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## The development of green logistics for implementation sustainable development strategy in companies

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### Abstract

While environmental issues have become critical concerns all over the world, organizations are constantly under pressure to develop environmentally responsible and friendly operations. Commitment to the natural environment has become an important variable. Therefore, the interest in developing green logistics from companies, government, and the public is increasing dramatically especially because traditional logistics cannot meet the requirements of modern society and has huge impact on the environment. The purpose of this paper is to present determinant factors that can influence the development of green logistic concept in companies as an element of Sustainable Development.

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*Keywords:* Green logistics, environmental sustainability, Sustainable Development, factors, environmental practices, company.

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### 1. Introduction

In recent years there has been increasing concern about the environmental effects on the planet of human activity. That is why it has had an increasing amount of attention in the popular press, in governmental agendas, in the academic literature and from the general public. Stakeholders are increasingly pressuring firms to assume responsibility for any negative effects their business activities might cause as well. The results are that firms are considering the incorporation of environmental thinking into their business strategies in Polish companies (Romanowska, 2004). The rising attention to the greener solutions doesn't leave logistics aside because it plays a very important role, as it is one of the main pollution sources and resource user.

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## 2. Green logistics and sustainable development

Typically, logistics is seen as the actions of which the objective is to minimize costs and maximize profits. The term was used mostly in purely business areas exhibiting companies and in financial reports. But, for many years, the term logistics was used in conjunction with the "green" by creating "Green Logistics" - the term containing costs, yet did not appear on financial reports and on the environment and society. The term "green logistics" is defined as supply chain management practices and strategies that reduce the environmental and energy footprint of freight distribution, which focuses on material handling, waste management, packaging and transport (Rodrigue et al., 2012). Green logistics consists of all activities related to the eco-efficient management of the forward and reverse flows of products and information between the point of origin and the point of consumption whose purpose is to meet or exceed customer demand (Mesjasz-Lech, 2011). Lee & Klassen (2008) describe green logistics as Green Supply Chain Management that can be defined as an organizations activity taking into account environmental issues and integrating it into supply chain management in order to change the environmental performance of suppliers and customers (Lee & Klassen, 2008). Green logistics activities include measuring the environmental impact of different distribution strategies, reducing the energy usage in logistics activities, reducing waste and managing its treatment (Sibihi & Eglese, 2009). From the sustainable development point of view, green logistics can be defined as, "producing and distributing goods in a sustainable way, taking account of environmental and social factors" (Sibihi & Eglese, 2009). This broad definition of green logistics is in line with the WCED (1987) definition of sustainable development and definitions of corporate responsibility (Lyon & Maxwell, 2008).

The three pillars of Sustainable Development can be applied to green logistics (see Figure 1). As mentioned in the definitions of green logistics before, in the past, companies coordinated their logistics activities comprising freight transport, warehousing, packaging, materials handling and data collection and management to meet customer requirements at minimum cost which just refers to the monetary terms (Nowakowska-Grunt, 2008). Now, the environment has become a concern. It is treated as a factor of the cost. Some companies have already taken external costs of logistics associated especially with the environmental issues such as climate change, pollution and noise into account. Green logistics is therefore defined as efforts to examine ways of reducing these externalities and achieving a more sustainable balance between environmental, economic and social objectives, (see Figure 1). All efforts in the "green" logistics area are therefore focused on contributing towards, and ensuring, sustainability (Hans, 2011).

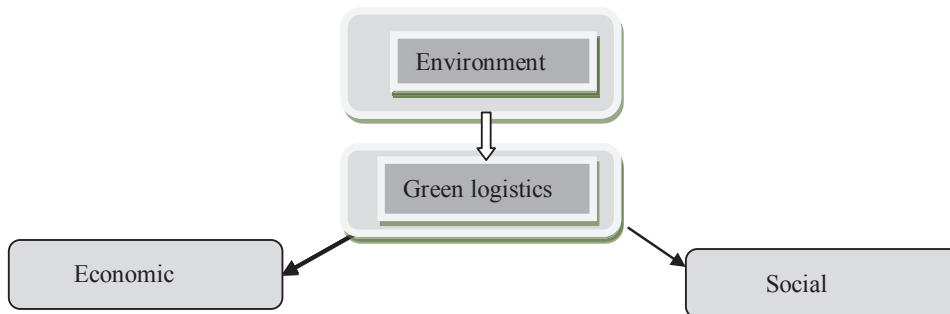


Figure 1. Green logistics as an element of sustainable development.

