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# GREEN LOGISTICS STRATEGY FOR SOUTH EAST EUROPE: TO IMPROVE INTERMODALITY AND ESTABLISH GREEN TRANSPORT CORRIDORS

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**Abstract.** This article describes the trend towards European green initiatives in the transport sector. The introduction of green logistics management and green policy in Europe has been analysed to understand better the positive impact of green policy on environment, society and economy. With the most recent EU initiatives in the field of green logistics, intermodality has become the platform for green logistics development in the EU. This stimulated a complete study of the case of South East Europe. The perspective of intermodal infrastructure development, the use of intermodality and the environmental impact of the transport sector has been analysed to build an appropriate model for a macro green logistics strategy for South East Europe, where Green transport corridors should be exposed as the main goal. In our proposal of a seven-pillar strategy, all parties, including governmental institutions, manufacturing industry and logistics operators, should take an active part, enabling industry to co-create a macro transport development in the region and to influence future legislation of green issues in the transport sector, with an aim to establish Green transport corridors till 2020. There is a strong need to regulate green logistics issues in the region of South East Europe; therefore, additional studies and proposals will be necessary in the future.

**Keywords:** Green transport corridors, Green logistics management, European green logistics policy, intermodality, South-East Europe, macro green logistics strategy.

## 1. Introduction

Logistics is one of the most dynamic scientific disciplines. It can be defined as the management of moving goods, people, information and other resources between the point of origin and the point of consumption. With strong pressure from the global crisis, lean supply chains are a global goal. Lean supply chain strategies focus on waste reduction, helping firms eliminate non-value adding activities related to excess time, labour, equipment, space, and inventories across the supply chain (Corbett, Klassen 2006). Moreover, all players in supply chains are under pressure to reduce costs and perform time savings, giving all players a lean supply chain management. All these actions must meet customer requirements and environmental aspects.

Lean supply chains, fast technological development, rapidly growing goods consumption and new transport concepts lead to new environmental consciousness, with the aim of obtaining and securing balanced global development. To some extent this fast and dynamic development may contradict a green approach (Mollenkopf *et al.* 2010). It is obvious that green logistics play an important part in new logistics approaches on a macro level in national economies and, on the other hand, on a micro level in production companies. The ecological aspect and consciousness has increased drastically over the last two to three decades, especially in the developed economies. This has been shown by BearingPoint research (Supply Chain Monitor… 2008), where 35% of global companies said that they have incorporated a green supply chain policy in the company's vision. In addition, over 54% of surveyed enterprises with a yearly turnover over 1 billion dollars claimed that they have established a green supply chain. A significantly lower percentage was obtained for small companies, as just 29% companies with turnover below 100 million dollars incorporated a green supply chain strategy as a company goal. The green strategy is therefore becoming a key factor to better position of the company on the global market. This was confirmed also by the Eyefortransport survey in November 2007 (Summary and Analysis of Eyefortransport's… 2007). It was found that 67% of the key company executives surveyed in Europe believed

that the green strategy is an important element of their company's strategy.

In regions with poorer and underdeveloped economies, 'green' thinking has still not been developed. This is undoubtedly true for the region of SE Europe. The main reason is limited financial funds, which are needed in the transport infrastructure and for equipment modernisation. However, it is an inevitable global trend to develop and adopt green logistics management in every sphere of national industry, especially in the production and transport sectors (Dunning, Fortanier 2007; Carter, Rogers 2008; Kovács 2008). Green logistics management is an extended management of the entire logistics, with special focus to run environmentally sustainable supply chains. The infrastructure plays an important role to assure basic platform for this approach.

Regions like SE Europe will soon be forced to develop green consciousness and regularly use green technology. The pressure on the transport infrastructure will be very strong and the state will be forced to adopt strategies of long-term development. Consequently, intermodal transport and green transport will be developed, in order to give the platform rapid development and use the green logistics concepts. The initiative for Green transport corridors has been pushed by the EU. These corridors are upgraded transport corridors and should be used as a platform for GLM development in Europe. All European regions should develop necessary environments for their easier introduction. Consequently, it is becoming very important to incorporate Green transport corridors in a macro green logistics agenda for SE Europe.

## 2. Green Logistics Management

In this period of economical crisis, special emphasis is placed on lean and modern logistics to find an important cost, time or energy savings. Modern logistics uses sophisticated transport and manipulation equipment, modern technologies on logistics terminals and warehouses to secure lean supply chains. Combining all those elements and developing environmentally sustainable supply chains is an issue which has been more emphasized in recent years (Mollenkopf *et al.* 2010). Moreover, a completely new sub-sector of logistics appeared with green logistics, using new models and tools as green logistics management. The trend is therefore to switch from classical logistics to green logistics.

Green logistics management (GLM) can be defined as the management processes by which different companies formally manage, evaluate, control and evaluate the environmental impacts of their professional actions (Sroufe 2003). The role of a state or even region is very important, as a macro level green policy has to be promoted and systematically developed, in order to stimulate different companies to adopt GLM in the lifecycles of their products. Consequently, a macro green logistics policy provides a platform to deal with a macro green logistics management and to stimulate companies to introduce GLM in their company's strategy.

