The Role of Transport Infrastructure for Regional Development in South-East Europe

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One of the main obstacles for economic development of the countries in eastern Europe is the poor quality of transport infrastructure in and between these countries and between them and western Europe. This problem has been addressed by the Transport Infrastructure Needs Assessment (TINA) programme of transport infrastructure corridors for the accession countries (TINA, 1999; 2002) and the High Level Group "Networks for Peace and Development" (HLG, 2006) advising the EU on the extension of the major trans-European transport axes to the neighbouring countries and regions (HLG, 2006). However, the territorial impacts of the trans-European transport network (TEN-T) projects, the TINA projects and further projects identified by the High Level Group are not clear at all. The outcome might be a higher level of cohesion but as well an increase in spatial disparities.

Therefore in the project "Particular Effects of Enlargement of the EU and Beyond" of the European Spatial Planning Observatory (ESPON) a scenario study was conducted to assess the impacts of the TEN-T and TINA projects on the regions in the new member states and accession countries Bulgaria and Romania (ESPON 1.1.3, 2006). The method used was the regional economic model SASI used already in ESPON 2.1.1 (ESPON 2.1.1, 2004). Here the SASI model was used specifically to forecast the socio-economic development of the regions in the new member states after their entry into the European Union taking account of the expected reduction of border barriers, such as waiting times and customs procedures as well as different scenarios of implementation of the TEN-T and TINA projects.

However, because the EU new member states and accession countries are neighbouring and, together with Greece form a half circle around the western Balkan states, Albania, Croatia, Bosnia and Herzegovina, Macedonia, Serbia and Montenegro were part of the model region, though with coarser spatial resolution than the new member states and accession countries. Therefore, in a preliminary and approximate way the results of ESPON 1.1.3 allow to draw tentative conclusions about the likely impacts of the TEN-T and TINA transport infrastructure projects on the western Balkan countries.

The SASI Model

The SASI model is to forecast socio-economic and spatial impacts of transport infrastructure investment and transport system improvements in Europe. For this it has to meet two requirements: It must be responsive to changes in European transport policy, in particular to different scenarios and time schedules of improving the trans-European road and rail networks, and it must produce regional indicators of socio-economic development and cohesion that are relevant from the point of view of policy objectives of the European Union.

The first of these two requirements is addressed by calculating regional accessibility indicators expressing the location of each region within the European road and rail networks. Changes in the trans-European networks affect the distribution of accessibility and the economic advantage across regions. However, regional socio-economic development cannot be explained by transport changes alone. Therefore other (non-transport) factors determining regional socio-economic development are included in the model. These factors include assumptions about European developments as well as factors expressing the endowment, or suitability and capacity for economic activities, of regions. When comparing different scenarios of transport network development, the non-transport factors are kept constant.

The second requirement determines the output and hence necessary submodels of the model. The goals of the European Union are the promotion of harmonious and balanced economic development, stable, non-inflationary and sustainable growth, convergence of economic performance, high levels of employment and social security, improvement of the quality of life and economic and social coherence and solidarity between the member states. Despite their acknowledged weaknesses the most commonly used indicators of regional economic efficiency are gross domestic product (GDP) per capita and employment. This implies that not only economic output and employment but also population and labour force have to be modelled. Equity or cohesion indicators finally express the distribution of GDP per capita and employment across regions. Based on the above considerations, the SASI model has six forecasting submodels: *European Developments*, *Regional Accessibility*, *Regional GDP*, *Regional Employment*, *Regional Population* and *Regional Labour Force*. A seventh submodel calculates *Socio-Economic Indicators* with respect to efficiency and equity. Figure 1 visualises the interactions between these submodels.

