GREEN LOGISTICS – A CONDITION OF SUSTAINABLE DEVELOPMENT

POPESCU (married BÎZOI) Alexandra-Codruța [1], ȘIPOȘ Ciprian Alexandru[2]

West University of Timișoara

Abstract

Green logistics is a field of growing interest. As a part of logistics, transportation is a major source of economic, social and environmental impacts. In our paper, we analyze the sustainability of the European transportation system in accordance with its effects on the economy, society, and environment. With the help of a three-component model, we found that in European countries and USA, the long-term economic growth is associated to a significant increase in GHG emissions. We registered a mild correlation between the percentage of GHG emissions from energy/transport in total emissions and the social sustainability indicators (life expectancy, healthy life years).

Keywords*: sustainability, sustainable development, logistics, green logistics, GHG*

JEL classification: *Q01*

1. Introduction

Logistics is the discipline, which focuses on the management and coordination of the supply chain activities (launching a supply order, materials handling, inventory management, and transport), being at the focal point of industry and commerce. Research shows that, in order to provide cost-effective services, some logistics activities are being outsourced and the value of those services – especially in high-income countries – is being assessed both qualitatively and quantitatively. Therefore, the logistics professionals

[1] *Assistant professor / Ph.D., Faculty of Economics and Business Administration/Management Department, West University of Timișoara, Timișoara, Romania, alexandra.bizoi@e-uvt.ro*

[2] *Associate professor / Ph.D., Faculty of Economics and Business Administration/ Economics and Business Modelling Department, West University of Timișoara, Timișoara, Romania, ciprian.sipos@e-uvt.ro*

take their decisions also based on the effects their activity has on their stakeholders (emissions, noise, accidents) (Fransoo J. C., Bouchery, Y., Arvis, J. F., Ojala, L., 2014)

This is the reason for which, nowadays, the concept of *green logistics* becomes of relevance. According to Alan McKinnon and other scholars (McKinnon et al., 2010), *green logistics,* is a major concern, given that 15% of global GHG emissions (greenhouse gas emissions) are logistics correlated. In this context, it is expected that by 2050, logistics will have its required contribution to the reduction of CO_2 emissions.

Logistics, as a part of supply chains applies to different area and sectors. Given this correlation between supply chains and logistics, their performance is also correlated and depends upon: transport infrastructure, the efficiency of logistics services, merchandise handling procedures and soft supply chain infrastructures associated with the physical movements (Fransoo J. C., Bouchery, Y., Arvis, J. F., Ojala, L., 2014).

The competitiveness of a country depends on its logistics performance, on the sustainability of the supply chains, on the attention towards its environmental impact. Within logistics, the transport sector has the largest impact on the environment, a significant footprint.

A percentage of 30% of final energy consumption is attributed to the transport sector, therefore, the management and diminish of this consumption become key challenges, whenever climate change and security of supply are concerned. The transport sector is subject to continuous improvements in energy efficiency. However, the growth in emissions, caused also by larger transport volumes, due to increased global trade and integration within the EU has been higher than the energy efficiency gains. The attempts of changing the mode of transport, from road to alternative modes and the use of bio fuels are not sufficient to compensate the large quantities of GHG emissions. An adequate solution which could lead to the reduction of GHG emissions would include a combination of different measures taken by the industry sector, which is seeking continuously to reduce its footprint, for both economic and environmental reasons.

The improved efficiencies at supply chain level impact positively on the environment, even if the initial motivation behind it - the reduced energy consumption - may be predominantly economic. Efforts have been made towards standardization, so that companies can understand the manner and place in which energy savings can be made, in their efforts to improve supply chains. Logistics companies too, included in their efficiency efforts mostly the calculation of greenhouse gas (GHG) emissions – carbon dioxide (CO_2) values for products and services (Schmied, Knoerr, 2012, p. 4).

The aim of our paper is to analyse the sustainability of the European transportation system, with the help of a three-component model. The model will be composed of three sets of variables, connected with the main impacts of transportation: economic, social and environmental.

The paper has four parts. The paper starts with the introduction in which we present the growing interest towards a new concept, namely *green logistics*, part of *green supply chain management*, which describes the care towards the effects of logistics on the environment, on supply chains, and on sustainable development. Secondly, we reviewed the contributions of the main authors in the field of green logistics and green supply chain management. Thirdly, we modelled the relationship between economic and social development and GHG emissions. Our paper ends with concluding remarks.

