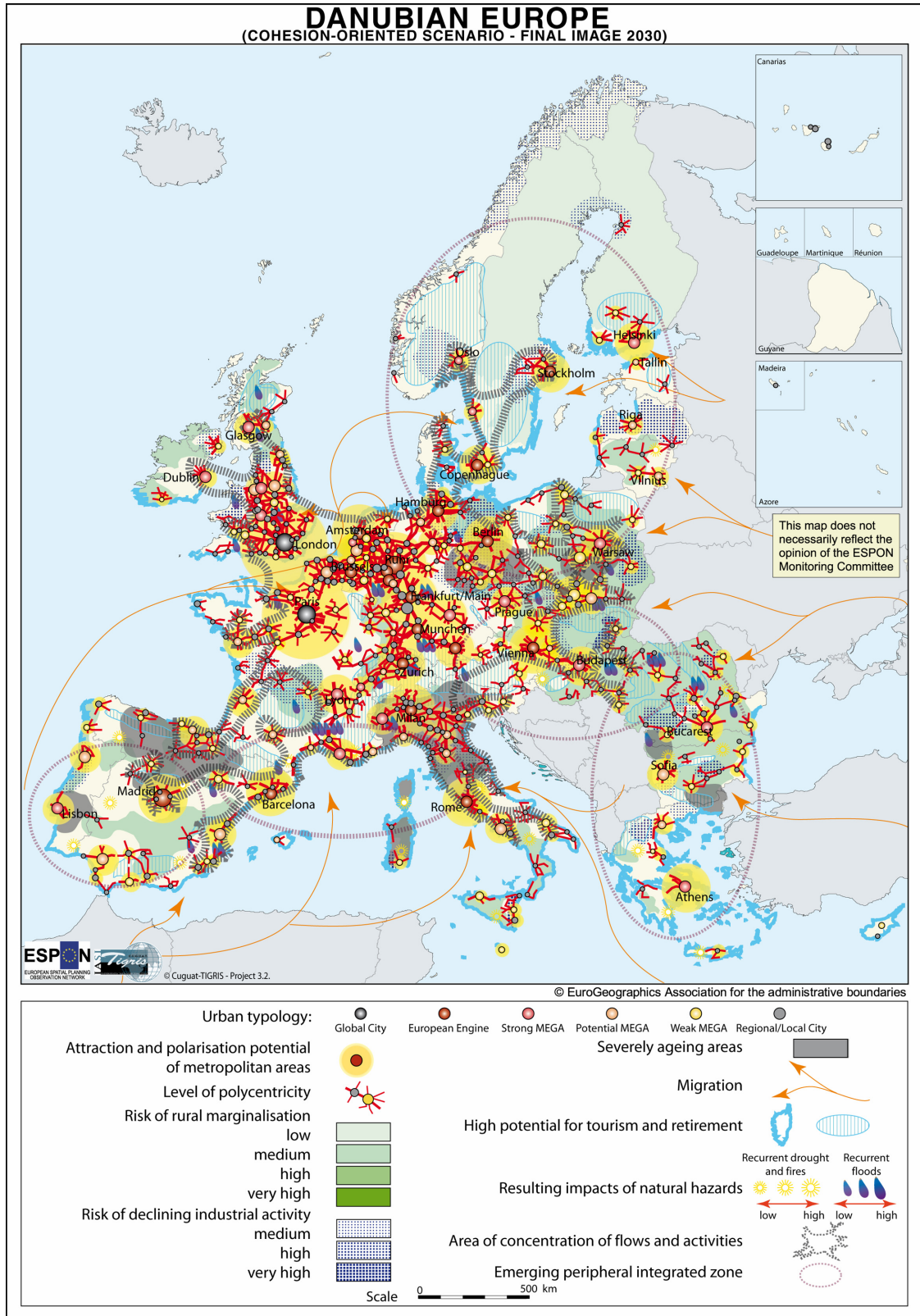


Figure 3 The final image 2030 of the cohesion-oriented scenario

4.4 Rhine-Rhone Europe: the competitiveness-oriented scenario

4.4.1 The scenario

The combination of the sobering mid-term review of the Lisbon strategy, coupled with the 2005 constitutional crisis served as a wake-up call for the EU. It was considered imperative to make bold decisions regarding Europe's continued prosperity: the Lisbon strategy would have to take precedence over institutional reform and other sectoral policies. The emphasis should be on expanding and improving the common market rather than deepening cooperation between the member states.

In order to attain superiority in the burgeoning knowledge economy, funds would need to be diverted from regional policy and CAP towards improving R&D, education and training and ICT infrastructure. Since the strongest regions have the best chance for competing at a global scale, they are supported accordingly. Regarding accessibility, it is generally felt that the market should dictate where links are most needed, but that priority should be given to linking together economically strong metropolitan areas as this would produce the most added value. To further enhance competitiveness, a selective immigration policy is pursued to attract the best minds to the EU, and negotiations with neighbouring countries are commenced to expand the common market further. In addition, government expenditures are slashed (particularly CAP), public services privatised, and policies to stimulate venture capital implemented. Other policy areas, such as environmental protection, social cohesion and integration are viewed as secondary.