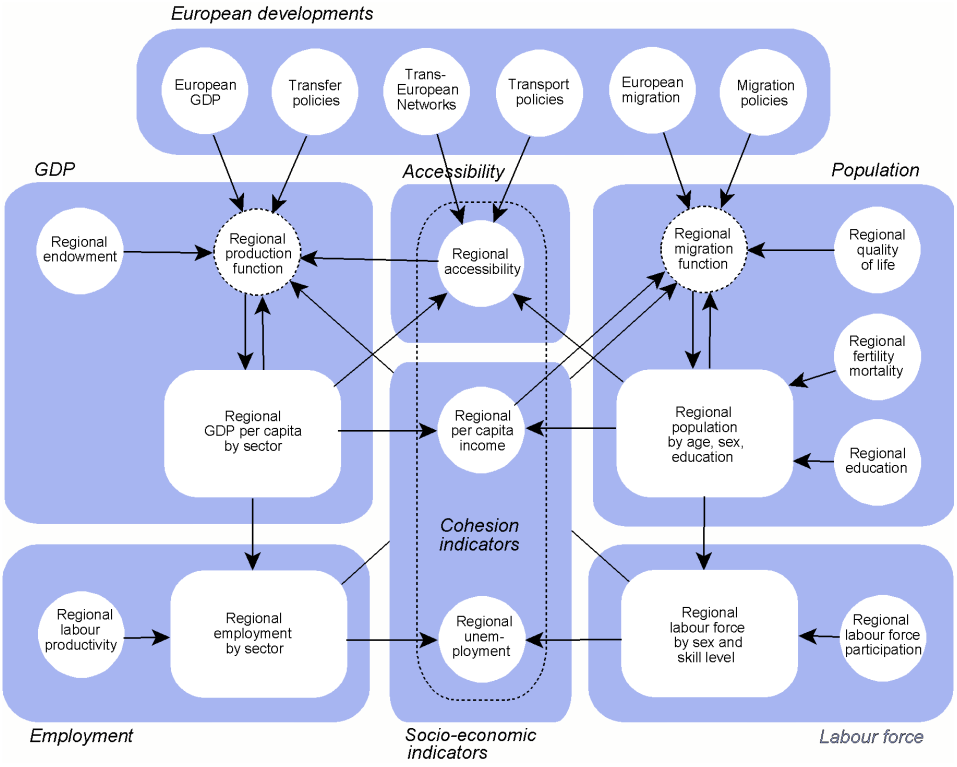

Figure 1. The SASI model

European Developments. Here assumptions about European developments that are processed by the subsequent submodels are entered. European developments include assumptions about the future performance of the European economy as a whole and the level of immigration and outmigration across Europe's borders. They serve as constraints to ensure that the regional forecasts of economic development and population are consistent with external developments not modelled. Given the expected rapid population growth and lack of economic opportunity in many origin countries, total European immigration will be largely a function of immigration policies by national governments of the countries of the European Union. Another relevant European policy field are transfer payments by the European Union via the Structural and Cohesion Funds or the Common Agricultural Policy or by national governments to assist specific regions, which, because of their concentration on peripheral regions, are responsible for a sizeable part of their economic growth. The last group of assumptions are those about policy decisions on the trans-European networks. As these are of focal interest in SASI, they are modelled with considerable detail. A network scenario is a time-sequenced investment programme for addition, upgrading or closure of links of the road, rail or air networks.

Regional Accessibility. This submodel calculates regional accessibility indicators expressing the locational advantage of each region with respect to relevant destinations in the region and in other regions as a function of travel time or travel cost (or both) to reach these destinations by the strategic road, rail and air networks (Schürmann et al., 1997; Wegener et al., 2001). In addition border waiting times and political, cultural and language barriers between countries barriers are taken into account as cost penalties added to the monetary transport costs. The effects of European integration are modelled by reducing these penalties over time.

Regional GDP. This is the core submodel of the SASI model. It calculates a forecast of gross domestic product (GDP) per capita by industrial sector (agriculture, manufacturing, construction, trade/tourism/transport, financial and other services) generated in each region as a function of endowment indicators and accessibility. Endowment indicators are indicators measuring the suitability or capacity of the region for economic activity. They may include traditional location factors such as availability of skilled labour and business services, capital stock (i.e. production facilities) and intraregional transport infrastructure as well as 'soft' location factors such as indicators describing the spatial organisation of the region, i.e. its settlement structure and internal transport system, or institutions of higher education, cultural facilities, good housing and a pleasant climate and environment. Accessibility indicators are derived from the Regional Accessibility submodel. In addition to endowment and accessibility indicators, monetary transfers to regions by the European Union such as assistance by the Structural and Cohesion Funds or the Common Agricultural Policy or national governments are considered, as these account for a sizeable portion of the economic development of peripheral regions. The results of the regional GDP per capita forecasts are adjusted such that the total of all regional forecasts multiplied by regional population meets the exogenous forecast of economic development (GDP) of Europe as a whole by the European Developments submodel.