### 2.1. Introducing Green Logistics

The introduction to green thinking became widespread three decades ago, as the environmental degradation caused by CFCs, acid rains and global warming became evident. This stimulated different social groupings and organizations emphasise the introduction of 'greening' movement by implementation of emission control standards and their global application. Consequently, in the early 1990's, green logistics became a societal obligation in the developed regions and logistics experts produced many studies, surveys and opinions. Tanja (1991) and Murphy *et al.* (1994) showed how environmental elements could be adopted by the logistics sector.

Fundamental actions in the late nineties also incorporated reverse logistics in supply chains, and this was a starting point in the development of complex GLM. Climate change, $CO_2$ emissions, waste collecting, reprocessing and finally redistribution became significant factors in logistical decision-making (De Brito, Dekker 2004). This was also recognised by logistics operators since, according to Piecyk and McKinnon (2010), over 50% of companies involved in road freight transport operations are likely to see their activities affected by these factors to a significant extent by 2015 and this is expected to rise to over 80% by 2020.

Therefore, GLM deals with environmental questions, infrastructure exploitation questions, pollution and environmental degradation caused by improper logistics processes and the utilisation of the old and environmentally unfriendly transport technology and waste (Blumberg 2004). The basis for all the tasks mentioned is a properly developed transport infrastructure, including roads, rail tracks, intermodal terminals, ports etc. With efficient infrastructure it is possible to obtain network optimization, modal shift, intermodal transportation, greener processes and operations, and introduce efficient recycling processes. Thus, it is very important that the state guarantees the basic elements of transport and logistics development.

Consequently, the introduction of GLM can be accelerated on all levels of the national economy, offering numerous benefits to environment, society and organizations. Emmett and Sood (2010) see these benefits through reduced impact on the ecosystem and on environmental degradation, enhanced safety and health, better transport operations and good global financial impacts on all levels of national economies.

### 2.2. European Green Logistics Policy

At present, the European green logistics consciousness is very strong in western and northern European countries. The green initiative is only strong on the macro level; however, there are still possibilities to develop it on the micro or company level. EU's GLM includes a vast number of different goals and decisions, which are incorporated in different European institutions. Such an approach enables the EU to make proposals and measure the adoption of them constantly, within all member states.

Moreover, the EU took a step forward in European GLM, with the ambition to develop a model of European environmentally sustainable logistics (A Sustainable Future for Transport… 2009). With such a policy the three main fields would be systematically covered: environment, society and economy. This approach requires different activities in all three fields:

- environment: water and air quality, land use and degradation, noise, biodiversity, waste problems, climate changes and light pollution;
- society: access, safety, health, equity;
- economy: efficiency, growth, employment, competitiveness, choice.

The main objective of the above-mentioned initiative is to co-ordinate all the activities in a way that brings long-term sustainable environmental development and, at the same time, fulfils customer needs and requirements in regard to logistics services. GLM is therefore a new approach versus traditional logistics management, which bases just on logistics processes, as GLM treats also with environmental impacts of complete logistics chain.

The transfer of external costs to European companies is an important environmental issue. Thus, the companies must cover a portion of the external costs of logistics associated mainly with water and air quality, pollution, noise, accidents, land degradation etc. For this reason, there are different research projects in pilot stage aiming to examine ways of achieving a more sustainable balance between environmental, social and economic objectives.

A new initiative named Green Corridors is a European concept in establishing and using long-distance freight transport corridors. It is an important change how traditional transport corridors are treated. Green Corridors support the EU's agenda towards efficient logistics to achieve energy efficiency, to reduce environmental impact towards de-carbonizing transport. Such corridors should be gradually established in all main transport routes around Europe. The initiative is supported by new EU legislation, which makes mandatory creation of a European intermodal network, with advanced technology and the use of co-modality (Jüriado 2010).

The concept of Motorways of the Sea and Short Sea Shipping is also an important development initiative, which can bring the same positive impacts on the greener transport services. Both concepts are an essential part of Green transport corridors. Their development should be harmonised with the development of Green transport corridors, as Motorways of the Sea represent a fundamental mode of transport to shift freight flows from road transport to a more environmentally friendly one.

Both initiatives, Green Corridors and Motorways of the Sea, stimulate green transport processes; therefore their long-term development must be included in the green logistics strategy of all European regions. As the special emphasis is on the transport infrastructure, it can be accentuated that intermodality becomes the platform for green logistics development in the EU.

## 3. Interdependence between Green Logistics and Intermodal Transport

### 3.1. Intermodal Transport Development in SE Europe

Intermodal transport and intermodal transport infrastructure development are directly linked with the health of the regional economy. There is a constant interaction and interdependence between traffic and the economy. With a stronger economy, the intermodal transport and infrastructure has an important role in the region, and with well-developed intermodality, the regional economy can achieve stronger long-term development (Dvorski 2006).

The link between GDP and the transport sector has been shown by our research, where we compared GDP per capita between Northern Europe and the economically much more underdeveloped South East Europe. The transport and logistics sector in Northern and Southern European regions are completely different, using different infrastructure and degree of automation, and with completely different management philosophies (Beškovnik 2010). Beside this, intermodal transport depends on different processes from industry sector, on geographical position and the size of country or region and on intermodal terminals in use. Šakalys and Palšaitis (2006) came to the conclusion that a very small quantity of inland terminals exist in Southern and Eastern Europe, operating with limited handling equipment and limited land area. This has negative impacts on faster development of intermodality in the region and requires additional financial investments from the states.

