Sustainable Logistics and Regional Competitiveness in the Eight Development Regions of Romania

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Abstract

This paper aims to contribute to the assessment of sustainable logistics at regional level, given that scholarly literature lacks such research.

We created the index of sustainable logistics based on a proprietary methodology, using two basic components: sustainable transport practices and responsible use of natural resources. We analysed data provided by Eurostat and the National Institute of Statistics, we defined the two sub-indices and ranked the eight development regions of Romania, based on the value of the Regional Index of Sustainable Logistics. Based on correlation matrix analysis, we identified a strong positive correlation between the Regional Index of Sustainable Logistics and the Regional Competitiveness Index.

The results of this paper demonstrate that regions with superior performance in sustainable logistics practices have a higher level of regional competitiveness.

Keywords*: sustainable logistics, regional competitiveness, Regional Index of Sustainable Logistics (RISL), Regional Competitiveness Index (RCI), Romania, development regions.*

JEL classification: O18, Q01, R11.

1. Introduction

"Logistics is the term widely used to describe the transport, storage and handling of products as they move from raw material source, through the production system to their final point of sale or consumption" (McKinnon et al., 2015, p.3).

Because of public and government pressures on companies, the impact of logistics on the environment has diminished considerably in the past twenty years. The impact of logistics activity on environment and community is explained by the emergence of negative externalities, such as decreased air quality, noise and vibration, accidents, significant contribution to global warming.

On the long term, employing sustainable logistics could solve many of the problems that today's intense logistics activity face. Many of the measures to reduce the impact of logistics on the environment, the so-called "green-gold" measures, could help reduce logistics costs and increase environmental benefits.

The present research aimed to determine the components of sustainable logistics and to evaluate it in the eight development regions of Romania, using

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proprietary methodology and indicators resulting from the content analysis of databases provided by the European Commission (Eurostat, 2017) and the National Institute of Statistics of Romania. We formulated the objectives and the hypothesis of the study. Obtaining the values of the Regional Sustainable Logistics Index (RISL) made it possible to determine the connection with the Regional Competitiveness Index, based on the statistical correlation method. Finally, we presented the conclusions and limits of the research.

2. Sustainable logistics

Starting with the Brudtland Report (1987), sustainable development has progressively become part of government policies and organizational strategy. Sustainable development has three dimensions: economy, environment and society. Within this framework, economic growth must be in line with environmental and societal responsibilities.

For the past twenty years, the interaction between sustainability and logistics has been the subject of research carried out to highlight the impact of logistics activity on the environment and to propose solutions for optimizing this impact (Linton, Klassen and Jayaraman, 2007, p.1075).

Oakden and Leonaite (2011) state that "sustainability is therefore not a fringe issue, but a strategic business concern". For McKinnon, Browne and Whiteing (2012, p. 19), "green logistics is now regarded as good business practice and something that can have positive impact on many financial and operational metrics".

All of the above-mentioned research demonstrates that explaining the externalities generated by business should also take into account the environmental and societal components. It is becoming clear that the term "sustainability" associated with logistics means more than just "green", and it is closely related to explaining the impact of logistics activity on the environment.

Brito, Carbone and Meunier Blanquart (2008) have shown that there is a positive link between sustainability and internal and external integration of logistics principles. They state that organizations can initiate a "virtual" circle to match sustainability, quality of coordination, and optimization issues of logistics activities.

Other research evaluates sustainable development, the lean concept and logistics (Sopadang and Wichaisri, 2014) in order to integrate them into a model called Lean Sustainable Logistics.

Sustainable logistics management includes sustainable planning, sustainable marketing, sustainable production, and sustainable logistics. Reducing environmental waste and pollution, using clean energy and efficiently using natural resources positively affects not only the environment, but also logistics through cost reduction. The performance of a company can be measured by resource productivity and by waste reduction, as waste does not bring value to an activity.

Sustainable logistics is the process of environmentally friendly use of resources and the transformation of these inputs into outputs that can be reused at the end of their lifecycle to create "green" or sustainable logistic chains (Kumar and Chandrakar, 2012). According to another vision, *sustainable logistics* integrates environmental principles into logistics chains, including production planning, resource and source selection, production process, final product delivery to the customer and end of product life, after use (Srivastava, 2007). According to Morana (2013), sustainable logistics"can be understood as the management of the flows of materials, information, capital, people and intelligence with an economic, environmental and social/societal purpose. As a strategic management approach, it is found in the quite deliberate set of intra and inter-organisational connections, with a view to the long-term performance of each company and its supply chain".