By 2015 Europe had already witnessed some territorial changes. There was strong aggregate growth in the total economy, more so than in the baseline scenario, which directly affected flows of traffic. Not all regions profited equally however. In fact, the growth was remarkably concentrated in the central 'Pentagon' area of Europe in general and in metropolitan areas in particular – many nations had a national 'champion' city which acted as their economic motor. Higher transport costs, due to higher energy prices, reinforced this trend towards consolidation. Regions which performed less favourably than in the baseline scenario were almost invariably located in the periphery. There was a rapid increase in immigration following the relaxation of controls, at first by highly-skilled workers, but given the high growth levels in major urban centres, a steady influx of (illegal) immigration followed suit. This had a clear impact on the composition of the European population; it is younger than the baseline scenario, more urban, and more racially diverse. This trend is most pronounced in Britain, France, Scandinavia and the Baltic states. A side effect of this is mounting social and spatial polarisation. Insufficient integration programmes coupled with a lack of affordable housing and eroded public services resulted in an increasingly disadvantaged, disaffected and vocal underclass. Social friction fuelled suburbanisation and the construction of secure (gated) communities, resulting in the origin of dualised cities where socio-economic exclusion is exacerbated by physical exclusion.

By 2030 more structural changes had become apparent. The main European metropolises had coalesced both functionally (business and personal networks) as well as physically (via transport links and urban convergence). Fifteen years on, not just metropolitan regions in West Europe, but also those in East Europe were attracting migrants, particularly after 2015 with the accession of the Balkan countries and the increased cooperation with Russia and the Ukraine. Existing kinship ties directed the flow of migrants from Turkey (joining the EU in 2020) and the Maghreb region mostly to west European cities. Rural regions across Europe saw a population decline, save for those areas being urbanised due to proximity to cities or popular tourist destinations. Employment in agriculture, in particular, was a small fraction of what it had been thirty years before. Some of these areas reverted to nature,

while others were rationalised further by agribusiness or cultivated for energy production. The disappearance of agriculture was most prevalent in areas most acutely affected by climate change. This does not necessarily imply that nature flourished in the spaces left behind. The decline in biodiversity had only been slowed but not stopped; in the absence of a meaningful Natura2000 network nature was literally marginalised and species forced to move to less habitable areas, if they could.

4.4.2 The final image

As figure 4 shows, by 2030 the *attraction and polarisation potential of metropolitan areas* is powerfully concentrated in the traditional pentagon. Very few metropolitan areas outside of this area generate significant attraction and polarisation effects. The *area of concentration of flows and activities* is much more limited than in the baseline scenario. These areas cover only parts of the traditional Pentagon, although it too extends outwards along a few major corridors, reaching Vienna and Copenhagen. The *risk of rural marginalisation* is much more intense than in the baseline scenario. The *areas at risk of declining industrial activity* are more extended than under the baseline scenario and the intensity of risk is also higher. *External migration flows* are particularly intense. The *areas with high potential for tourism and retirement* are similar to the baseline scenario, but the *areas with severe population ageing*, generally in remote rural regions, are more expansive. The *resulting impacts of natural hazards* (drought, fires, floods) are more intense than under baseline assumptions.