From the transport infrastructure situation and the economic situation in South East Europe a particular intermodal development model is necessary, since the railway, ports and hinterland terminals are underdeveloped and still state-owned property and, therefore, subject to state development policy which can be seen as an obstacle to develop green transportation and green logistics. It is of crucial importance that a state recognises and promotes the development of infrastructure, especially the railway network. This can be done through a multinational project, as Green transport corridors, where different states should give their support in the research area and in applicative proposal in the final stage.

On the other hand, road transport is massively used in the freight transport sector due to the scarcity of state financial funds for infrastructure and superstructure modernization. As the data in Table 1 shows, the road share of inland freight transport, expressed in tonne-kilometres, is clearly higher in South East European countries than in North European countries. The share in southern countries is over 70%, while in northern countries it is below 57%. This has significant environmental impacts, as road transport contributes higher emissions of greenhouse and $CO_2$ emissions.

In addition, according to the data obtained from National Chambers of Commerce, road transportation processes are still mainly covering the traditional west-east transport route between western economies and South East Europe. On the other hand, road transport

processes cover logistics needs to move general cargo from port systems to final destinations. This is mainly valid for Far East cargo flows, which are shipped through ports and specialized terminals. Moreover, according to our previous research (Beškovnik 2010), intermodal inland connections with hinterland terminals hardly exist at all.

Intermodal transport and the green logistics concept emphasises that rail transport must be developed as the key transport solution between hub terminals. These hub terminals must be developed and operated as modern intermodal logistics platforms. Road transport should only be used on shorter transport routes and on direct to door deliveries. Our research shows the use of rail transport in South East Europe drastically decreased in the last decade, and railway infrastructure was not modernised accordingly. On the contrary, the total length of railway lines was reduced by over 200 km in the countries analysed. Beside this, the railway network in SE Europe is not enough developed to secure optimal logistics. According to the data collected in Table 2 the railway density per 100 km$^2$ is more than half lower compared to North European railway network. Consequently, rail transport needs huge support by road transport to ensure modern logistics concepts.

Our research also analysed port infrastructure and actual superstructure used in sea-land operations, hinterland terminals and in land-land operations. All maritime ports, except Constanta, Piraeus and Koper, are underdeveloped on the sea side as well as on the land side. The intermodal transportation infrastructure is very poor, especially the rail connection from all ports to hinterland railway stations. In addition, in the South East Europe region there are no functioning modern hinterland intermodal terminals. The only operating railway stations that can accommodate containers and other intermodal units are situated in capital cities such as Ljubljana, Zagreb, Sarajevo, Belgrade, Sofia, Bucharest etc. These terminals do not use modern handling technologies, the degree of automation is very low and static and dynamic capacities cannot secure optimal handling processes.

Moreover, ports are state owned systems, with just a small degree of privatisation established in last years. On the other hand in Northern and Western Europe the community or state is just the landlord, meanwhile port operators are private companies. This enables northern and western ports to realize faster development. The state supports their vision with development of needed hinterland connections.

Based on described facts, it has to be emphasized that intermodal transport in SE Europe is underdeveloped and, due to the current economic and financial crisis, it will be very difficult to improve in short-term. Moreover, all countries are still in the economical transition process, and they do not have the financial funds for investment in developing infrastructure and for modernization of the superannuated infrastructure of sea and hinterland intermodal terminals. The port privatisation is therefore an obvious need.

**Table 1.** Road share of inland freight transport (% of tonne-km)

| Country | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|
| Belgium | 77.5 | 76.5 | 74.9 | 72.4 | 71.1 | 71.1 | 69.1 |
| Germany | 66.3 | 67.0 | 66.1 | 66 | 65.9 | 65.7 | 65.5 |
| Estonia | 30.3 | 29.1 | 32.7 | 35.4 | 34.7 | 43.2 | 55.3 |
| Latvia | 29.2 | 27.5 | 28.4 | 29.8 | 39 | 41.9 | 38.7 |
| Lithuania | 52.3 | 50 | 51.3 | 56.1 | 58.4 | 58.5 | 41.9 |
| Netherlands | 63.3 | 64.6 | 64.7 | 63.6 | 63.1 | 61.4 | 59.9 |
| Sweden | 65.6 | 64.5 | 63.9 | 64 | 64.2 | 63.6 | 64.7 |
| Austria | 65.8 | 67.4 | 65.6 | 64.1 | 63.2 | 60.9 | 58.6 |
| Slovenia | 70.0 | 70.0 | 74.1 | 77.3 | 78.2 | 79.2 | 82.2 |
| Croatia | 76.4 | 76.1 | 76.7 | 76 | 74.8 | 74 | 72.7 |
| Macedonia | 92.3 | 93.6 | 92.6 | 91.3 | 93.1 | 88.5 | – |
| Romania | 57.3 | 62.4 | 60.8 | 67.3 | 70.5 | 71.3 | 70.2 |
| Bulgaria | 62.9 | 61.7 | 66.9 | 70.8 | 69 | 70 | 66.9 |
| Greece | – | 97.7 | – | 97.5 | 98.1 | 97.1 | 97.3 |