Regional Employment. Regional employment by industrial sector is derived from regional GDP by sector by exogenous forecasts of regional labour productivity (GDP per worker) by sector modified by effects of changes in regional accessibility.

Regional Population. Regional population changes due to natural change and migration. Births and deaths are modelled by a cohort-survival model subject to exogenous forecasts of regional fertility and mortality rates. Interregional migration within the European Union is modelled as annual net migration as a function of regional unemployment and other indicators

expressing the attractiveness of the region as a place of employment and a place to live. The migration forecasts are adjusted to comply with total European immigration and outmigration forecast by the European Developments submodel and the limits on immigration set by individual countries. In addition educational attainment, i.e. the proportion of residents with higher education, is forecast as a function of national education policy.

Regional Labour Force. Regional labour force is derived from regional population and exogenous forecasts of regional labour force participation modified by effects of regional unemployment.

Socio-economic Indicators. Regional per capita income is derived from regional GDP per capita. Regional unemployment is the difference between regional employment and labour force. Accessibility, besides being a factor determining regional production, is also considered a policy-relevant output of the model. In addition, equity or cohesion indicators describing the distribution of accessibility and GDP per capita across regions are calculated.

The *spatial* dimension of the model is established by the subdivision of the European Union into regions at the NUTS-3 level. The study area of the model consists of the original 15 EU member states (1,085 regions), the 10 new member states (121) regions, the two accession countries Bulgaria and Romania (70 regions), Norway and Switzerland (45 regions) and the western Balkan countries Albania, Bosnia and Herzegovina, Croatia, Macedonia and Serbia and Montenegro (9 regions), in total 1,330 regions. The regions are connected by road, rail and air networks. The *temporal* dimension of the model is established by dividing time into periods of one year. The base year of the simulations is 2001 and the forecasting horizon 2031, however, in a backcast also the period 1981-2001 is modelled. In each simulation year the seven submodels of the SASI model are processed in a recursive way, i.e. sequentially one after another, i.e. within one simulation period no equilibrium between model variables is established; in other words, all endogenous effects in the model are lagged by one or more years.

More detailed information on the SASI model and its implementation and calibration for ESPON can be found in Wegener and Bökemann (1998) and the Final Reports of ESPON 1.1.3 (ESPON 1.1.3, 2006).

Transport Scenarios

In ESPON 1.1.3 one Reference Scenario and various transport policy scenarios were simulated. Here only the results of three scenarios can be presented:

- Scenario 00: The Reference Scenario (Scenario 00) is defined as the fictitious development that would have taken place if there had been no EU enlargement and only the transport projects of the *old* ('Essen') priority list of TEN projects (European Commission, 2002) would be implemented. The Reference Scenario serves as the benchmark against which all policy scenarios are evaluated.

- Scenario A1: The first policy scenario is not a transport scenario in the narrow sense of the term but examines the impacts of the EU enlargement itself on transport and hence accessibility and economic development. In the enlargement scenario no transport infrastructure projects beyond the projects already contained in the Reference Scenario are implemented.

However, it is assumed that the general process of European integration and the process of EU enlargement starting in 2004 gradually reduces the barriers to economic exchange and travel as well as waiting times and costs at border crossings between the old and new member states and between the new member states themselves but also between the EU member states and other countries including the western Balkan states.

- Scenario B1: This scenario assumes that in addition to the EU enlargement all transport infrastructure projects of the *new* TEN priority list identified by the High-Level Group headed by Karel van Miert (HLG, 2003), which includes more projects in the new member states, are implemented.

Other scenarios modelled included scenarios in which in addition to the TEN priority projects all TEN and TINA projects as documented in the latest revisions of the TEN-T and TINA programmes (European Union, 2004; TINA, 2002) are implemented as well as scenarios in which further transport infrastructure projects in eastern Europe responding to the needs of east European countries are implemented. The results of all scenarios are presented in the ESPON 1.1.3 Final Report (ESPON 1.1.3, 2006).

Scenario Results

This section presents the impacts of policy scenario B1 on accessibility and GDP per capita of the 1,330 model regions until 2031, with special emphasis on the western Balkan states.