Over the past 40 years, "Green Logistics" has represented a lot of nature trails, the most distinguishable as follows:

- reduction in transport costs,
- city logistics,
- corporate environmental strategies towards logistics,
- reverse logistics,

- green supply chain management.

The green logistics represents also three perspectives: public (public to private), operational (operational to strategic) and local (local to global). The first perspective of green logistics relates to pressure groups which began to lobby government intervention to mitigate the damaging effects of freight movement and public agencies sought to improve their understanding of the problem and find means of addressing it. The public sector interest in this subject has been complemented by a growth in the private sector involvement in green logistics research as business has begun to formulate environmental strategies both at a corporate level and more specifically for logistics. Operational to strategic as a second general trend has been a broadening of the corporate commitment to green logistics, from the adoption of a few minor operational changes to the embedding of environmental principles in strategic planning. Local to global perspective is focused on the local environmental impact of air pollution, vibration, noise, accidents and visual intrusion. With climate change now the dominant environmental issue of the age, the impact of logistics on global atmospheric conditions has become a major focus of many researchers (McKinnon A., Browne & Whiteing, 2010).

### 3. Green logistics and reverse logistics

It is worth mentioning about the reverse logistics which is a part of green logistics. Rogers and Tibben-Lembke (1999) briefly consider the differences between reverse logistics and green logistics. In reverse logistics there should be some flow of products or goods back from the consumer to an earlier stage of the supply chain. The reduction of waste that this implies certainly means that reverse logistics should be included within green logistics. Currently, the term "green logistics" is often used interchangeably with "reverse logistics", but in contrast to the reverse logistics, green logistics „summarizes logistics activities that are primarily motivated by environmental considerations” (Scott, Lundgren & Thompson, 2011).

First of all, the most significant difference is that reverse logistics concentrates on saving money and increasing value by reusing or reselling materials to recover lost profits and reduce operational costs. In turn green logistics focuses on transportation issues, recycling and re-use. “Green logistics is about using material friendly options for transportation and centered on saving money but places priority on the company’s image” (Nylund, 2012). DeBrito (2003) clarifies that green logistics focuses on the forward flow of the supply chain while reverse logistics is viewed as sustainable development. “The prominent environmental issues in [green] logistics are consumption of non-renewable natural resources, and both hazardous and non-hazardous waste disposal” (DeBrito, 2003). Green logistics is often known as ecological logistics defined as “understanding and minimizing the ecological impacts of logistics” (Rogers and Tibben-Lembke, 1998). These activities are designed to measure environmental impacts on transport reducing energy consumption, and reducing the use of materials (see Figure 2).

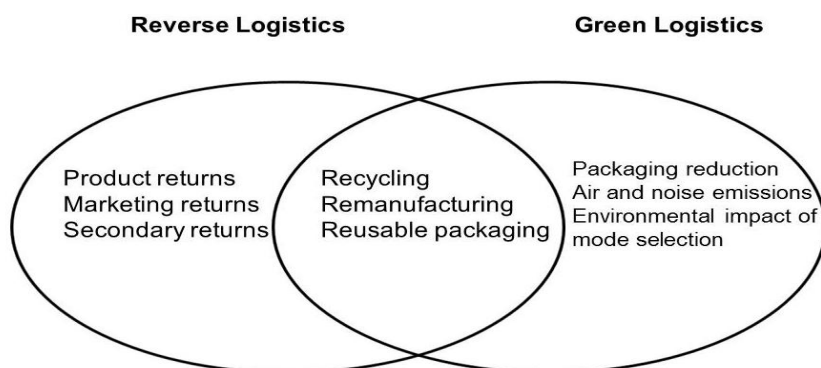


Figure 2. Comparison of green logistics and reverse logistics

#### 4. The drivers of green logistics

##### 4.1. Factors affecting green logistics from a wide perspective

Schmied (2010) distinguishes four factors affecting green logistics – company, customers, politics, and society. According to Figure 3, it can be concluded that each of the factors may affect green solutions (Schmied, 2010). From the consumers point of view they have their own requirements for green products and services. Customers especially with high environmental awareness may require products delivered with clean vehicles or in such manner that the emissions are minimized, forcing suppliers to go to green solutions. This should be a key drive for companies that are taking measures in green logistics. By understanding the consumers important role in green logistics it can be beneficial for the company. Perhaps the biggest affect from customers may be home delivery, as they are the direct users of this service.