*Source*: Eurostat 2010a

**Table 2.** Total length of railway lines and rail network density between 2001 and 2008

| Country | Total length (km) | | Railway line density (km/100 km$^2$) | | Change |
|---|---|---|---|---|---|
| | 2001 | 2008 | 2001 | 2008 | 208/2001 |
| Belgium | 3454 | 3513 | 11.31 | 11.51 | 101.7 |
| Czech Rep. | 9523 | 9586 | 12.07 | 12.15 | 100.6 |
| Germany | 35986 | 37798 | 10.08 | 10.59 | 105.1 |
| Spain | 12310 | 13353 | 2.44 | 2.65 | 108.5 |
| Netherlands | 2809 | 2888 | 6.76 | 6.95 | 102.8 |
| Slovenia | 1228 | 1228 | 6.06 | 6.06 | 100 |
| Croatia | 2726 | 2722 | 4.82 | 4.81 | 99.8 |
| Macedonia | 699 | 699 | 2.72 | 2.72 | 100 |
| Bulgaria | 4320 | 4144 | 3.89 | 3.74 | 95.9 |
| Romania | 11015 | 10785 | 4.62 | 4.52 | 97.9 |
| Greece | 2377 | 2552 | 1.80 | 1.93 | 107.4 |

*Source*: Eurostat 2010b

### 3.2. Green Logistics Management Potentials Using Intermodality

Given the analysed infrastructure, superstructure and current economic situation in South East Europe, it is necessary to develop a sustainable transport policy for this European region. The main focus of GLM has to be on infrastructure modernization to stimulate intermodality and, at the same time, the key elements and goals of modern, lean and green logistics should be considered by logistics operators.

In order to put in place and develop green logistics concepts in long term GLM, priority must be given to investment in the modernization of rail infrastructure

on the V, VIII and X pan-European corridors. It can be anticipated that road transport share in inland use will decrease gradually and traffic pollution should be reduced drastically in this way, as road transport contributes 86% of CO, 33% of CH and 42% of $NO_x$ of all traffic.

From the green logistics perspective, crucial energy savings can be foreseen. Road transport contributes more than 82% of all energy consumption in the traffic sector. On the other hand, the energy consumption of rail transport is less than 3% of the traffic sector (Nikoličić, Lazić 2006).

From the data presented in Table 3, there is an obvious need to start building a long-term green strategy immediately appropriate for South East Europe since the countries of South East Europe register a significantly higher increase of greenhouse and $CO_2$ emissions. This is directly linked to road transport use, superannuated superstructure in ports and terminals and missing green logistics consciousness on a regional level.

Supporting the development of intermodality and rail use in the region is an obvious option for raising the green logistics base. With oriented investments it is possible to increase rail transport utilization while at the same time intermodal units are very easy to handle and, consequently, minor handling equipment is needed. By using intermodal units, the modal shift is easier to perform in shorter time, with lower energy consumption and lower gas pollution.

Based on this the initiative the Green transport corridor appears as an important approach, which should be proposed and financial supported by the governments. Such an initiative can also influence manufacturing industry to optimally redesign their manufacturing processes, distribution networks and entire logistics supply chain. Additional green thinking on a micro level should be stimulated in this way. Waste collection, waste transportation, recycling processes and use of recycled materials should be included in company's GLM.

## 4. Macro Green Logistics Strategy for SE Europe

The economic situation in South East Europe is not as good as in the developed western or northern part of Europe and the recent global economic crisis made the situation in the region even worse. In summary, the entire region is underdeveloped economically, and this directly affects the entire transport sector. Not just from an infrastructure perspective, but also from one of business development. Much effort was invested in highway network development and modernisation causing, from a logistics perspective, unacceptable one-way road transport, which is resulting in many empty return journeys and lower performance, expressed in less tonne-km.

Our research led us to the conclusion that a macro green logistics strategy is an obvious need for the entire region, because issues of fuel and energy consumption, utilization of transport means, issues of pollution, safety and collecting of waste are not prioritised by the transport sector.

### 4.1. Introducing a Macro Green Logistics Strategy

Governments took some actions to set up a green agenda on a macro national level, but these actions were not as aggressive and clear as they would be needed to stimulate the entire industry adequately. In this context, we worked out a macro model with seven main fields of development, which the transport sector of South East Europe should be focused on achieving in the future. The proposed model is an extended model we developed

**Table 3.** Total greenhouse gas and $CO_2$ emissions from transport (million tonnes of $CO_2$ equivalent)

| Country | Total Greenhouse gas emissions | | | | | Total $CO_2$ emissions | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2003 | 2004 | 2005 | 2005/1999 | 1990 | 2003 | 2004 | 2005 | 2005/1999 |
| Denmark | 15.44 | 18.44 | 18.42 | 18.85 | 22% | 15.24 | 17.95 | 18.12 | 18.57 | 22% |
| Finland | 15.7 | 16.97 | 17.13 | 17.12 | 9% | 14.61 | 16.00 | 16.1 | 16.14 | 10% |
| France | 138.44 | 16.96 | 172.95 | 170.99 | 24% | 126.74 | 160.48 | 162.76 | 160.43 | 21% |
| Germany | 184.17 | 198.39 | 199.47 | 194.96 | 6% | 182.09 | 189.42 | 193.41 | 186.84 | 3% |
| Norway | 11.33 | 13.86 | 14.34 | 14.65 | 29% | 13.72 | 15.61 | 16.03 | 16.84 | 23% |
| Albania | – | – | – | – | – | 0.71 | 2.08 | 2.01 | 2.64 | 272% |
| Bosnia-H. | – | – | – | – | – | 2.29 | 2.06 | 2.3 | 2.57 | 12% |
| Bulgaria | 12.78 | 8.12 | 8.27 | 9.03 | –29% | 7.4 | 7.4 | 7.72 | 8.49 | 15% |
| Croatia | 4.47 | 5.61 | 5.79 | 6.06 | 36% | 4.29 | 5.42 | 5.62 | 5.85 | 26% |
| Greece | 26.23 | 35.15 | 35.77 | 35.77 | 36% | 25.82 | 33.76 | 34.34 | 33.53 | 30% |
| Macedonia | – | – | – | – | – | 0.79 | 1.04 | 1.05 | 1.05 | 33% |
| Romania | 8.73 | 12.27 | 14.69 | 12.05 | 38% | 12.53 | 12.95 | 13.43 | 12.53 | 0% |
| Serbia/MN | – | – | – | – | – | 4.94 | 5.15 | 6.47 | 6.66 | 35% |
| Slovenia | 2.72 | 4.19 | 4.32 | 4.61 | 65% | 2.72 | 3.97 | 4.13 | 4.42 | 63% |