Accessibility

Table 1 shows summary results for accessibility (rail/road/air, travel) of the two policy scenarios.

Table 1. Accessibility impacts (difference to Reference Scenario in %)

Region	Enlargement effect A1	Transport effect B1-A1	Total effect B1
Abania	+28.79	+3.93	+32.72
Bosnia and Herzegowina	+24.90	+7.46	+32.36
Croatia	+21.52	+6.34	+27.86
Macedonia	+26.30	+4.91	+31.21
Serbia and Montenegro	+54.72	+7.32	+62.04
EU15	+8.90	+2.38	+11.28
CH+NO	+22.40	+4.37	+26.77
NMAC	+19.13	+9.02	+28.15
EU27+7	+11.10	+3.49	+14.59

The numbers are differences between the two policy scenarios and the Reference Scenario in 2031 in percent for each of the western Balkan states and the old EU member states (EU15), Switzerland and Norway (CH+NO), the ten new member states and the accession countries Bulgaria and Romania (NMAC) and the total model region (EU27+7).

All scenarios improve accessibility everywhere, with the greatest improvements in the new member states, accession countries and western Balkan countries. The largest effect has the enlargement process itself (Scenario A1), even for the accession states Bulgaria and Romania and the western Balkan states because it has reduced border barriers not only between the EU member states but also between the EU and other countries. But also the infrastructure scenario (Scenario B1) has stronger effects in east and south-east Europe. Projects in the new member states and accession countries contribute most to this improvement. If the number of projects in the eastern Europe is increased, as in the other scenarios not shown here, the transport effect is larger. In all infrastructure scenarios the gap in accessibility between western and eastern Europe is reduced; in the scenario with maximum additional infrastructure projects in eastern Europe it is actually closed.

Figure 2 shows the spatial distribution of accessibility in the Reference Scenario and Scenario B1. Except in northern Croatia around Zagreb, accessibility is inferior even compared with the eastern Balkan states Romania and Bulgaria because of decades of lack of investment and maintenance. However, in Scenario B1 with TEN priority projects 7 (Motorway axis Athens-Sofia-Budapest) and 22 (Railway axis Athens-Sofia-Budapest-Vienna) implemented significant accessibility effects on Serbia and Montenegro and to a lesser extent also Bosnia and Herzegovina and Macedonia are visible.