2. Going green – logistics and supply chain management

In this part of our paper, we focused our attention on the green dimension of both logistics and supply chain management, a recently developed feature, which is developing even further. Starting from the interest towards sustainability and sustainable development as defined by the Brundtland Commission, the current interest is to reconcile economic, social and environmental objectives. In John Elkington's view this is the triple bottom line. The *triple bottom line* contains the *three pillars of sustainability* (financial, social and environmental. Many companies embraced this concept meant to help them evaluate their performance, on a broader scale (Slaper, Hall, 2011).

Savitz and Weber (2006) developed further connotations of this concept. In their book, *The Triple Bottom Line*, Savitz and Weber encourage companies to promote sustainable management, in order to achieve business success and competitive advantage. Companies must acknowledge the environment and the interests of society, besides their business interests. Sustainability becomes a business practice, in the authors' view.

When considering sustainability, it is obvious that the efficiency, the growth and reliability of the transport sector are connected with national economic development. It is, therefore, that many countries' governments are still reluctant in imposing drastic environmental constraints to the transport sector, as they are conscious of its negative effect on the economy.

Out of all the activities involved in logistics, transport is the activity which leaves the most notable footprint, releasing the largest volume of emissions. These emissions vary depending on the mode of transport: road, rail, maritime, in-land waterway or air. Companies select their preferred manner of transport, according to its cost, efficiency, reliability and not always, the most environment-friendly version. Efforts are being made nowadays by numerous companies to reduce the environmental print of their supply chains, when transport is concerned, with the help of multi-criteria systems, which allow them to select the best mode of transport, the most efficient one, and also innovate throughout the process. Therefore, companies underlie all their strength towards finding the transportation modes, which are energy efficient and release less polluting emissions. However, the new innovative modes of transportation present a series of limitations: the high cost of technologies, less reliable, fuel temperature-dependent, fact which makes the adoption of *green logistics* within supply chains a difficult task (Fransoo J. C., Bouchery, Y., Arvis, J. F., Ojala, L., 2014).

Further on, we will present the concepts of green logistics and the concepts correlated with it, and then the concept of green supply chain management. The terminology on environmental-focused logistics includes different concepts like green logistics, reverse logistics, ecological logistics, environmental logistics and green distribution, as follows:

a) Min and Kim (2012) define *green logistics* as the environmental issues related to logistics activities (launching of a supply order, packaging, transportation, warehousing, inventory, etc.).

b) Rogers and Tibben-Lembke (2001) use the term *reverse logistics*, when referring to the efforts made within a supply chain to reduce its environmental footprint, by reusing, recycling and remanufacturing. These authors make a distinction between *reverse logistics* and *green logistics*.

On the one hand, *reverse logistics* includes the efforts which were made to recapture value, when moving the goods from the typical place of disposal. On the other hand, *green logistics* or *ecological logistics*, refer, in the view of Rogers and Tibben-Lembke, to the understanding and thus, the minimization of the ecological footprint of logistics, including the following activities: the measurement of the environmental footprint of different modes of transport, the ISO 14000 certification, and the reduction of energy usage for logistics correlated activities and materials usage.

c) The term *environmental logistics* was used by Gonzales – Benito and Gonzales – Benito (2006) when describing the logistics practices (purchasing, transport, distribution, storage, and reverse logistics).

d) Shi and his colleagues (2012) consider *green distribution* to be the process of integrating environmental concerns whereas logistics is concerned (packaging, reverse logistics, labelling, transportation).

The concept of *green supply chain management* (GSCM) is a new concept, applicable mostly to the manufacturing companies, which gained interest among both professionals and academia. Authors (Walker et al., 2008; Zsidisin and Siferd, 2001) in this field use also the concept of *environmental supply chain management (ESCM).* Synonym with the above concepts is *sustainable supply chain management*, although it mainly focuses on the environmental dimension and less on the economic and social ones (Carter and Rogers, 2008; Seuring and Müller, 2008). Hart (1995) explains the concept of *green manufacturing* as an environmental practice meant to prevent and control pollution, steward product. The *green supply/ environmental purchasing* are two concepts designed at aiming to improve the suppliers' environmental performance (Bowen et al., 2001).

Linton and his colleagues (Linton et al., 2007) see a shift from facility or organisational level towards supply chain level whereas environmental management is concerned. Hervani et al. (Hervani et al., 2005) consider the main components of GSCM to be green logistics activities, starting with green purchasing, followed by green manufacturing, then green distribution and reverse logistics. GSCM includes the environmental conscious practices in all supply chain and product life-cycle stages.

The environment – focused, green supply chain management practices are environmental monitoring (it assumes the evaluating and monitoring of suppliers) and environmental collaboration (buyers and suppliers come up jointly with environmental solutions) (Vachon and Klassen, 2006). *Green supply chain management* includes, according to Zhu and his colleagues (2005), inter-organisational activities, like product life cycle analysis, industrial ecosystems, industry ecology, and extended producer responsibility.