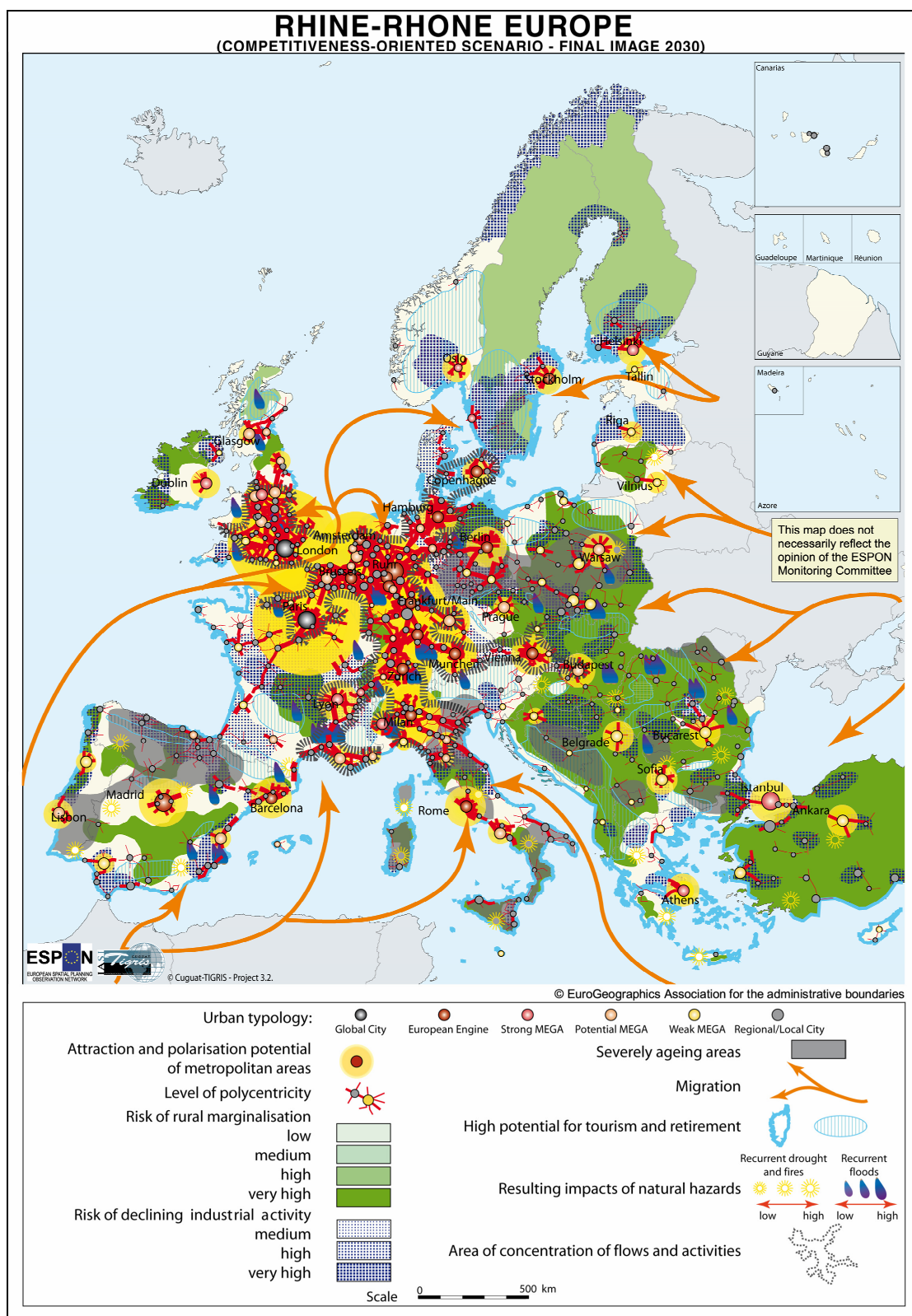


Figure 4 The final image 2030 of the competitiveness-oriented scenario

4.5 The chosen path: the proactive scenario

After the rejection of the constitution and the ensuing crisis in European institutional politics, a wide public debate was opened to engage the population about how best to tackle the current problems facing Europe. Three values emerged as indispensable and non-negotiable: a high standard of living for all areas in the EU, safety and the opportunity to contribute to society.

Translating these values into policy measures required a coordinated effort to enhance competitiveness, cohesion and sustainability simultaneously. Taking a territorial approach allowed these three dimensions to be addressed not as trade-offs but as complementary. Most notably, spatial strategy were geared to meeting the challenges of demographic evolution, globalization, high energy prices and climate change. It was finally accepted that this strategy would require substantial public spending, and a 'Scandinavian model' was advocated where high levels of public intervention went hand-in-hand with economic growth. This could only be achieved through significant increases in productivity.

Two elements proved indispensable for raising productivity in a sustainable way: education and innovation. In 2011 a pan-European treaty was signed which integrated new criteria into the old Maastricht budgetary criteria: R&D, education and public services such as health and child care. In order to allow for regional specificities, the criteria could be nuanced and prioritised according to regional realities, leaving a certain degree of autonomy to each region on how to reach the goals. This aspect was bolstered by a requirement for ex ante territorial impact assessments for all kinds of policies.

By 2015 increases in R&D and educational spending had made themselves apparent with the growth of science parks and expansion of university departments. The strategy of focusing on those sectors in which Europe already had a strong position (e.g. environmental technology, new energy sources, transport, biotechnology) had proved advantageous. The high energy prices had raised the profitability of industries based on renewable resources. Despite these positive signs, there was insufficient spill-over to industry via innovation, so new measures were designed to address this issue. This was not done generically, but applied in a differential manner: policy applied to each region had to be tailor-made in a bottom-up process, requiring a territorial governance approach which interlinks and coordinates all policies affecting a particular region. In addition, precautionary measures were implemented in places most likely to suffer from climate change, allowing them to pre-emptively diversify their economies.

By 2030, the achievements of increased productivity have allowed for practising a solid cohesion policy, which itself contributes to producing more competitiveness. All areas of Europe participate in the economic developments. Much of the top-level innovative economic activities continued to take place in larger metropolitan areas of Europe, mainly the central areas in and around the pentagon, but also in other clusters of metropolitan areas. Old industrial areas now have lower populations, but have succeeded in upgrading their industrial heritage into modern high-tech, capital-intensive industries. Many of the remaining regions either developed residential or tourist based economies or specialised in large-scale agricultural production (biomass and food). Some areas, however, became less populated and either gained more natural land cover, or provided spaces for more autonomous living situations. Mountain areas are very busy adapting to the impacts of climate change, such as reduced snow fall and increased risks of land slides. In the very remote low-density areas, innovative systems of flexible and mobile service provision allow the local populations to profit from modern services.

Europe in 2030 is well-connected by a clean and efficient multimodal system, the envy of the world. Even though the transport system is dominated by the main links between metropolitan areas, strong secondary networks link the intermediate spaces. Energy is produced in large quantities from renewable sources. Much of this production is decentralised to individual homes or small settlement areas, although some large-scale installations also exist.

Europe has strongly incorporated its neighbourhood into its functional area through cooperation and assistance, such as large education and infrastructure programs, but also through the abolition of international trade barriers, notably in agriculture.