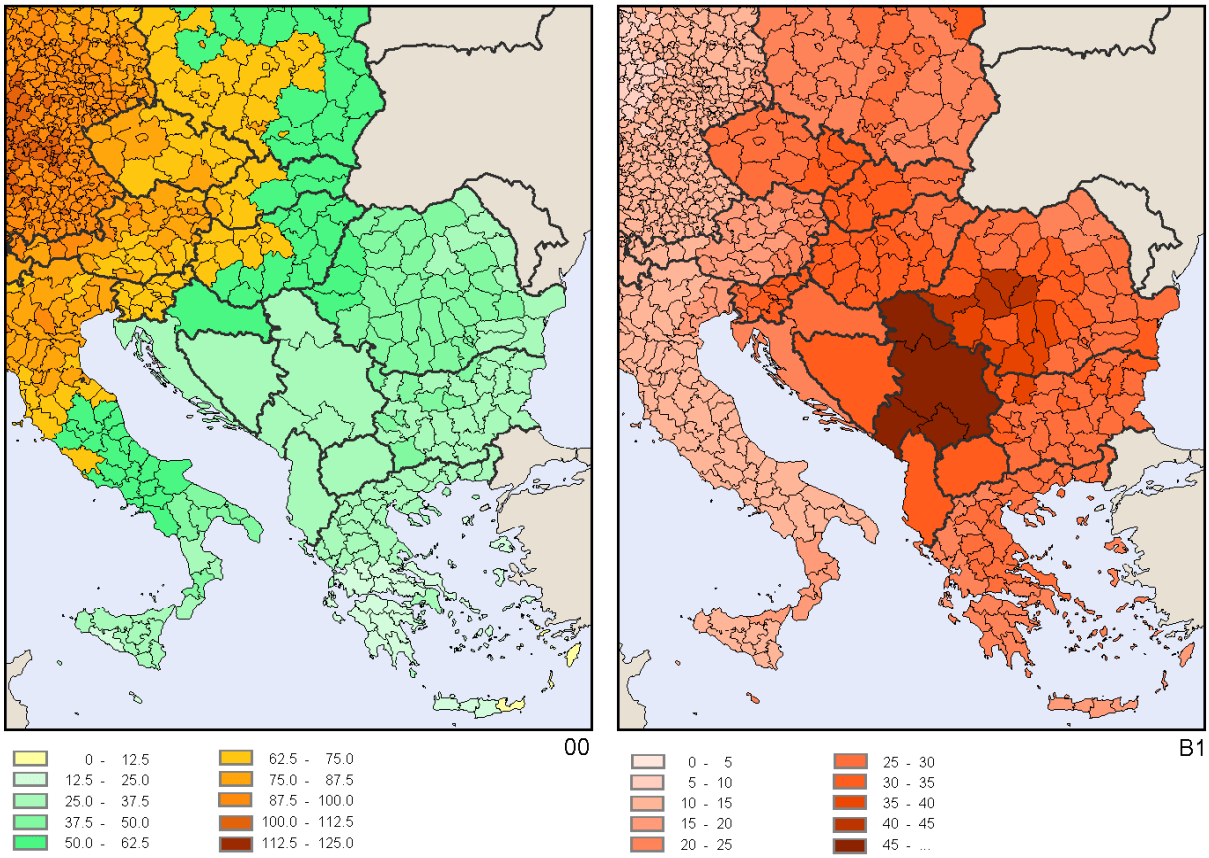

Figure 2. Accessibility rail/road/air, travel in the Reference Scenario 00 (million) and accessibility effects of Scenario B1in 2031 (%)

GDP per capita

Table 2 shows the results for GDP per capita of the three scenarios as differences between the policy scenarios and the Reference Scenario in 2031 in percent for the western Balkan countries, the old member states (EU15), Switzerland and Norway (CH+NO), the new member states and accession countries (NMAC) and the total study region (EU27+7).

Table 1. GDP impacts (difference to Reference Scenario 00 in %)

Region	Enlargement effect A1	Transport effect B1-A1	Total effect B1
Abania	+7.46	+0.57	+8.03
Bosnia and Herzegowina	+5.63	+1.59	+7.22
Croatia	+3.28	+0.78	+4.06
Macedonia	+5.16	+0.65	+5.81
Serbia and Montenegro	+7.59	+0.99	+8.58
EU15	+2.02	+0.49	+2.51
CH+NO	+2.97	+0.57	+3.54
NMAC	+2.88	+1.23	+4.11
EU27+7	+2.10	+0.53	+2.63

Table 2 shows that the relative large changes in accessibility translate into only very small changes in economic activity. Like the accessibility effects in Table 1, the economic effects of enlargement are much larger than those of transport infrastructure investments, even for the accession countries and western Balkan countries for the reasons stated above. If the number of projects in the east European countries is increased, as in the other scenarios not shown here, the transport effect is larger, but even with maximum transport investments the gap in income between western and eastern Europe is not closed: The east European countries are the winners only in relative terms, i.e. in percent. However, due to their low initial values of GDP per capita, their gains in absolute terms are only about one third of those of the old EU member states. This underlines that transport infrastructure alone is not enough to significantly reduce the existing economic disparities between west and east Europe. However, massive provision of transport infrastructure would significantly contribute to that goal.

Figure 3 shows the spatial distribution of the economic effects indicated in Table 2. The distribution of GDP per capita in the Reference Scenario is shown in the left-hand map. The right-hand map shows the economic effects of Scenario B1. The maps show standardised GDP per capita, i.e. GDP per capita in percent of the European average (EU27+7=100). In the map on the left the lighter shades indicate GDP per capita below the European average in the Reference Scenario, i.e. without EU enlargement. It can be seen that even parts of the old EU member states, such as east Germany, southern Italy and Greece, have below-average GDP per capita but the GDP per capita of the Balkan states, except Croatia, remains below 20 percent of the European average. The map on the right shows the relative winners and relative losers among the regions. It can now be seen that parts of Poland and the Czech Republic, except the capitals Warsaw and Prague, become relative losers, i.e. grow less than the European average. The largest economic effects occur in Serbia and Montenegro and Albania and to a lesser degree in Bosnia and Herzegovina and Macedonia.