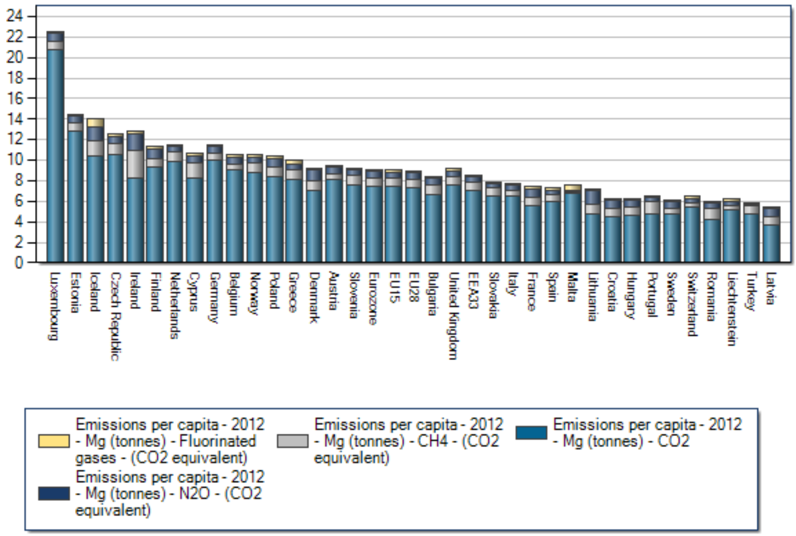
Wiedmann and Barett (2010) consider that *green supply chain management* reduces environmental impact while aiming to increase profits and market share. The effect of supply chain activities on the environment can be measured throughout the environmental / ecological footprint, a concept which was designed to show when and whether the *sustainability threshold* exceeds its forecasted values.

The ecological footprint measures the anthropogenic impact on earth and the existing bio-capacity, but also the bio-capacity people use (UN Environment Programme). Another indicator is being used more and more, namely the carbon footprint. However, this indicator is not very comprehensive, as there is also the GHG footprint, which includes other *greenhouse gas emissions* as well (Wiedmann and Minx, 2007).

The GHG footprint measures the quantity of GHG emitted in the process of products and services' creation. The main greenhouse gases emitted by human activities are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gas (F-gas) (US Environmental Protection Agency). In 2012, the country with the highest emissions from the EU was Luxembourg, as it can be seen in Figure 1. At EU level, transport activities are one of the main greenhouse gas emissions sources.

In the context of sustainability, green supply chain management and green logistics, transport becomes of extreme relevance, given the fact that it contributes to the support of all others sectors. Transport is a sector in which emissions are high and expected to grow within the next 20 years. Therefore, transport-related decisions should be carefully analysed by political factors.

Figure 1: Emissions per capita by country and gas, 2012



Source: European Environment agency

At EU level, there is growing concern regarding sustainable transportation. The Council of the EU sees a sustainable transportation composed of transport systems which meet the economic, social and environmental needs of the society, having minimal impact on the economy, society and the environment (Council of the EU, 2006). Åhman (2004) and McKinnon (2006) detail the impact of transport on economic growth and promote the fostering of economic growth while having an efficient transport system, with little negative impacts on environment, economy and human health.

In this context, an appropriate indicator must be found which could encompass all potential impacts of transport on the economy, society and environment. Litman (2008) considers that a sustainable transportation indicator should have three components:

- Economic: infrastructure costs, accident damages, mobility barriers, consumer costs, depletion of non-renewable resources, traffic congestion.

- Social: human health impacts, community cohesion, aesthetics, impacts on the mobility disadvantaged, equity/fairness, community liveability.
- Environmental: climate change, habitat loss, depletion of non-renewable resources, hydrologic impacts, air pollution.

Given the extensive interest towards sustainable development and green logistics, in this article we analyze the sustainability of the European transportation system. Our analysis has three dimensions correspondent to the major impacts of sustainability: economic, social and environmental.