5. Now let's do it: A selection of policy recommendations

5.1 Introduction

The elaboration and confrontation of the three integrated scenarios, together with the outputs of the numerous thematic scenarios, have yielded a number of salient policy implications about the future territorial development of Europe. These have been translated into a series of concrete policy recommendations. Before going into these more detailed policy recommendations, however, three fundamental messages arising from the scenario study need to be highlighted.

The first message is that **the European territory will be confronted in the coming decades with a number of new challenges, independent of the fundamental policy options related to cohesion or competitiveness**. In the face of these new challenges, current policies appear insufficient or not adequately targeted. New policy approaches will be necessary in the future, departing in many respects from the policies applied up to now.

The second message is that **the long-term evolution of European regions (more than 20 years) may significantly differ from the evolution in the short and medium-term (up to 15 years)**. Looking at the long-term future, the question can be raised how long the catching up process now observed in the new member states is likely to continue. The same applies to Western Europe for regions which had so far a stable economy but may be dealt a heavy blow by the challenges of globalisation.

The third message is that **market forces and the general evolution of the European society have, and will continue to have, far-reaching impacts on territorial development as compared to the expected effects of public policies**. Although the hypotheses of the various scenarios vary significantly in terms of basic priorities and resource allocation, the regional patterns of development resulting from the scenarios are not fundamentally different, even if distinct characteristics cannot be overlooked.

In the following sections, we present a brief selection of more detailed recommendations. As this project covers all aspects of territorial development, the recommendations are very diverse. Some are already present in policy documents (although not always with a territorial perspective), but are still included here because they are part of a coherent whole. For more information and recommendations, as well as specific recommendations for macro-regions, see Vol. 2, chapter 8.

5.2 General Policies

Territorial goals cannot be reached by territorial policies alone. A lot of the fundamental challenges have to be tackled at other levels and by using sectoral policies. Some of these are:

- promote redistribution of parts of the productivity gains to salaries and taxes in order to support internal demand and to more possibilities for active policy making
- go beyond the Open Method of Coordination by improving the linking of the sectoral policies and different spatial levels both in design and implementation
- significant public and private investment in education and training (including mainstream school system);
- significant public and private investments in new technologies, research and R&D, but also in other productivity-enhancing measures (organisational, IT-use, etc)
- targeted support to Europe's high competitiveness sectors, such as biotechnologies, energy, transport and bio products
- promote selective, but substantial immigration together with active integration policies for immigrants and groups originating from immigrant families (language, education, accommodation etc)
- development of sufficient and affordable child care facilities as well as special services and technologies for the elderly
- support to the development of new technologies and efficiency measures in:
 - energy
 - transport
 - water management
- promoting generalisation of Intelligent Transport Systems, combining information flows and transport flows to substitute physical mobility
- taxation and pricing policies (e.g. road pricing) to limit use of unsustainable transport modes and to finance development of sustainable transport modes

5.3 Territorial Policies

The selection of territorial policies listed below give an overview of the wide array of issues at hand. Many of them are implemented at different spatial levels. Vertical coordination is thus vital for their success.

- promote infrastructures and human capital (language, training in sectors of relevance etc) for the potential Global Integration Zones (GIZ) by implementing a global approach for each one and giving priority to the links of the respective network of MEGAs and cities
- particular support of policies at European level for certain technology clusters in specific locations (implying a more active European-level governance of technology / industry policies) without locking European development to certain technologies.
- integration of immigrants, poor and other weak social groups in socio-spatial structures mainly through integrated regional / local programs combining education, employment, housing, local environment amelioration interventions
- development of sufficient and affordable social services (health, education, child care facilities, facilities for the elderly etc) in remote, sparsely populated and population decline areas; innovative solutions for the provision of these services in the countryside especially in the very sparsely populated areas.
- decentralised systems of energy production and distribution in rural areas reducing their external energy dependency

- use of renewables should be promoted in local combined heating / electricity production on neighbourhood and individual household level
- policies for urban regions and metropolitan areas should favour energy savings through better integration of urban functions generating less mobility
- investments in water-saving irrigation techniques as well as in desalination plants in rural areas, especially in Southern Europe.
- exact evaluation of local and regional climate hazards and investment in adaptation measures, including, if necessary, relocation of settlements
- funding prevention measures against floods, such as shaping of river beds, designation of emergency water retention areas
- strict and active land use regulations and policies, as well as public intervention on land markets to
 - manage urban sprawl
 - reduce pressure from excessive building and large scale agriculture on sensitive and unique ecosystems
 - better coordinate the development of settlements with that on transport infrastructures and services
- more support and investments on public transport mainly in cities and metropolitan areas including the respective wider surrounding territory to create both opportunities for commuting as well as for weekend tourism.
- in disperse settlements areas and in areas undergoing a huge population decline "intelligent" solutions for providing transport services should be encouraged.
- support to strategic regional transport axes and to the interlinking of these secondary networks with the primary, long-distance network
- tackle social segregation by implementing integrated urban policies of social inclusion of the immigrants as well as of the poor and other weak social groups
- conduct an affordable infrastructural policy in less densely populated territories either by concentrating the respective facilities in mid-size cities and towns which might serve as centres of provision of services of general interest (communications, health, education etc with emphasis in child care facilities and specific services for the elderly) and by practising innovative forms of infrastructural provision, e. g. mobile health care service, distance learning. Emphasis should be given in territories which undergo a considerable population decline, in small island regions and in very sparsely populated regions.
- reorientation of almost all the existing EU policies or parts of them, i.e.: Cohesion policy, Agricultural policy, Transport policy, etc with focus on the implantation of territorially focused, integrated horizontal policy packages
- continued development of common spatial Europe-wide strategies and visions;
- creation of forms of governance for metropolitan areas comprising both the city and its surroundings; more efficient urban - rural partnership
- integrated management of 'abandoned' and environmental sensitive areas, including development of adapted economic activities