The first research on sustainable logistics began between 1950 and 1960. Murphy and Poist (1995) considered that: "prior to the 1960s, there was relatively little concern regarding environmental degradation. For the most part, the environment's ability to absorb wastes and to replace resources was perceived as being infinite".

Specialized research carried out after 1960 analysed five main issues: reducing freight transport externalities, city logistics, reverse logistics, corporate environmental strategies towards logistics, and green supply chain management (McKinnon, et al., 2015, p.6).

Adopting sustainable logistics is profitable for a business because the effect of responsible practices in supply, transport, storage, and packaging is cumulative. If sustainability occurs in each logistic activity, then it is possible to talk about the integration of sustainable logistics.

The implementation of sustainable logistics strategies becomes extremely important in the current global context. Scholarly literature presents different types of sustainable logistics strategies, such as (Mohanty, 1997):

➥ *The strategy of using information technology* (electronic data exchange is a computerized system whereby consumers, suppliers and producers can send information in real time; this helps maintain an optimum level of stock and allows for rapid decision making);
➥ *The reverse logistics strategy* (based on reduced resource consumption, reuse and recycling of materials);
➥ *The strategy of waste management* (based on three principles: waste reduction, control and prevention of waste).

All sustainable logistics strategies are interdependent and condition each other. Waste management contributes to improving the quality of finished products, which could lead to reduced returns and inverse logistics efforts. Better information for stakeholders could reduce excess inventory and waste. The implementation of each strategy generates a synergistic effect (Ganapathy, 2014).

According to Panayiotou and Aravosis (2011), the most used practical applications for sustainable logistics are "social responsibility in procurement,

sustainable packaging, sustainable storage, sustainable transport and reverse logistics."

There is a growing interest of companies in implementing green logistics strategies as part of CSR programs. Among the first papers to describe the responsible component of sustainable logistics were those belonging to authors Gănescu, et al., 2013, McKinnon, et al., 2015, pp. 107-122.

3. The relationship between sustainable logistics and competitiveness

The productivity paradigm unifies total quality management, sustainable development, business process and production. Sustainable logistics has thus become the "soul" of sustainable development, a current and socially relevant concept.

Businesses gain competitive advantage if they manage to integrate corporate sustainability, economic contribution and social responsibility into environmental performance (Azapagic, 2003). Among the advantages of this integration are: lower labor costs, increased company reputation, market advantages, ethical investments, safer and healthier products, etc.

To achieve increased profitability, market share and cost reduction, logistics must operate at an inter-functional level; it must mediate and harmonize the activities of multiple sectors, departments or functions within the organization. Logistics is, in this light, a transversal function, and its approach and optimizations within the organization are achieved through processes, not functions (Ilieş, 1999).

The ultimate goal of logistics should be to ensure competitive advantage, i.e. to ensure lasting superiority over competitors, starting from the idea that the level of service to consumers and the cost are significantly influenced by it. The source of competitive advantage may be to operate at a lower cost or to provide a higher value to the customer. Successful companies either have a cost or productivity advantage, a "value" advantage or a combination of the two.

Logistics is a classic example of a systemic approach to business issues and to analysing the total cost of logistics activities, which means that the company's objectives can be achieved by recognizing the mutual interdependence of major business functions such as marketing, production, finance, logistics. Since the systemic approach requires compatibility between the objectives of major functions in the organization and its general objectives, a logistics system, however efficient and effective, cannot fit all the companies as they have different goals and objectives.

Scholarly literature considers logistics capabilities as the main source of competitive advantage. Some authors (Esper, et al., 2007) identify some logistical capabilities that define a company's competitive advantage: customer focused capabilities, supply management capabilities, integration capabilities, measurement capabilities, and information exchange capabilities. Scholarly literature identifies sustainable logistics as a source of competitive advantage.

Despite all these attempts, a more comprehensive picture of how sustainable logistics creates competitive advantage is missing from scholarly literature.