3. Is the European transportation system sustainable?

We analyze the sustainability of the European transport system using a model based on linear regressions which aims to study the relationships between greenhouse gas emissions (considered to be an environmental indicator) and the main indicators of economic and social sustainability. We used the following indicators in order to measure the greenhouse gas emissions: the total greenhouse gas emissions (*GHGs total*), the volume of greenhouse gas emissions resulted from energy and transport (*GHGs energy/transport*), respectively, the percentage of greenhouse gas resulted from energy and transport in total emissions *(%GHGs energy/transport*). The indicators of economic sustainability are the size of the economy, measured by GDP, the unemployment rate (*UnE%*) and total employment (*TE*). Finally, the indicators of social sustainability we used in the model are life expectancy (*LE*) and healthy life years (*HLY*). The linear equations composing the model are:

Table 1: The equations of the model

Environmental / Economic indicators	Environmental / Social indicators
$GDP_i = \alpha_1 + \beta_1 \cdot GHGs\ total_i + \varepsilon_{1i}$	$LE_i = \alpha_{10} + \beta_{10} \cdot GHGs\ total_i + \varepsilon_{10i}$
$GDP_i = \alpha_2 + \beta_2 \cdot GHGs\ energy/transport_i + \varepsilon_{2i}$	$LE_i = \alpha_{11} + \beta_{11} \cdot GHGs\ energy/transport_i + \varepsilon_{11i}$
$GDP_i = \alpha_3 + \beta_3 \cdot \%GHGs\ energy/transport_i + \varepsilon_{3i}$	$LE_i = \alpha_{12} + \beta_{12} \cdot \%GHGs\ energy/transport_i + \varepsilon_{12i}$
$UnE\%_i = \alpha_4 + \beta_4 \cdot GHGs\ total_i + \varepsilon_{4i}$	$HLY_i = \alpha_{13} + \beta_{13} \cdot GHGs\ total_i + \varepsilon_{13i}$
$UnE\%_i = \alpha_5 + \beta_5 \cdot GHGs\ energy/transport_i + \varepsilon_{5i}$	$HLY_i = \alpha_{14} + \beta_{14} \cdot GHGs\ energy/transport_i + \varepsilon_{14i}$
$UnE\%_i = \alpha_6 + \beta_6 \cdot \%GHGs\ energy/transport_i + \varepsilon_{6i}$	$HLY_i = \alpha_{15} + \beta_{15} \cdot \%GHGs\ energy/transport_i + \varepsilon_{15i}$

$TE_i = \alpha_7 + \beta_7 \cdot GHGs\ total_i + \varepsilon_{7i}$ $TE_i = \alpha_8 + \beta_8 \cdot GHGs\ energy/transport_i + \varepsilon_{8i}$ $TE_i = \alpha_9 + \beta_9 \cdot \%GHGs\ energy/transport_i + \varepsilon_{9i}$	

The pairs (α_1; β_1) to (α_{15}; β_{15}) are the intercepts and the regression coefficients of each linear function, respectively, ε_{1i} to ε_{15i} are the stochastic components of these functions.

We analyzed these relationships using data provided by World Bank and Eurostat. In our study, we included the countries from EU28 to which we added Iceland, Norway, Switzerland and, for comparison reasons, the USA. For all specified countries, the period all indicators cover is 1995 – 2012, an exception being the Healthy Life Years indicator, covering only the timeframe 2004 – 2012 and having no data for the USA. The main results of regression analysis are in **Table 2**:

Table 2: The main results of regression analysis

Environmental indicators	**Econometric parameters**	**Economic indicators**			**Social indicators**	
		GDP	Unemployment Rate	Total employment	Life expectancy	Healthy life years
GHGs total, in Gg CO_2 eq.	*Linear Correl. Coefficient*	0,952930	-0,063528	0,993514	0,104473	0,008495
	Significance F	0,000000	0,142999	0,000000	0,012496	0,892827
	Coeff. β	1,992606	-1,804E-07	0,043655	2,659E-07	8,269E-08
	t stat	76,408643	1,466887	200,7802	2,505794	0,134864
GHGs from Energy/ Transport, in Gg CO_2 eq.	*Linear Correl. Coefficient*	0,907688	-0,080760	0,995161	0,105125	0,034565
	Significance F	0,000000	0,062439	0,000000	0,011955	0,583466
	Coeff. β	7,459074	-8,726E-07	0,210482	9,750E-07	1,601E-06

	t stat	52,583399	-1,867093	232,7388	2,521587	0,549037
% GHGs from Energy/ Transport of total GHGs	*Linear Correl. Coefficient*	0,043918	-0,144813	0,005168	0,297884	0,215981
	Significance F	0,285641	0,000799	0,905514	0,000000	0,000528
	Coeff. β	373871,55	-1,587907	591,5595	2,668249	2,344194
	t stat	1,068701	3,372530	0,118755	7,443560	3,511467