B. Scientific Summary

6. Introduction

At the outset this project was intended to elaborate scenarios on the basis of knowledge developed in the ESPON programme. Very rapidly, however, it became clear that the ESPON projects had not been conceived for the special purpose of serving as basis for scenarios. The team, thus invested heavily in activities which supported the elaboration of the integrated scenarios, but which all stand on their own as important contributions to territorial research: the scenario knowledge bases, the MACroeconomic, Sectoral, Social and Territorial (MASST) model, the Know trans-European Networks (KTEN) transport model, the exploration of potentials for a European Index of Territorial Cohesion (ETCI), an Indicator of Sustainable Demographic Development (ISDD), a Long-term Database (LTDB), and a methodology for territorial impact assessment (TIA). Finally, the project also had the task of scientific coordination of ESPON and of the maintenance and enhancement of the ESPON Database and Map Kit.

7. The scenario knowledge bases – Vol. 2, chapter 2 and Vol. 3

A very important part of the effort was the collection and synthesis of a vast amount of information on a wide array of themes related to European territorial development. The results of this work are the thematic scenario bases and the integrated scenario base which constitute a goldmine of information for anyone wanting an overview in any of the fields.

8. MACroeconomic, Sectoral, Social and Territorial (MASST) model – Vol. 4, Chapter 2

The MACroeconomic, Sectoral, Social and Territorial (MASST) model was created within the ESPON 3.2 project in order to quantify and territorialise the scenario forecasts developed within 3.2. MASST is a macroeconomic forecasting model consistent with the general ESPON philosophy that considers the efficiency and quality of territorial assets and socio-economic relationships to be the driving forces behind regional competitiveness and performance. Factors like accessibility, infrastructure endowment, local innovative capacity, local urban structure and geographical position are intrinsic to the logic of the model, and have been identified as crucial variables in the economic explanation of regional success in Europe. These local factors are complemented by macroeconomic, national ones which also play an important role in the model's logic for the interpretation of regional performance.

The model is therefore a predictive model for regional growth able to forecast territorial scenarios on different assumptions concerning: a) national macroeconomic tendencies and policies (e.g. interest rates, exchange rates, inflation rate, public expenditures, geographical reorientation and size of FDI, trend in public debts, revision of the Maastricht parameters, increase in energy price, attitude towards East-West and North-South migration, trend in fertility rate and in population ageing, trend in saving ratio); b) new institutional arrangements (widening vs. deepening of the European Union); c) European policies (e.g. geographical orientation and amount of structural funds and community agricultural policy;

transport infrastructure priority choices; flexible vs. rigid respect of the Lisbon agenda and of Maastricht parameters).

The MASST model is able to forecast medium to long term (max 2015) trends in real regional GDP growth and convergence trends, as well as in demographic variables (population growth and migration flows) at NUTS 2 level, under alternative assumptions on macroeconomic tendencies and policy options. When these qualitative assumptions are “translated” into quantitative terms and inserted into the MASST model, the latter enables the magnitude of the likely effects to be identified. The results should be interpreted as the tendencies and relative behavioural paths of regional GDP and population growth that will take place under certain conditions.

The MASST model reflects the modern conceptualization of regional growth. The model specification, in fact, defines regional growth as a competitive, bottom-up, endogenous and cumulative process. The endowment of local material resources, such as labour and infrastructures, and of non-material resources like the quality of human capital and the presence of value added functions, are all elements that in the MASST model explain the capacity of a region to grow at a rate above the national average. Regional competitiveness is therefore closely linked with the presence of endogenous resources and with the region’s ability to exploit its potentialities. In MASST, local factors matter. However, the model considers a second family of development factors, these being macroeconomic and national. It is well known that all regions belonging to a nation state are deeply affected by the national performance, a fact justified in economic terms by the relevance of: a) wholly macroeconomic elements, namely interest rates, exchange rates, inflation rate, public expenditure; b) institutional and generalised structural factors like the efficiency of the public administration, general education level of the population, the characteristics of the labour market relations. The bottom-up, “generative” nature of regional performance is therefore fully acknowledged, and it is incorporated into the internal logic of the model in a manner that seems extremely innovative within the existing literature. MASST has been successfully applied to the three qualitative scenarios developed within the ESPON 3.2 project: a baseline, a competitive, and a cohesive scenario.