4. Research objectives and methodology

The aim of this research is to evaluate sustainable logistics at the level of Romania's eight development regions, to build a regional index of sustainable logistics (RISL) and to determine the connection of sustainable logistics with regional competitiveness (RCI). The objectives are:

O1. Identify the elements needed to assess sustainable logistics for each of the eight development regions of Romania.

O2. Determine the sustainable logistics index for each of the eight development regions of Romania, for 2016.

O3. Analyse the correlation between sustainable logistics and regional competitiveness at the level of the eight development regions of Romania.

The hypothesis of the study is as follows: *There is a positive correlation between sustainable logistics and regional competitiveness.*

In our opinion, sustainable logistics can be explained by the use of sustainable transport practices and the integration of environmental principles into logistic chains (Figure 1).

Sustainable transport practices are extremely important because they ensure both lower costs to organizations and long-term benefits for the community and the environment. In particular, it is necessary to use waterways and railways, to the detriment of road transport, to reduce greenhouse gas emissions and decongest road and air traffic, to ensure safer air, sea and road transport, to improve infrastructure, to reduce dependence on oil, in the context of decreased oil resources and increased prices, to increase investment in research and innovation, and to introduce new green transport technologies.
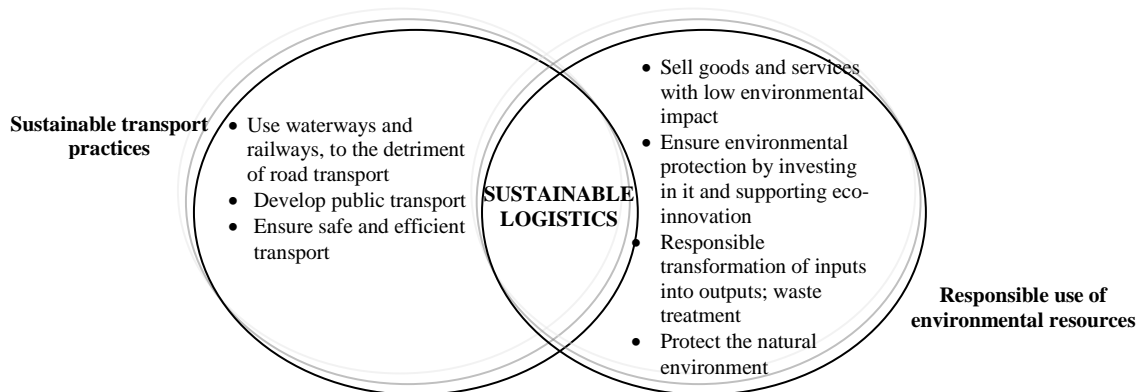

Figure 1. Components of sustainable logistics
Source: created by author

Responsible use of natural resources is an essential requirement for a smart and sustainable economy. Given that the food, construction and transport industries generate negative externalities to the environment, there's need for another way to produce and consume, a better infrastructure and less polluting transport systems. It is therefore necessary to redesign products, packaging, logistics systems, and encourage more ecological technologies and wide use of eco-labelling.

"The economy must create more with less, produce more value with less resources, use resources sustainably and minimize their impact on the environment" (European Commission, 2014, p. 6).

In order to carry out this research, we used secondary data sources such as: Eurostat (for the evaluation of regional competitiveness and IRSL variables) and the National Institute of Statistics of Romania (for the evaluation of some variables of IRSL).

We carried out the assessment of sustainable logistics on the basis of several indicators, presented in Table 1:

Table 1: Regional evaluation indicators of sustainable logistics

Sub-indices of sustainable logistics	Sustainability conditions	Regional evaluation indicators (source)
Sustainable transport practices (Sub-index 1)	• Use waterways and railways to the detriment of road use • Develop public transport • Ensure safe and efficient transport	▪ Waterway, road and rail networks (Eurostat) ▪ Local public transport (INSSE) ▪ The length of city streets (INSSE) ▪ Number of vehicles (Eurostat) ▪ Victims of road accident (Eurostat)
Friendly use of natural resources (Sub-index 2)	• Ensure environmental protection by investing in it and supporting eco-innovation • Responsible transformation of inputs into outputs; waste treatment • Protect the natural environment	▪ Number of eco-labels (INSSE) ▪ The evolution of artificial space (INSSE) ▪ Investments for environmental protection (INSSE) ▪ Waste generation and treatment (Eurostat)

Source: created by the author

The methodological framework used to determine the IRSL is based on the content analysis of the Eurostat database on regional indicators (European Commission, 2017) and of statistical reports of the National Institute of Statistics of Romania (INSSE, 2017).