Source: Own calculations based on World Bank & Eurostat data

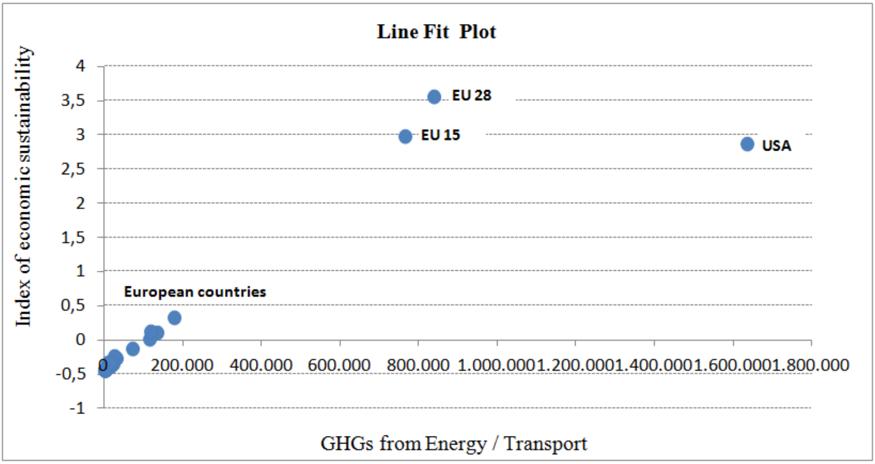
The results of the regression analysis in **Table 2** show that there are very strong correlations in some cases, as there are very weak correlations in other cases. We registered very strong positive correlations between GHGs total and GDP, respectively, between GHGs total and total employment. Also, very strong positive correlations are between GHGs from energy/transport and GDP, respectively, between GHGs from energy/transport and total employment. That shows the very close relationship between environmental indicators and the economic sustainability. We found only a mild positive correlation between the percentage of GHGs from energy/transport in total emissions and the social indicators (life expectancy and healthy life years). This shows that even if weaker than in the case of economic sustainability, there is a significant relationship between environmental indicators and social sustainability. We registered very weak negative correlations between all environmental indicators and the unemployment rate.

These results confirm the assertion that companies prefer to select their mode of transport mainly cost-related, and often not the most environment-friendly one. The very strong positive correlations between the most important economic sustainability indicators and greenhouse gas emissions show that in European countries and the USA the long-term economic growth is associated with an increase in gas emissions. The mild positive correlation between greenhouse gas emissions and social sustainability indicators shows that growth rates of these two categories are different. Unfortunately, the gas emissions have a higher growth rate than the quality of life indicators.

Based on these results, we made groupings of analyzed countries with regard to the economic, social and environmental sustainability, according to the strength of the correlations.

Due to a very strong correlation observed in Table 2, we made the first grouping according to the GHGs from energy/transport (in Gg CO_2 eq.) and an index of economic sustainability for the year 2012 (the most recent available data). The index is composed out of a mean of standardized values (z-scores) of GDP and total employment. The grouping is illustrated by Figure 2 and Figure 3:

Figure 2: The positioning of Europe and USA regarding greenhouse gas and economic sustainability



Source: Own calculations based on World Bank & Eurostat data

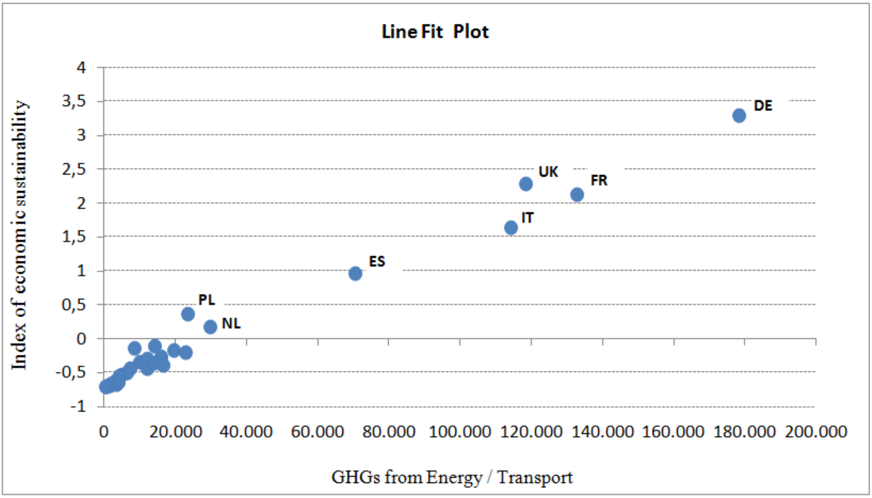
In Figure 2, we can see the positioning of USA vs. Europe, when the correlation between greenhouse gas emissions from energy/transports and economic sustainability is concerned. Thus, we see that USA has a level of greenhouse gas emissions practically double compared to the total volume of emissions generated by the entire EU28. However, the economic sustainability index of USA, composed as shown above of GDP and total employment, is below EU28 and even more, below the EU15. The USA has a really serious problem with greenhouse gas emissions, in connection with economic development. We can observe the relative small differences between EU28 and EU15 from both economic sustainability and gas emissions, fact which highlights the importance of developed countries within the European Union.