9. Know trans-European Networks (KTEN) - Vol. 4, Chapter 3

KTEN Purpose: KTEN, together with MASST, have been used to precise qualitative scenarios into quantitative ones, providing an economic, spatial and environmental strategic assessment of them. In particular, KTEN is used to define transport network scenarios and evaluate them, from an European perspective.

KTEN Definition: (“Know trans-European Networks”) is a passenger and freight traffic forecast metamodel developed to facilitate a strategic analysis of the trans-European Transport Networks in a wider pan-European and Mediterranean scale.

KTEN Formulation: It is a sequential Four-steps model, with combined modal split and assignment on multimodal networks; assignment of interurban trips and freight between NUTS3 is made without congestion constraints (1 complete run of KTEN takes about 4 days; KTEN is 4GB large in total).

KTEN Information: It uses STREAMS results, WTO and EUROSTAT Air Traffic OD databases, ETIS-BASE freight matrices.

KTEN Integration with MASST: infrastructure regional endowment as output for MASST, GDP and population predictions from MASST as inputs.

KTEN main outputs: Multimodal passenger trips and costs and freight forecast between NUTS2 (disaggregated into NUTS3), traffics on rail, road, air and maritime links, relative European interest of road and rail links (considering interurban NUTS3 relation), spatial development and environmental aggregated indicators.

KTEN steps:

- Definition of infrastructure scenarios using IGIS project database according to the scenarios sketched by ESPON 3.2 TPG, following expert criteria.
- Calculation of construction costs, which are sent to MASST.
- MASST provides provisional GDP and population forecasts.
- Calculation of travel costs between NUTS2 capitals for different transport modes in a year 2000 scenario and a complete scenario with all infrastructures finished.
- Creation of future passenger and freight matrices for the complete scenario.
- Assignment of matrices and calculation of indicators.
- Redefinition of infrastructure scenarios using calculated indicators.
- Calculation of construction costs, which are sent again to MASST.
- MASST provides definitive GDP and population forecasts.
- Calculation of travel costs between NUTS2 capitals for different transport modes and all scenarios.
- Creation of future passenger and freight matrices for all scenarios.
- Assignment of matrices and calculation of indicators.

10. European Territorial Cohesion Index (ETCI) - Vol. 4, Chapter 4

The initial phase of work on the European Territorial Cohesion Index (ETCI) consisted in exploring the literature on international and regional composite indexes (like Human Development Index or Sustainable Development Indexes) and on an exploration of statistical and spatial analysis tools able to be used in order to build an ETCI. This first round of research led us to the pessimistic conclusion that even if a lot of solutions are theoretically available in order to build such an index, practically there is a major problem of availability of data at regional level covering all ESPON area. Sustainable development and - particularly - social data are currently missing at European level and databases like ESPON or EUROSTAT does not provide enough accurate data in order to build a global and synthetic ETCI taking into account the three main dimensions of ESDP (economic competitiveness, social cohesion, sustainable development). Moreover, in parallel with the discussions about the scientific difficulties to propose such an index, the question of the selection of the parameters used in order to measure such a bad defined concept like territorial cohesion is discussed in this first part of the report. This discussion led us to underline the ideological sensibility of this matter and to remember that the decision of the selection of the indicators should belong in definitive to politics.

Considering these pessimistic conclusions, we propose possible ways of evaluation of the scenario and measure of European territorial cohesion in the framework and the limits of time of ESPON 3.2 project. The extension of the use of demographic variables to other dimensions than the one that has been analysed by ESPON 1.1.4 ("Demographic Trends") is one of the most promising way to secure a social dimension (demographic indicators are "social sponges" reflecting the standards of living and the attractiveness of the territories, they are very difficult to manipulate and data are generally available at many space and time scales). The construction of an Index of Sustainable Demographic Development (ISDD) combining life expectancy at birth and median age permits to reflect indirectly the social situation (as life expectancy is an indirect social indicator) and the dynamics and

potentialities of territories (as median age is in Europe an indirect migratory dynamics indicator). It offers an alternative solution to purely econometric studies in order to secure a social dimension in ESPON 3.2 quantitative projects. It also permits to respond to the growing policy preoccupations at European level about the problematic of population ageing that have been underlined in many recent official documents and that is also recorded at the beginning of this second part. The ISDD values in 2030 in function of the different scenarios have been calculated with statistical models of convergence/divergence based on the hypothesis in terms of migrations, mobility, fertility and social cohesion of the qualitative scenarios, and the results are presented in a set of maps (smoothed maps and maps of discontinuities). In order to propose multi-scalar comparisons and to underline the advantages and the limits of ISDD, evaluations at international or intra-regional scales are also proposed.

Another possible way to study the question of territorial cohesion is explored with the problem of local access to economic services of general interest. This option is developed here more in order to establish a basis for the measure of territorial cohesion in the ESPON 2013 programme than to produce definitive results: the case study of accessibility to maternities in the Grande Région (border region between Belgium, France, Germany and Luxemburg) permits to vary the scale and to give an example of another approach of territorial cohesion matters, at more local level and in the particular cross-border context. This allows principally to present a methodology that could be generalized and reproduced in other European contexts in order to take into account another dimension (accessibility) and another scale (more precise than NUTS2) to measure territorial cohesion. However, intends of evaluation of the possible evolution of the accessibility to maternities in function of the scenarios are also developed in this part in order to illustrate at local level the qualitative scenario of ESPON 3.2.