*Source*: Greenhouse Gas Reduction… 2008

in our previous research (Beškovnik, Jakomin 2010), and is based on Stokes's and Aimi's (2009) proposal for cooperation in the logistics sector between production enterprises and complete logistics providers.

We propose to set up an adequate seven-pillar strategy (Fig. 1) of green logistics development, where activities in establishing Green logistics corridors should be prioritized. All other activities should be developed separately too, but with strong harmonization to the main goal. The seven-pillar strategy should cover the following important fields of regional transport development:

- green transport corridors as the main goal,
- intermodal network optimisation,
- efficient modal shift and greener operations,
- motorways of the sea and short sea shipping model,
- intelligent transport systems and standardised it platforms,
- standardised transport units and packaging materials,
- recycling operations.

According to the new EU programme, including project SuperGreen started in 2010, green transport corridors will be priority developments. Consequently, extra financial funds will be secured by the EU. All states in South East Europe must consensually select some priority transport routes to gradually develop as Green transport corridors and to actively participate in EU projects, in order to obtain significant financial funds from EU. These selections should be coordinated with development of Motorways of the Sea strategy. Establishing Green transport corridors should be a top priority activity till 2020 and all activities in the ports and in hinterland connections should be harmonized with this approach.

The first supporting field includes all necessary actions to achieve intermodal network optimisation, including administrative processes, bilateral agreements between different countries and securing funds for investments. According to the actual situation 500 millions EUR should be immediately invested in maritime and river ports. Additionally, 1 billion EUR should be secured for inland waterway modernisation and approximately 1.5 billion EUR for new intermodal terminals in SE Europe.

What is more, a concrete agreement for cooperation in rail transport should be agreed in a triangle between Slovenia, Romania and Greece. With this actual pan-European transport corridors V, X and VIII, should be developed in harmonisation. All supporting processes for complete logistics should be simplified, as customs formalities, inspections, documentation etc.

The second supporting pillar should be focused on co-modality and superstructure modernisation. This approach calls for rail modernisation and around 7 billion EUR are needed to improve actual situation. Beside high