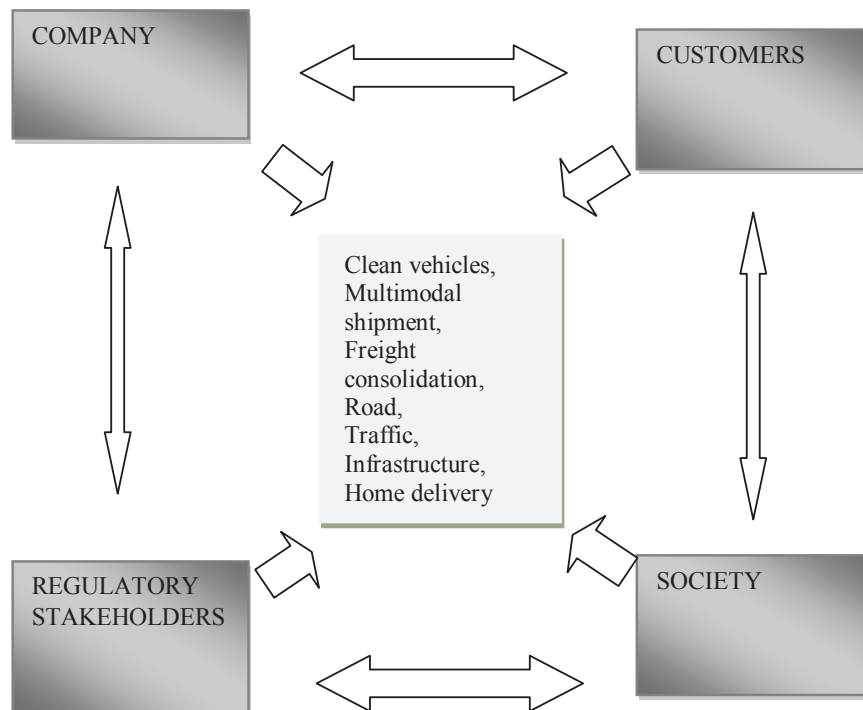


Figure 3. General factors affecting green logistics

##### 4.2. Determinant factors of green logistics at a corporate level

Many researchers have proposed various explanations as to what factors influence a firm's adoption of environmental practices. Generally, we can distinguish external and internal factors of environmental practices (Murillo-Luna, Garcés-Ayerbe & Rivera-Torres, 2011). Stakeholder pressure, environmental regulations, company size, industrial sector and geographical location, internationalization, position in the value chain, strategic attitude, managerial attitudes and motivations, manager's characteristics and human resources are relevant environmental and organizational variables frequently appearing in the related research (Gonzalez - Benito & Gonzalez Benito, 2006). Among many factors there are some which can be the barriers to green practices. Chan (2008) identifies six types of barriers from the information provided by the managers of a sample of 83 hotels. Using an exploratory analysis, he finds that the six types of barriers are negatively related to environmental behavior: 1) lack of know-how and skills,

2) lack of professional advice, 3) uncertainty of outcome, 4) participation of certifiers/verifiers, 5) lack of resources and 6) implementation and maintenance costs. Although organizational and environmental factors have been taken into account in several studies on green issues, these factors have been considered very rare in the studies of environmental management in the logistics industry. Lin & Ho (2010) conducted a survey in 353 Chinese companies in the logistics industry. They proposed 32 variables describing 10 dimensions of determinants characteristic of the adoption of green practices in logistics companies (see Figure 4).

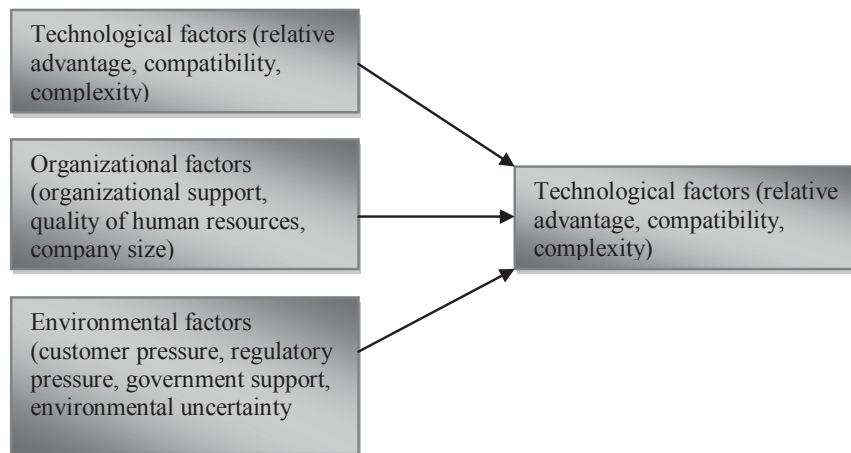


Figure 4. Determinant factors of green management practices in logistics industry. A conceptual model derived from Lin & Ho (2010).