Therefore, if comparing the US transportation mode to the European transportation mode, we can state that the European one is sustainable in accordance with the effects it has on the economy, society, and the environment. However, the very strong correlation between economic sustainability and greenhouse gas emissions shows that there are numerous actions which need to be implemented towards reaching environment-friendly transportation modes in Europe.

Based on our analysis, we drew the positioning of different European countries among the EU in terms of greenhouse gas emissions and economic sustainability in Figure 3.

From the European countries' positioning on the chart, we can see that the most developed economies produce also the largest greenhouse gas emissions from energy and transport. Clearly, the size of the countries' economy is an important factor when analyzing greenhouse gas emissions. We mention the special positioning of the Netherlands though it is a small sized country, it significantly contributes to greenhouse gas emissions within Europe, at the level of the energy and transports sector. Also, another interesting positioning worth mentioning is the positioning of Poland, the only in Eastern European country, found in the group of countries with high greenhouse gas emissions from the energy and transport sector.

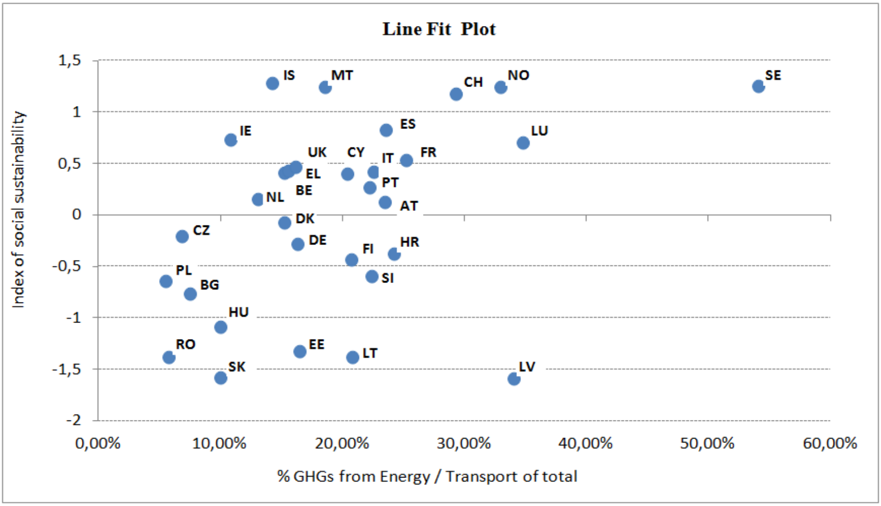
Figure 3: The positioning of European countries regarding greenhouse gas emissions and economic sustainability



Source: Own calculations based on World Bank & Eurostat data

Due to the mild positive correlation found in Table 2, the second grouping consists of European countries according to the percentage of GHGs from energy/transport in total emissions and an index of social sustainability, based on available data from 2012. The index of social sustainability comprises a mean of standardized values (z-scores) from the social indicators analyzed, life expectancy and healthy life years. This grouping is illustrated in Figure 4, as follows:

Figure 4:The positioning of European countries according to percentage of GHGs from energy/transport of total emissions and social sustainability



Source: Own calculations based on World Bank & Eurostat data

We can see that the relationship between social sustainability and greenhouse gas emissions is much different from economic sustainability. In terms of social sustainability, European countries are more scattered and the correlation is significantly weaker. Almost all of the EU15 countries are situated in the upper part of the chart, registering high social sustainability indices while the former communist countries are positioned at the bottom, with low social sustainability indices. We note the positioning of Sweden, Luxembourg, Norway and Switzerland in the area in which we find countries with very high percentages of greenhouse gas emissions from energy and transport in total emissions. We observe the positioning of developed countries like Germany, the UK and Netherlands in the area of lower percentages of greenhouse gas emissions, along which we find also Belgium, Denmark or Ireland. In the lower area of the chart, we find Romania, Bulgaria, Hungary or Slovakia.

We note the very good positioning of the Czech Republic, with an index of social sustainability close to the European average and a very low percentage of emissions from energy and transport in total emissions.