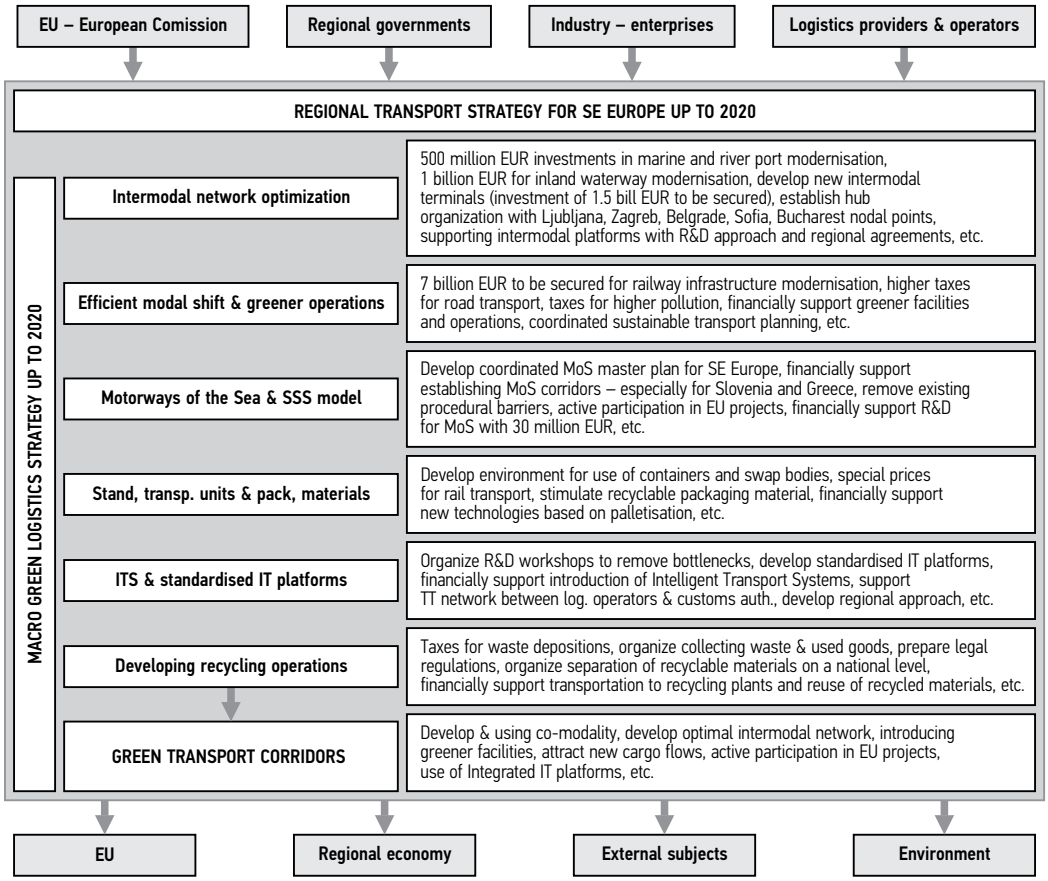


**Fig. 1.** Macro green logistics strategy for South East Europe (*source*: model worked out by authors)

investments, the states should pose additional taxes for road transport and higher pollution to stimulate greener facilities and operations.

Developing and introducing the model of Motorways of the Sea suitable for South East Europe cargo flows is an important field, which must be a priority development. Different studies have been produced in recent years, but they are still only project proposals. An important proposal of 9 Motorways of the Sea corridors has been prepared by a Project Consulting consortium of 9 parties supported by the European Commission. A proposed Master plan of Motorways of the Sea for the East Mediterranean should be adequately incorporated in the Green logistics strategy. Additional 30 million EUR will be needed for research and development of Motorways of the Sea in the region, and to establish efficient environments for new services to Koper port and Igoumenitsa, defined as key ports for this kind of transport. This way the V and X pan-European corridor should be easier introduced as Green transport corridors of SE Europe.

Based on this, the region should develop its long-term transport development plan, at least till 2020. By this, new overseas cargo flows can be attracted by South European maritime transport routes and it will offer a serious alternative to North European ports. With Green transport corridors and Motorways of the Sea, the need arises for ITS (Intelligent Transport Systems) and new IT solutions implementation to speed up the entire transport process and to attract new cargo flows. With ITS implementation in the transport process, an efficient modal shift can be obtained and greener operations will follow. According to our short analysis of actual IT support for logistics processes in the ports and in the hinterland terminals, all these systems are working on their own IT platforms, which are superannuated and do not enable direct IT communication and data exchange with logistics operators. A macro green logistics strategy for SE Europe should be significantly focused on development of integrated IT platforms between shipping lines, ports, land operators, hinterland intermodal terminals, warehouses and all subjects in the logistics chain. Special founds should be secured for research and development define and remove existing bottlenecks and to work out new IT concepts of integrated IT platform.

The sixth supporting field should be focused on the use of standard transport units in the entire transport process, in order to decrease physical work and to achieve higher utilisation of loading space. The use of ISO containers, swap bodies, pallets etc. on the entire route should be stimulated. The rail transport should play an important role as rail operators should calculate and charge special prices for this kind of transport. On the other hand the states should financially support the introduction of new technologies on the terminal and in private production enterprises.

The last field of recycling operations is an important part of green logistics and development should be mainly up to the producing enterprises, since European Directives placed the costs of recycling principally with producers. It encourages them to design their products differently to make recycling easier and therefore less expensive. The transport sector can help them in developing a harmonised network and operations. These activities should be an extended activity of Green logistics corridors and would attract new global companies to enter the market with their production, like FIAT does. The case of FIAT's new production in Serbia planned for 2011 should be the representative case how all supporting logistics processes should be organized. Beside pure transport and logistics processes they expressed the need for higher environmental standards, including recycling operations.

All these activities should be included in the Green agenda for South East Europe, based on governmental consensus and with industry support. Special emphasis should be posed to Green transport corridors. Establishing such intermodal transport corridors should attract new greener cargoes and new clients. To develop a dynamic environment for rapid introduction of Green transport corridors all other activities mentioned in proposed Macro green logistics strategy for SE Europe should be developed gradually and in harmonization with other development plans in the region. Consequently, the development and implementation of macro green logistics strategy is the crucial starting point for all following green transport initiatives.

### 4.2. Introduction of Macro Green Logistics Strategy

The entire industry of South East Europe must take an active part in setting up a macro green logistics strategy, including governments and private sector. All actors must see the benefits of implementing green logistics as a national strategy and as a corporate strategy in enterprises. It is up to governments to develop a single intermodal network, with modern intermodal points and sophisticated superstructure. On the other hand, it is up to manufacturing industry and logistics providers to use standardised transport units and packages, to build greener private logistics facilities and to support recycling processes.

In our research, we ascertained that some companies, like Krka Ltd. Co., Gorenje Ltd. Co., Lek Ltd. Co. etc., have already implemented green logistics in their corporate strategies and they are not waiting for actions on a governmental level. They are also successful in the EU projects and in obtaining EU's financial founds. It is good and important that the so-called bottom-up concept is present, and that the industry recognizes the benefits of GLM. Within GLM they are mainly focused on their production; on the use of standardised transport and packaging units, on the use of greener transport means and recycled materials, on waste collecting and recycling. These actions do not impose high financial investments and do not increase total costs drastically, but are important marketing actions, especially for green conscious clients or markets.

We see that with the bottom-up approach the industry can efficiently enter the sector of pollution, environment degradation and efficient use of means of transport. With such an approach, the industry can present its

expectations to governmental institutions and co-create a macro transport development in the region – to influence future legislation and governmental intervention in the logistics sector. These actions are one of the most important ones to gradually develop Green transport corridors in SE Europe, although the states have to secure financial founds for the infrastructure modernisation.