To calculate the IRSL we followed several steps. In the first stage, we created the list of development regions of Romania (Macro-region 1 - North-Western and Central Region, Macro-region 2 - North-Eastern and South-Eastern Region, Macro-region 3 - South-Muntenia Region and Bucharest-Ilfov Region; Macro-region 4 - South-Western Oltenia and Western Region). We then created the database, introducing the indicators that are part of the two sub-indices.

Since these sub-indices also included variables expressed in other units of measurement, we aggregated and transformed data using the min-max method to maintain the order and relative distance between scores of different regions. We normalized values by applying the following formula:

$$P_i=100*(X_i-val_{min})/(val_{max}-val_{min}),\qquad(1)$$

where: X_i - the value of the indicator to be normalized, val_{max} - the best value, val_{min} - the weakest value.

In step three, we calculated the two sub-indices, while the IRSL value determined as the arithmetic mean of the two sub-indices, using the following formula:

$$IRSL = (I_1+ I_2)/2\qquad(2)$$

where: IRSL - the value of the Regional Index of Sustainable Logistics; I_1, I_2 - sub-indices of sustainable logistics.

Based on the results, we ranked Romania's development regions according to the capacity of the organizations and institutions operating in these regions to integrate sustainable practices into logistics activities. The region with the highest IRSL value achieves superior logistics performance.

We determined performance in terms of regional competitiveness on the basis of the Regional Competitiveness Index (RCI) 2016 (European Commission, 2017) (Table 2).

Table 2: Performance in terms of sustainable logistics and regional competitiveness

Macro-region/ Region	Sustainable transport practices (Sub-index 1)	Friendly use of natural resources (Sub-index 2)	IRSL 2016	RCI 2016
North-Western Region	46.23	38.71	42.47	11.9
Central Region	46.32	48.70	47.51	8.2
North-Eastern Region	24.10	54.29	39.20	6.4
South-Eastern Region	35.02	47.63	41.32	0.1
South-Muntenia Region	46.72	35.22	40.97	5.7

Macro-region/ Region	Sustainable transport practices (Sub-index 1)	Friendly use of natural resources (Sub-index 2)	IRSL 2016	RCI 2016
Bucharest-Ilfov Region	85.25	58.36	71.80	45.4
South-Western Oltenia Region	13.81	31.05	22.43	5.6
Western Region	34.35	24.78	29.56	13.2

Source: calculated by the author

The Regional Index of Sustainable Logistics reveals significant differences between regions, explained by particular economic and social issues. The Bucharest-Ilfov region ranks first, mainly due to the numerous investments made by multinational companies. At the opposite end, with low values of the IRSL, is the South-Western Oltenia Region or the North-Eastern Region. Surprisingly, the values of IRSL obtained by the Western Region are low, partly due to the lack of reporting of some indicators.

We used data analysis methods to analyse data and tested the hypothesis using the statistical correlation method, in order to analyse the correlation between the regional index of sustainable logistics and the regional competitiveness index (Table 3).

Table 3: Result table: statistical correlation method

	IRSL	RCI
IRSL	1	
RCI	0,782552	1

Source: calculated by the author

The results in Table no. 3 highlight a positive, strong correlation with a value of> 0.75 between *Sustainable Logistics* and *Regional Competitiveness*. Therefore, the study hypothesis that "*There is a positive correlation between sustainable logistics and regional competitiveness*" is correct.

5. Conclusions

This paper demonstrated its important contribution to assessing and evaluating sustainable logistics at regional level, based on an index created using proprietary methodology. Based on the research results, the work contributes additional knowledge to the field, as there is a limited number of such studies in scholarly literature.

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Performance in terms of sustainable logistics practices depends, in particular, on local and national policies to stimulate sustainable transport and the responsible use of environmental resources.

The limits of this research derive from the methodology of determining the IRSL itself, as it is based on regional indicators existing in the databases. We suggest that in the future, as companies and authorities with regional responsibilities make efforts to report additional regional indicators relevant to sustainable logistics, research can become more valuable.

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