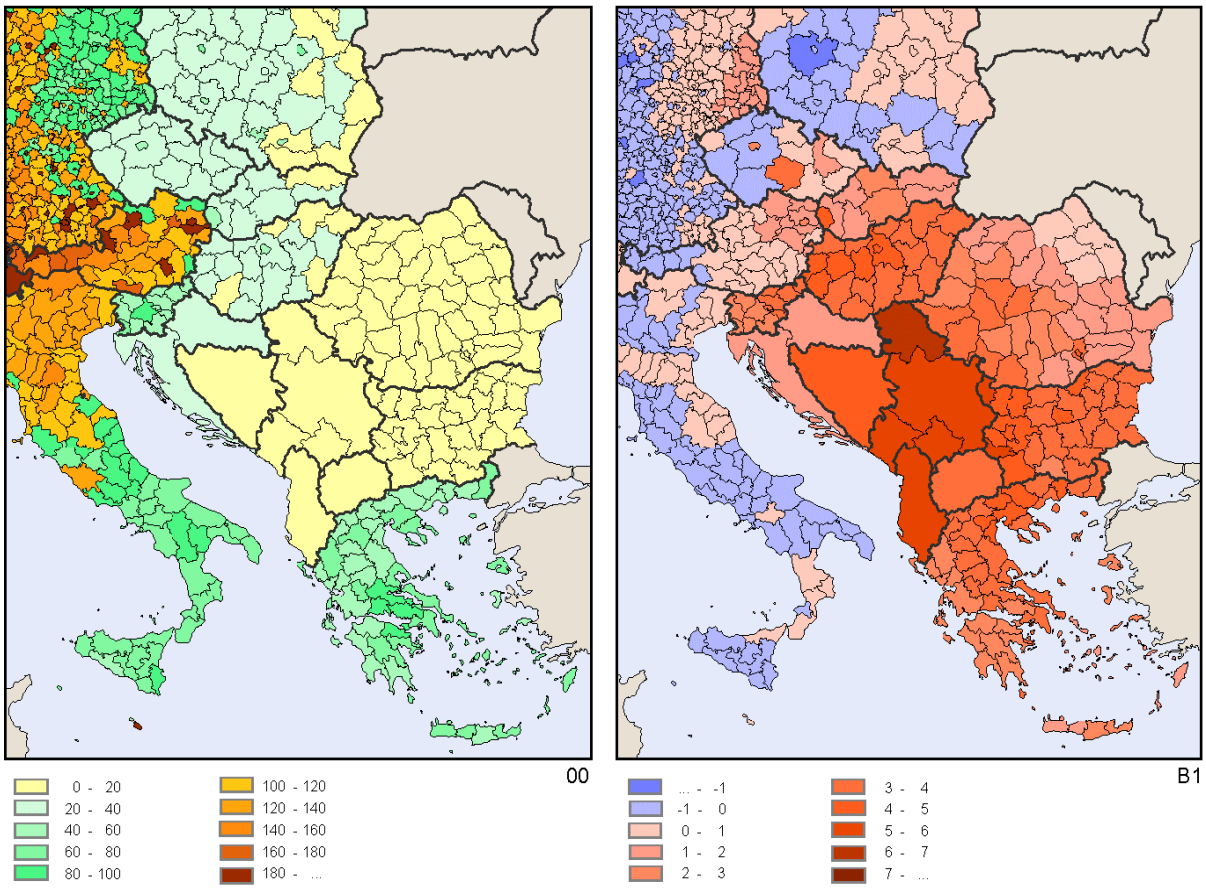

Figure 3. GDP per capita in the Reference Scenario 00 (EU27+7=100) and relative GDP per capita effects of Scenario B1 in 2031 (%)

Transport Policy in the Western Balkan

The modelling analyses presented in this article were conducted in 2004 and 2005 in ESPON 1.1.3 with the main emphasis on the ten new member states that joined the European Union in 2004 and the accession countries Bulgaria and Romania earmarked for accession in 2007. The western Balkan states were included in the study because they lie between the old EU members states and Romania, Bulgaria and Greece.