As a whole, only a small number of companies see the benefits of GLM introduction, thus, the top-down model appears inevitable. This is the valid practice for the underdeveloped regions; therefore governmental institutions should formulate a proposed macro strategy. Rodrigue *et al.* (2001) say that with a top-down approach direct and fast actions can be implemented. Consequently, all seven fields should be included in regional green agenda, in order to have an extensive view of national environmental policy and to cover environmental issues. The next steps of the top-down model are legislation and pricing policy. The state has to collect and distribute funds to cover external costs, to propose safety regulations and land disruption restrictions, to introduce mandatory collection and recycling of products and education measures.

Especially important is the question of absorbing the additional costs, which should be handled with great care by all players. Industry and final users often refuse to meet them; therefore it is unlikely that logistics providers will easily absorb them. For this reason, a long-term strategy has to be adopted which industry and private owners identify with. Such strategy should be formulated for the period 2010–2020, with important action plans, also for the development after 2020. The top priority is to define how 10 billion EUR can be secured for infrastructure modernisation and to introduce Green transport corridors, especially because obstacles in model introduction are foreseen.

### 4.3. Expected Obstacles to Introducing the Model

Resistance to the adoption of new strategies, which have long-term positive impacts but at the same time present some negative impacts reflected in higher taxes and production costs, are expected from manufacturing and the logistics industry. We foresee such reaction from the industry, as costs, time and flexibility still have priority over environmental objectives. The industry must recognise its role in extra financial support for infrastructure modernisation.

This will be a strong challenge as the crisis put pressure on some logistics elements, which are not in favour of green logistics concepts. In such circumstances the pressure is on costs reduction, to produce operations by just-in-time concept and to introduce lean concepts in production and transportation, to organize massive transport flows between hub logistics platforms and capillary distribution up to final users and to reduce time between production and consumption of the goods (Rodrigue *et al.* 2001).

The pressure of costs savings and limited investments is becoming stronger. According to the green strategy infrastructure and superstructure provisions, pollution and congestion costs and safety issues are not a top priority issues by the industry. Thus, with the introduction of an external cost covering model, the enterprises will be even under higher pressure just to remain solvent. Cooper *et al.* (1998) estimated that with such an approach transport costs for companies could rise by 20 to 25%.

The issue of time reduction between production and consumption poses a need to achieve increased speed and direct distribution, but with higher speed pollution the energy consumption increases drastically (Corbett *et al.* 2009). With direct to door deliveries the use of road transport is preferred. Moreover, investments in underdeveloped railway infrastructure are automatically postponed, as industry does not see interest in using it regularly.

Obviously, big challenges in the development of green logistics exist in the region of South East Europe. It has been ascertained that, to some extent, industry is not motivated to introduce GLM. Therefore, there is a strong need to promote and gradually develop a regional approach to green logistics. Consequently, there is a need to develop a macro green logistics strategy for the entire region. This can only be done with representing the main goal to be exposed for the next decade. The issue of Green transport corridor for SE Europe might be this fundamental goal, which might stimulate active cooperation between government institutions, industry and logistics operators. All these parties should be motivated adequately to develop a sustainable green logistics model, with all subsystems needed to support Green transport corridors. Therefore, further research and proposals are very important for reaching this essential goal.

## 5. Conclusions

1. It has been ascertained that the situation in South East Europe is far from the green European perception. Obviously, big challenges in the development of green logistics exist in the region of South East Europe. Moreover, intermodality becomes the platform for green logistics development in EU.
2. Intermodal transport in South East Europe is underdeveloped and, due to the actual economic and financial crisis, it will be very difficult to improve it in the short-term. About 10 billion EUR should be secured to modernise the infrastructure importantly. This has strong impacts on the development of green logistics and calls for an immediate action.
3. Countries of South East Europe, compared to other European countries, registered significantly higher increases of greenhouse and $CO_2$ emissions in the last two decades. Consequently, a need to start acting to decrease greenhouse and $CO_2$ emissions immediately appears inevitable. Higher taxes for road transport and higher pollution should be implemented accordingly.
4. We are proposing a macro model with a seven-pillar strategy of GLM, where special emphasis should be on Green transport corridors. All supporting activities

exposed in supporting six pillars of macro GLM have to be developed gradually. An important note should be on ITS, infrastructure development and in simplifying existing procedures in ports and on the borders. These actions should be supported by additional research and their development should be incorporated in a green strategy till 2020.

5. The governments should stimulate a bottom-up approach for GLM, enabling industry to co-create a macro transport development in the region and to influence future legislation in the transport sector.
6. The proposed model of introducing a macro green logistics strategy can be a good starting point to develop environmental policy for SE Europe. Consequently, this calls for further research of GLM in the region of South East Europe, in order to present them to governments and local economy. In this way, an agenda might be elaborated accordingly, till 2020.

## References

*A Sustainable Future for Transport: Towards an Integrated, Technology-led and User Friendly System*. 2009. Commission of the European Communities. Communication COM(2009) 279 final. Available from Internet: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0279:FIN:EN:PDF

Beškovnik, B. 2010. Managing and organizational changes of intermodal network in transition regions: the case of South-East Europe, *Problemy Transportu – Transport Problems* 5(2): 37–47.