11. Long-term Database (LTDB) - Vol. 6, Chapter 3.3

Not really a tool for prospective research as such, the Long-Term Database (LTDB) is nonetheless an important pre-condition for such research. In order to be able to project into the future, one must dispose of long-term information concerning the past. The Long-Term Database is an application designed to fulfill two main purposes:

- *The LTDB should provide a framework for **long-term storage of thematic and geometric data** for territorial units of the European area, at different resolution levels (ranging from the state level (NUTS 0) to the communes level (NUTS 5)).* The long term storage of data implies tackling several issues:
 - **Evolutivity issues:** the LTDB should rely on a flexible schema, so that new data (e.g. indicator values) and new types of data (e.g. new types of indicators) can be easily added.
 - **Data quality issues:** the LTDB should keep track of the quality of the data it contains.
 - **Usability issues:** the LTDB should be usable by other people than its designers, possibly as a shared resource.
- *The LTDB should provide a framework for a **reliable estimation of missing indicator values**, either for filling informational gaps or for the purpose of simulation of past or future hypothetical situations.* In order to provide this, several components should be designed:
 - A set of **generalized estimation methods** should be created in order to make it possible to estimate unknown indicator values from the available information in the database.

- A set of **generalized estimation strategies** should be provided in order to be able to choose the most appropriate estimation method for a given situation, based on the knowledge of thematic experts.
- A **mechanism for evaluating the quality of the estimated data**, by taking into account the accuracy of the method and the quality of the data used for estimation.

Our approach in the design of the LTDB is modular and incremental. This allows, on the one hand, the building of independent modules, which can be developed and can evolve independently from each other, and, on the other hand, the development of basic functionalities first, with the option of adding the more advanced ones later in the development of the application.

LTDB is composed of four modules:

- **An Application Management Module** which provides the interface between users and the application. It controls the execution of all the functionalities of the application.
- **An Estimation Module** which is a hierarchy of themes and indicators and which eliminates ambiguities for thematic queries and maintaining data consistency on updates
- **An Estimation Module** which controls the application of estimation methods whenever data gaps are detected.
- **A Data Management Module which contains the database itself.**

The LTDB database schema has been implemented using the open source object-relational DBMS PostgreSQL and its spatial extension PostGIS. An interface for data acquisition from other relational sources (GIS data, .shp files, other databases and Excel sheets) has been implemented in Java. This interface allows to retrieve data from external sources and to insert them into the specific schema of the LTDB. This can be used both for the construction of the database and for updates. Some data have already been integrated into the database (demographic data for 1980 and for 1998). Other data are to be integrated from more sources (e.g. ESPON) in order to test the reliability and efficiency of the estimation methods.

In volume 6, we also provide recommendations concerning the integration of the LTDB, in relation to the ESPON Database into the database system of the ESPON 2013 programme.

12. Territorial Impact Assessment (TIA) - Vol. 5

One of the tools high on the wish list of territorial policy makers is a tool which should allow non-specialists to organise their thinking about the territorial impacts of particular policy choices and programmes. This tool should offer the necessary framework for decision makers, and stakeholders in general, to help them explore the impacts of any policy on different spatial levels in order to allow informed debate and decision-making processes.

The existing formalised tools such as the Environmental Impact Assessment and the Strategic Environmental Assessment only concern programmes and projects, not policies, and are limited to the field of environmental sustainability. Recently, the Commission has also developed the general Impact Assessment procedure which aims at evaluating the impacts of different forms of policy implementation. Up to now, territorial impacts have not been taken into account. The ESDP explicitly mentions the need for specific territorial impact assessment procedures, at least for concrete projects, but also calls for the need to

coordinate the sectoral policies with territorial goals. In line with the ESDP proposals, the ESPON has tried to measure the territorial impact of a whole series of sectoral policies.

The eleven ESPON policy impact studies examined in this report show a rather strong diversity in the approaches adopted. This diversity reflects the heterogeneity of the policies themselves which influence the evolution of the territory through the application of rather different instruments and measures. Diversity is however stronger in the field of techniques of analysis than in that of types of impacts investigated or in that of logic and formalisation of cause-impact relations. Only a few policy impact studies are future-oriented and produce substantial simulations of possible territorial impacts of future policies.

In order to provide a more unified methodology, we present the prototype and first implementation of a methodology for future assessments, called TEQUILA. TEQUILA is a multicriteria model which breaks down the impact assessment into a general part exploring impacts of policies on policy-related indicators (criteria) on a general level and a regionalised part where these general impacts are then adapted to regional specificities.