4. Conclusions

Given the growing international concern towards sustainable development, in our paper we analyzed the sustainability of the European transport and energy sector compared to the US one, throughout a three-component model. We started from the hypothesis that both economic and social growth is associated with significant increases in GHG emissions.

We found very strong positive correlations between GHGs total and GDP, respectively, between GHGs total and total employment, between GHGs from energy/transport and GDP, respectively, between GHGs from energy/transport and total employment. This proves our first hypothesis to be correct, as there is a close relationship between environmental indicators and economic sustainability. We consider that in European countries and the USA the long-term economic growth is associated with an increase in gas emissions.

Our second hypothesis proved also correct, although we found only a mild positive correlation between the percentage of GHGs from energy/transport in total emissions and the social indicators (life expectancy and healthy life years). We found that, unfortunately, gas emissions have a higher growth rate than the quality of life indicators. Even if weaker than in the case of economic sustainability, there is a significant relationship between environmental indicators and social sustainability. We registered very weak negative correlations between all environmental indicators and the unemployment rate.

The results we obtained confirm that companies neglect environmental protection, choosing cost-effective means of transportation. There are considerable differences between the US and the European countries. EU 28 has only half of the total volume of emissions the USA has. The economic sustainability index of USA (composed of GDP and total employment) is not only below EU28, but below EU15. We can, therefore, assume that USA has serious issues with greenhouse gas emissions, in connection with economic development, explaining why USA has signed, but not ratified the Kyoto protocol. At the level of the EU, we found that EU15 has the largest importance (namely the developed countries), and there are relatively small differences between EU28 and EU15 from both economic and environmental sustainability point of view. We came to the conclusion that in comparison to the US transportation mode the European transportation mode is sustainable in accordance with the effects it has on the economy, society, and the environment. However, the very strong correlation between economic sustainability and greenhouse gas emissions shows that there are numerous actions which need to be implemented towards reaching environment-friendly transportation modes also in Europe, in the most developed countries, which are also the ones which produce the largest greenhouse gas emissions from energy and transport.

In our paper, we analyzed the social sustainability of European countries in connection with GHG emissions. These countries are more scattered and the correlation is significantly weaker. Almost all of the EU15 countries are situated in the upper part of the chart, registering high social sustainability indices while the former communist countries are positioned at the bottom, with low social sustainability indices.

Therefore, we can say that economic and social growth both correlate positively to environmental issues. Special attention must be granted to these environmental issues as it influences economic and social development. This development must grow more and more sustainable in order to ensure a long-term growth, with minimal impact on the environment. In this direction, efforts must be made to encourage developed countries to introduce institutions which supervise the supply chain activities, and which could collect a fee if supply chain activities impact negatively on the environment. This supply chain level supervising institution would have the role to observe if material fluxes are consistent with the orders which were received (informational flux) from the clients in terms of quality, quantity and time (Bîzoi and Șipoș, 2014), and besides that with minimal negative environmental impact, with industry taking different measures to continuously reduce the footprint of their supply chains, for both economic and environmental reasons.

In conclusion, the environmental footprint of logistics influences the sustainability of supply chains. At its turn, this sustainability correlates with the competitiveness and the development of a country. Therefore, green logistics and green supply chain management should be encouraged, as they are triggers for both economic and social sustainable development. Efforts should be made towards having efficient transportation modes, fostering economic growth, with little negative impacts on environment, economy and human health.

Acknowledgement

This work was co-financed from the European Social Fund through Sectoral Operational Programme Human Resources Development 2007-2013, project number POSDRU/159/1.5/S/134197 'Performance and excellence in doctoral and postdoctoral research in Romanian economics science domain'.

5. References

- Åhman, M., (2004). *Closer Look at Road Freight Transport and Economic Growth in Sweden. Are There Any Opportunities for Decoupling?* Report 5370 Naturvårdsverketa. Available at: http://www.miljo.lth.se/svenska/internt/publikationer_internt/pdf-filer/Ny620-5370-1H.pdf
- Bîzoi Cristian-Gabriel, Șipoș Gabriela Lucia, (2014). *Innovation in Supply Chain Management: compensating customers for quantitative, qualitative and temporal inconsistencies.* "Proceedings of MAC-EMM 2014", ISBN 978-80-905442-8-4.
- Bowen, F.E., Cousine, P.D., Lamming, R.C., Faruk, A.C., (2001). *Horse for courses: Explaining the gap between the theory and practice of green supply*. Greener Management International, (Autumn) (2001), pp. 41–59.
- 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 2008, 38:5, 360-387.
- Council of the EU, (2006). Renewed EU sustainable development strategy. Fransoo J. C., Bouchery, Y., Arvis, J. F., Ojala, L., (2014). *Green Logistics: Sustainable Supply Chain and Enabling Policies*. Available at: https://openknowledge.worldbank.org/bitstream/handle/10986/17820/858260WP0Posit00Box382162B00PUBLIC0.pdf?sequence=1
- Hart, S. L., (1995). *A natural-resource-based view of the firm*. Academy of Management Review, 20(4), 986-1014.
- Hervani, A.A., Helms, M.M., Sarkis, J., (2005). *Performance measurement for green supply chain management*, Benchmarking: An International Journal, 12, 4, 330-353.