Beškovnik, B.; Jakomin, L. 2010. Challenges of green logistics in Southeast Europe, *Promet – Traffic and Transportation* 22(2): 147–155.

Blumberg, D. F. 2004. *Introduction to Management of Reverse Logistics and Closed Loop Supply Chain Processes*. 1st edition. CRC Press. 296 p.

Carter, C. R.; Rogers, D. S. 2008. A framework of sustainable supply chain management: moving toward new theory, *International Journal of Physical Distribution and Logistics Management* 38(5): 360–387. http://dx.doi.org/10.1108/09600030810882816

Cooper, J.; Black, I.; Peters, M. 1998. Creating the sustainable supply chain: modelling the key relationships, in *Banister, D. Transport Policy and the Environment*. E & F. N. Spon, 176–203.

Corbett, J. J.; Wang, H.; Winebrake, J. J. 2009. The effectiveness and costs of speed reductions on emissions from international shipping, *Transportation Research Part D: Transport and Environment* 14(8): 593–598. http://dx.doi.org/10.1016/j.trd.2009.08.005

Corbett, C. J.; Klassen, R. D. 2006. Extending the horizons: environmental excellence as key to improving operations, *Manufacturing and Service Operations Management* 8(1): 5–22. http://dx.doi.org/10.1287/msom.1060.0095

De Brito, M. P.; Dekker, R. 2003. *A framework for reverse logistics*. ERIM Report Series Research in Management. 29 p. Available from Internet: http://repub.eur.nl/res/pub/354/ERS-2003-045-LIS.pdf

Dunning, J. H.; Fortanier, F. 2007. Multinational enterprises and the new development paradigm: consequences for host country development, *Multinational Business Review* 15(1): 25–46. http://dx.doi.org/10.1108/1525383X200700002

Dvorski, S. 2006 Međuovisnost prometa i gospodarstva, *Suvremeni Promet – Modern Traffic* 26(6): 121–125 (in Serbian).

Emmett, S.; Sood, V. 2010. *Green Supply Chains: An Action Manifesto*. 1st edition. Wiley. 316 p.

Eurostat. 2010a. *Modal Split of Freight Transport*. Available from Internet: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=tran_hv_frmod&lang=en

Eurostat. 2010b. *Railway Transport – Length of Tracks*. Available from Internet: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rail_if_tracks&lang=en

*Greenhouse Gas Reduction Strategies in the Transport Sector: Preliminary Report*. 2008. OECD-ITF. Available from Internet: http://www.internationaltransportforum.org/Pub/pdf/08GHG.pdf

Jüriado, R. 2010. *Greening of Transport and the SuperGreen Project*. Available from Internet: http://www.supergreen-project.eu/docs/public/naples2010/1%20-%20Rein%20Juriado.pdf

Kovács, G. 2008. Corporate environmental responsibility in the supply chain, *Journal of Cleaner Production* 16(15): 1571–1578. http://dx.doi.org/10.1016/j.jclepro.2008.04.013

Mollenkopf, D.; Stolze, H.; Tate, W. L.; Ueltschy, M. 2010. Green, lean and global supply chains, *International Journal of Physical Distribution and Logistics Management* 40(1–2): 14–41. http://dx.doi.org/10.1108/09600031011018028

Murphy, P. R.; Poist, R. F.; Braunschweig, C. D. 1994. Management of environmental issues in logistics: current status and future potential, *Transportation Journal* 34(1): 48–56.

Nikoličić, S.; Lazić, D. 2006. Zelena logistika – Green logistics, in *1. Nacionalna konferencija o kvalitetu života*. Available from Internet: http://www.cqm.rs/fq2006/pdf/B/12%20-%20Nikolicic%20S.,%20Lazic%20D.pdf (in Serbian).

Piecyk, M. I.; McKinnon, A. C. 2010. Forecasting the carbon footprint of road freight transport in 2020, *International Journal of Production Economics* 128(1): 31–42. http://dx.doi.org/10.1016/j.ijpe.2009.08.027

Rodrigue, J.-P.; Slack, B.; Comtois, C. 2001. Green Logistics, in *Brewer, A. M.; Button, K. J.; Hensher, D. A. Handbook of Logistics and Supply-Chain Management*. 1st edition. Pergamon Press. Vol. 2, 339–350.

Sroufe, R. 2003. Effects of environmental management systems on environmental management practices and operations, *Production and Operations Management* 12(3): 416–431. http://dx.doi.org/10.1111/j.1937-5956.2003.tb00212.x

Stokes, S.; Aimi, G. 2009. The green logistics factor, *Inside Supply Management* 20(4): 34.

*Summary and Analysis of Eyefortransport's Worldwide Survey: Green Transportation & Logistics*. 2007. Available from Internet: http://www.greenlogisticsforum.com/2008/free_report.pdf

*Supply Chain Monitor "How Mature is the Green Supply Chain?"*. 2008. Survey Report. BearingPoint. 36 p. Available from Internet: http://www.escp-eap.eu/uploads/media/Supply_Chain_Observatory_2008.pdf

Šakalys, A.; Palšaitis, R. 2006. Development of intermodal transport in new European Union states, *Transport* 21(2): 148–153.

Tanja, P. T. 1991. A decrease in energy use by logistics: a realistic opportunity?, in *Proceedings of the European Conference of Ministers of Transport: Freight Transport and the Environment*, 151–165.