The general assessment refers to a general, abstract territory, and the impact on each criterion (c) may be seen as a 'potential impact' (PIM):

$$GA = \sum c \theta_c \cdot PIM_c$$

where

θ_c = weight of the c criterion

PIM = potential impact of policy (abstract)

In a second step a *Territorial Impact* model is built to assess the impact on single regions r:

$$TIM_r = \sum c \theta_c \cdot S_{r,c} \cdot (PIM_c \cdot PI_r) \cdot PA_r$$

where

TIM = territorial impact (for each dimension: efficiency, quality, identity)

c = criterion of the multi-criteria method

r = region

θ_c = weight of the c criterion, $0 \leq \theta_c \leq 1$; $\sum c \theta_c = 1$

$S_{r,c}$ = sensitivity of region r to criterion c, $0 \leq S_{r,c} \leq 1$

PIM = potential impact of policy (abstract), $-5 \leq PIM_c \leq +5$ (in qualitative analyses)

PI = policy intensity (in region r)

PA = policy applicability (a 0/1 variable)

13. Of networks and databases: The ESPON scientific platform - Vol. 6

This project was the coordinating project of ESPON which means that it supported the ESPON Coordination Unit in all tasks linked to the ESPON scientific platform. ESPON results were obviously privileged sources for the scenario knowledge bases. As such, this project was obviously permanently networking with all ESPON projects.

The central element of this tasks was obviously the ESPON Database and the ESPON Mapkit. ESPON is all about data. Its main aim is to collect and analyse evidence concerning the

territorial structures and trends in Europe. Quantitative data is obviously the prime source of information for this task. Other sources, such as case studies, exist and are being used, but even though they sometimes allow to go deeper into the complexities of the actual mechanisms and driving forces, they do not offer the coverage of the entire ESPON space. It is, thus, logical that in a programme dealing with such a large space and a context of common policy making across most of this space, statistical indicators are the central axis around which the scientific work revolves, and this axis is represented by the ESPON database.

This database contains all the indicators collected and used in the ESPON projects. It complements Eurostat Regio data with many other sources and adds ESPON-made indicators to the lot. It is a unique collection of data at regional level across 29 states. The continuous updating and maintenance of this database was a major task for the project.

However, both statistical analysis and cartography at a regional scale in Europe are confronted with the problem of continuously changing definitions of indicators and administrative regions, regularly interrupting time series. This made the maintenance of the database, but also of the ESPON MapKit which contains all of the geometric layers necessary for ESPON cartography, a continuous challenge. The Long-Term Database presented in a previous section is the attempt to find a more permanent solution to this issue.

In order to support such long-term efforts in the future, we recommend the following guidelines for data collection:

- Always submit the raw data exactly as received from the original data provider(s).
- For each raw data set provide at least the following information (as is already more or less the case):
 - Exact definition of original data (as given by data provider – example: number of unemployed according to ILO methodology)
 - Exact source of data, including provider and data collection system (example: Eurostat – Labour Force Survey)
 - Geographic units: which units, defined by whom and at which period (example: NUTS2 - Eurostat – 2003)
 - Information about missing data (example: no data for Romania and Switzerland; only NUTS 1 data for Germany)
- For any indicator derived from this raw data:
 - Exact formula of calculation (example: unemployment rate = number of unemployed / total of active population between 15 and 65 years of age).
 - Methods of estimation used for missing data (example: for France unemployment as per national (not ILO) definition)

14. Further research issues and data gaps to overcome

This project was about the future. Data “gaps” are, therefore, total, as no data exists for the future. It would also be too tedious to go into each of the many fields contained in the scenario knowledge bases and to highlight missing indicators. The thematic projects of ESPON have done this sufficiently.

The same holds true for further research issues which in the context of scenario elaboration are obviously infinite. The following list is, therefore, the simple result of a brainstorming exercise help within the project team. The order does not indicate any choice of priority.

- **Geographical scales and scopes**

- include lower spatial levels, e.g. intra-urban; this should also allow to identify those levels where driving forces have their major effects
- Europe's neighbourhood: see Europe as a system which includes outside elements
- special focus on New Member States (currently too limited data, which is sometimes misleading to the very special situation of the last 15 years)
- link between Europe's role in the world and intra-European structures and dynamics
- detailed prospective studies for different types of territories (mountain areas, coastal areas, etc)

- **Thematic fields** (some of these have been addressed partly in ESPON, but will need deepening)

- more social matters, including at local scales
 - housing
 - poverty
- environment and climate change
 - more prospective analyses (integrating existing studies into ESPON logic and space)
 - more data
- evolution of urbanisation, landscape and land use patterns, including the mechanisms and driving forces
- relation between winning metropolitan areas and their weaker surroundings
- shrinking cities
- how to reorganise infrastructure and housing
- database of best practices
- innovation areas, economic clustering and networking: how can policy influence these
- state, trends and impacts of population ageing
- state, trends and impacts of the change in energy paradigm
- spatial impacts of possible technological developments
- territorial integration process
 - what are they ?
 - where do they take place ?
 - why ? how ?
- evolution of values (cf. European Social Survey)
- tourism
- driving forces and dynamics of large companies / MNC and their dynamics of location
- access to services of general interest
- territorial impact of privatisation / market management of public services

- **Methodologies**

- more in-depth studies, not necessarily covering the entire ESPON space
- continuous maintenance and enhancement of the "scenario base", i.e. constant monitoring, adaptation and synthesis of knowledge on trends, driving forces and mechanisms created inside and outside ESPON
- integration of different models (KTEN, MASST) with other models (including environmental) in order to create comprehensive model of territorial development.
- more focus on driving forces and mechanisms and less on instant snapshots