The research findings by Lin & Ho, (2010) reveal that pressure resulting from legal regulations of the State, governmental support, organizational support and the quality of human resources have a significantly positive influence on the adoption of green practices for Chinese logistics companies (Lin & Ho, 2010). Environmental uncertainty and the complexity of green practice show significantly negative influences on environmental practices. Surprisingly, the influence of customer pressure is not significant for Chinese logistics companies (Lin & Ho, 2010). It is interesting because most of the studies from the EU associated with environmental issues indicate the influence of customer pressure and their environmental awareness on environmental practices but these findings are focused on manufacturing firms. Their study also provides the empirical evidence that technological factors have significant influence on the adoption of green practices when compared to organizational and environmental factors (Lin, & Ho, 2010). Similar findings come from Polish studies, which indicate a weak and insignificant correlation between the environmental awareness of management staff and the eco-effectiveness of environmental practices (Seroka-Stolka & Nowakowska-Grunt, 2012).

Greening the supply chain is a growing concern for many business enterprises and a challenge for logistics management. The structure of the green supply chain is relevant to implementing a green logistics system, as a green supply chain creates green environment for green logistics in a sustainable development which, again, paves a green channel towards green logistics and, simultaneously, supports and promotes the development of green logistics. A real sense of green action can be achieved by supply chain management at a corporate level. It is worth mentioning that while adopting a green logistics approach towards supply chain, strategies can be additionally emphasized. Environmental logistics practices must be incorporated into corporate environmental strategies. When it comes to the product design and production planning, the most common is the fact that usually they emphasize the product design and the development that comes from the improvements of their competitive and commercial attributes, and these are factors such as price, quality, features and performance.

Trowbridge (2006) distinguishes both internal and external driving forces of the implementation of GSCM at a chip manufacturer. The internal ones include the willingness to improve risk management due to potential

interruptions in the supply chain, and the collaboration with suppliers to find alternative materials and equipment that minimize the environmental impact. The external ones include customers, investors and non-governmental organizations (Trowbridge, 2006). This is similar to the findings of González-Benito & González-Benito (2006) which indicate that Spanish companies perceive two different sources of environmental pressure: governmental and non-governmental. However, only the latter is able to explain the implementation of environmental logistics practices in a significant way, perhaps because these practices are proactive and voluntary and governmental pressure focuses on the observance of regulations. They also prove that the environmental awareness of managers is also able to explain a significant part of the implementation of environmental logistics practices.

Hu & Hsu (2010) explore the factors that are critical for the implementation of green supply chain management (GSCM) practices in the Taiwanese electrical and electronics industries referring to the European Union directives, and they extract 20 critical factors in four dimensions (supplier management, product recycling, organization involvement and life cycle management) (Hu & Hsu, 2010). Diabat & Govindan (2011) introduce the review of studies which present different factors of green supply chain management. The results of the review are presented in table 1.

drivers	sources
Certification of suppliers' environmental management system	Vachon (2007), Zhu et al. (2007a,b, 2008a,b,c) and Paulraj (2009)
Environmental collaboration with suppliers	Zhu and Sarkis (2006), Zhu et al. (2005, 2007a,b, 2008a,b,c), Lippmann (1999), US-AEP (1999), Yuang and Kielkiewicz-Yuang (2001), Klassen and Vachon (2003), Lippman (2001)
Collaboration between product designers and suppliers to reduce and eliminate product environmental impacts	Lippman (2001), Zhu et al. (2005) and Holt and Ghobadian (2009)
Government regulation and legislation	Green et al. (1996), Walton et al. (1998), Beamon (1999), Hall (2001), Min and Galle (2001) and Walker et al. (2008)
Green design	Zhu et al. (2005, 2007a,b, 2008a,b,c), Hu and Hsu (2006), Routroy (2009) and Zhu and Sarkis (2006)
ISO 14001 certification	Zhu and Sarkis (2006), Zhu et al. (2005, 2007a,b, 2008a,b,c), Rao and Holt (2005),
Integrating quality environmental management into planning and operation process	Hu and Hsu (2006), Vachon (2007) and Holt and Ghobadian (2009)
Reducing energy consumption	Rao and Holt (2005), Holt and Ghobadian (2009), Paulraj (2009), and Gonzalez et al. (2008)
Reusing and recycling materials and packaging	Rao and Holt (2005), Holt and Ghobadian (2009), Paulraj (2009), and Vachon (2007)
Environmental collaboration with customers	Vachon (2007), Zhu et al. (2008a,b,c), Paulraj (2009), Holt and Ghobadian (2009), and Klassen and Vachon (2003)
Reverse logistics	Lippman (2001), Rao and Holt (2005), Zhu et al. (2005), Hu and Hsu (2006), Vachon (2007), and Routroy (2009)