- Linton J.D., Klassen R., Jayaraman V., (2007). *Sustainable supply chains: an introduction*. Journal of Operations Management 25(6):1066–1082.
- Litman, T., (2008). *Todd Litman (2008), A Good Example of Bad Transportation Performance Evaluation: Critique of "Transportation Performance of the Canadian Provinces*", Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/per_ind.pdf.
- McKinnon, A., (2006). *The Decoupling of Road Freight Transport and Economic Growth Trends in the UK: An Exploratory Analysis*. Transport Reviews: A Transnational Transdisciplinary Journal Volume 27, Issue 1, 2007, pp. 37-64.
- McKinnon, A., Cullinane, S., Browne, M., Whiteing, A., (2010). *Green logistics: improving the environmental sustainability of logistics*/Alan McKinnon ... [et al.]. Kogan Page Limited, London, ISBN 978-0-7494-5678-8.
- Min, H., Kim, I. (2012). *Green supply chain research: past, present and future*, Logistics Research, 4 (1/2), pp 39–47Rogers, D.S., Tibben-Lembke, R.S., (2001). *Going Backwards: Reverse Logistics Trends and Practices*, Available at: http://www.rlec.org/reverse.pdf
- Savitz, A. W., Weber, K., (2006). *The Triple Bottom Line. How Today's Best-Run Companies Are Achieving Economic, Social, and Environmental Success — and How You Can Too*, Jossey-Bass; 1 edition (August 11, 2006), ISBN-13: 978-0787979072.
- Schmied, M., Knoerr, W., (2012) *Calculating GHG emissions for freight forwarding and logistics services*. Available at: http://www.verkehrsrundschau.de/sixcms/media.php/4513/CLECAT_Guide_on_Calculating_GHG_emissions_for_freight_forwarding_and_logistics_services.pdf,
- Seuring, S., Muller, M., (2008). From a literature review to a *conceptual framework for sustainable supply chain management.* Journal of Cleaner Production 16(15): 1699-1710. A framework of sustainable supply chain management: moving toward new theory
- Shi V.G., Lenny Koh S.C., Baldwin J., Cucchiella F., (2012). *Natural resource based green supply chain management*. Supply Chain Manage: An International Journal, Vol. 17 Issue: 1, pp.54 – 67.

- Slaper, T. F., Hall, T. J., (2011). *The Triple Bottom Line: What Is It and How Does It Work?* Indiana Business Review. Spring 2011, Volume 86, No. 1.
- Vachon, S., Klassen, R.D. (2006). *Extending green practices across the supply chain: the impact of upstream and downstream integration*. International Journal of Operations and production Management, 26(7), 795-821.
- Walker, H., diSisto, L., McBain, D., (2008), *Drivers and barriers of environmental supply chain practices: lessons from the public and private sectors*, Journal of Purchasing and Supply Management, Vol. 14 No. 2, pp. 69-85.
- Wiedmann T., Barrett J., (2010) *A Review of the Ecological Footprint Indicator—Perceptions and Methods.* Sustainability, 2010, 2, 1645-1693.
- Wiedmann, T., Minx, J., (2008). *A Definition of 'Carbon Footprint'*. In: C. C. Pertsova, Ecological Economics Research Trends: Chapter 1, pp. 1-11, Nova Science Publishers, Hauppauge NY, USA. Available at: https://www.novapublishers.com/catalog/product_info.php?products_id=5999
- Zhu, Q., Sarkis, Geng, J. Y., (2005). *Green supply chain management in China: Drivers, practices and performance*. International Journal of Operations and Production Management 25(4), 449-468.
- Zsidisin G.A., Siferd S.P., (2001). *Environmental purchasing: a framework for theory development*. European Journal of Purchasing and Supply Management, 7(1):61–73.
- *** Eurostat, http://ec.europa.eu/eurostat
- *** United Nations Environment Programme http://www.unep.org/
- *** US Environmental Protection Agency, http://www.epa.gov/
- *** World Bank Open Data, http://data.worldbank.org/