However, as it can be seen on the maps in Figures 2 and 3, the spatial subdivision of the five western Balkan countries was much coarser than the that of the other countries, and data collection even for these large regions was difficult. Information on the state of the road and rail networks in the western Balkan states was scarce and probably outdated Moreover, except the Ljubljana-Zagreb-Belgrade-Thessaloniki motorway axis, no transport projects in the western Balkan states were included among the TEN-T and TINA projects – the western Balkan states represented a "hole" in the middle of the EU territory bypassed by TEN-T projects, such as TEN priority projects 7 (Motorway axis Athens-Sofia-Budapest) and 22 (Railway axis Athens-Sofia-Budapest-Vienna).

This changed when in November 2005 the High Level Group "Networks for Peace and development" headed by former EU transport commissioner Loyola de Palacio presented its report "Extension of the Major Trans-European Transport Axes to the Neighbouring Countries and

Regions" (HLG, 2006). The group proposed four multimodal land-based axes for linking the EU territory with adjacent macro regions. The "South-Eastern Axis" is to link the EU through the Balkans and Turkey to the Caucasus and the Caspian Sea as well as to Egypt and the Red Sea. Of the projects selected for the axis, three pass through the western Balkan states:

- the multimodal connection Ljubljana-Zagreb-Belgrade-Nis with extensions to Sofia-Istanbul and Skopje-Thessaloniki
- the multimodal connection Budapest-Sarajewo-Ploce
- the multimodal connection Bari/Brindisi-Durres/Vlora-Tirana-Skopje-Sofia-Burgas/Varna

In addition, Austria, supported by Croatia and Bosnia and Herzegovina, promoted the so-called Pyhrn corridor Berlin-Zagreb connecting to TEN priority project 22 (Railway axis Athens-Sofia-Budapest-Vienna).

The report met with criticism claiming that it put unjustified emphasis on uneconomical rail projects, failed to link the major capital cities of the western Balkan states and unduly prioritised major transport corridors at the expense of secondary regional road connections which were deemed to be more important for economic development (ERF, 2006)

This debate could be enlightened by a thorough investigation of the economic, social and environmental impacts of different scenarios of transport infrastructure development in the western Balkan states taking into account the effects of the forthcoming accession of Bulgaria and Romania to the European Union, the likely separation of Serbia and Montenegro into two independent states and possible further accessions of western Balkan states to the European Union. Such scenarios should investigate not only the socio-economic and environmental impacts of the implementation of the major transport corridors of the south-eastern Axis of the High Level Group report but also alternative schemes placing more emphasis on secondary regional road and rail networks.

Such an analysis should also look into the likely effects of the alternative transport policies on employment both in the transport sector and in the rest of the economy. However, the expectations that the employment effects of further market opening, deregulation, privatisation of formerly state-operated transport companies including mergers and take-overs can be reliably predicted should not be too high. The experience of the transition of the new EU member states to market economies has demonstrated that such forecasts are very difficult if not impossible.

Conclusions

The model simulations of ESPON 1.1.3 have shown that the existing large gaps in accessibility and economic development between the old EU member states and the new member states and accession states and western Balkan states cannot be totally overcome but can be significantly reduced by a strategy of transport infrastructure development in co-ordination with other EU policies.

The simulations have shown that the largest gains in accessibility in east and south-east Europe are due to the enlargement process itself, even for the accession countries and western Balkan countries, because the process of European integration and the enlargement of the EU have reduced barriers for travel and goods transport not only between the EU member states

but also between the EU and other countries. The infrastructure projects examined contribute to this effect and, not surprisingly, the more infrastructure projects are implemented in eastern Europe, the larger is the effect there.

These results confirm the need for a spatially differentiated spatial policy which does not adopt the same development model for all European countries but differentiates it according to the phase of development of each country. Such a strategy implies that in the already highly developed and urbanised old EU member states no longer the economically most successful large agglomerations are further promoted but existing or emerging polycentric structures are strengthened by predominantly improving the accessibility of medium-level central places and compensating the accessibility deficits of rural and peripheral regions. In the still urbanising new member states, accession countries and western Balkan countries, however, for a transition period of ten to fifteen years it is justified to enhance the growth dynamics of these countries by fast and efficient transport connections between their capital cities and major agglomerations and the economic centres in western Europe. After that period, however, the risk of over-dominance of these cities will have to be reduced by shifting the focus of transport investments first to medium-size cities and later, as in the old EU member states, to rural and peripheral regions.

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