Diabat & Govindan (2011) present 11 types of driving forces ( and interactions between them), which have been analyzed using Interpretive Structural Modeling (ISM). The research results show that the government regulations and legislation and reverse logistics are significant driving forces to achieve cooperation between product designers and suppliers to reduce and eliminate the environmental impact of products. Environmental cooperation with

suppliers and customers and ISO 14001 certification are placed at an intermediate level of the ISM model. Green design, integrating quality environmental management into the planning and operation process, reducing energy consumption, and reusing and recycling materials and packaging are at the top level of the ISM hierarchy (Diabat & Govindan, 2011). The ISM model for the driving forces affecting the implementation of green supply chain management is presented in Figure 5.

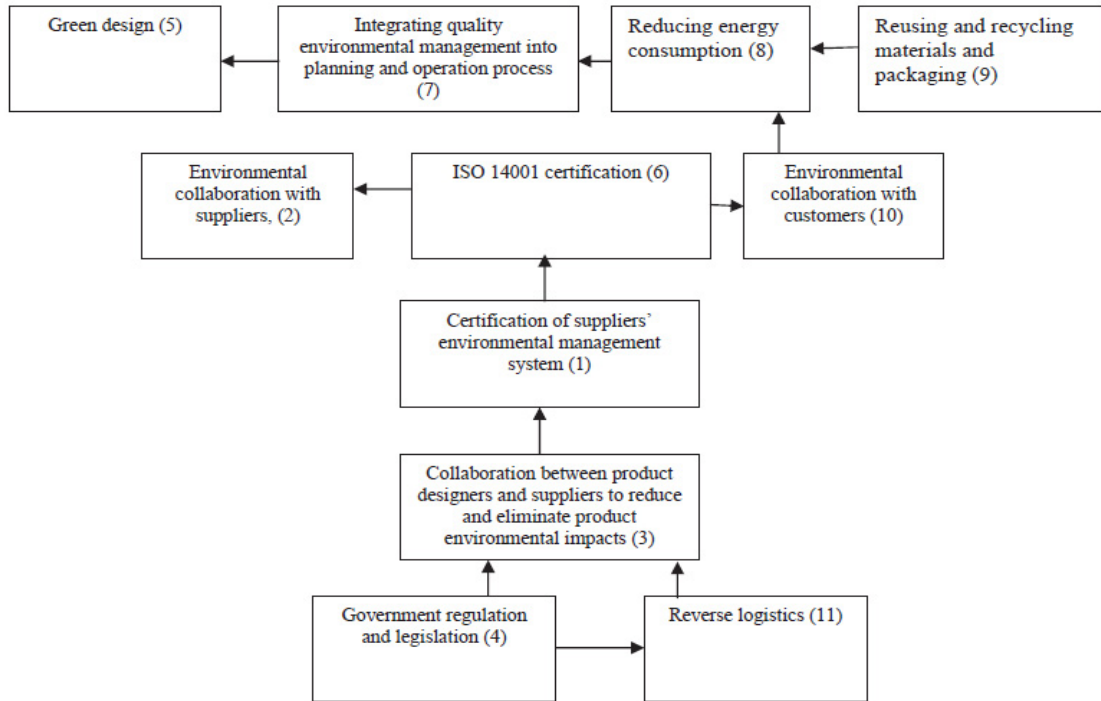


Fig 5. ISM model for the drivers affecting the implementation of green supply chain management according to Diabat & Govindan, 2011.

**5. Conclusions**

Companies are constantly under pressure to develop environmentally friendly and responsible operations, and commitment to the natural environment is an important variable within the competitive scenarios. Organizations face either internal or external factors of green logistics at a corporate level. The review of the literature indicates some interesting findings. First all, managers must take into account that incorporating environmental issues into corporate strategies depends on various factors which can change over time. Determinant factors of adoption of environmental logistics practices vary among companies and depend on sector of activity, geographical location and the level of customer environmental requirements. The findings of the influence on green logistics varies according to customer pressure on company’s environmental behaviour and it may be associated with the different position of companies standing in the supply chain. Organizational factors are very important for most industries but technological factors should be taken into account in the future by logistics managers. Pressure through legislation is not the only way of fostering the environmental behaviour of a firm, rather, there are other means such as increasing the environmental awareness of managers, but it is a long term objective at a corporate level.

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