

THE ENVIRONMENTAL IMPACTS OF LOGISTICS SYSTEMS

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In recent decades the environmental effects of transportation has become a topic of increasing importance around the world. As a result studies have been conducted to increase our understanding of pollutant emissions along with their consequences, and to develop schemes for impact reduction. Some researchers have also made efforts to define the long-term direction for future transportation and environmental research from a broader perspective. These analyses provide a general framework for the concept of sustainability, defining the purpose of studying transportation and the environment, which encompasses logistics systems and their impacts. In addition, research has been conducted for the purpose of including sustainability in a general framework to guide future logistics planning. As a result industry has begun to respond and make adaptations to the growing need for sustainable activities.

Accordingly, consideration for the long-term effects of transportation activities should strongly influence policy decisions. Many transportation agencies have formulated their own definitions of sustainability, with consideration for these underlying concepts. Three recurring considerations are found to be especially important:

1. economic development
2. environmental preservation
3. social development

In the case of logistics systems, economic development can be thought of as relating to the profits and in turn the benefits to the employees of logistics companies and the indirect effects on the economy. Second, environmental preservation considers ecological impacts which can range from effects on local wildlife to those of global warming depending on analysis boundaries. Finally, social development accounts for the effects of logistics activities on human society, including the detrimental impact that pollution can have on the public. Most all studies pertaining to logistics and the environment have long-term implications based on one or more of these three considerations.

In the past, planning and research related to freight logistics systems has primarily been focused towards the objective of increasing the efficiency of industry activities with respect to timing and profits. However, within the last 15 years growing concern over environmental impacts has spawned the concept of Green Logistics as a stimulus for developing methods which can reduce the environmental impacts of freight transportation. As a result researchers and industry have begun assessing mitigation options for planning freight transportation with consideration for environmental externalities.

Green Logistics can be thought of as an approach for planning freight logistics systems that incorporates sustainability goals with a primary focus on the reduction of environmental externalities. In accordance with this description, various studies provide some background on the current state of Green Logistics practices.

Although governments and the general public influence corporate policy, logistics companies make the final decisions which directly affect pollutant releases within their market context. Accordingly, when developing Green Logistics solutions for reducing environmental externalities, the industry perspective must be considered. Unfortunately, the goals of logistics providers often conflict with the aims of Green Logistics. Freight logistics systems are commonly thought to be an indispensable component of modern societies. Accordingly, they are not only necessary in today's world, but can also provide many non-essential benefits to citizenry.

However, as with most mechanized transportation modes, freight logistics systems also generate negative externalities. The concept of externalities allows for the characterization of the indirect effects of logistics activities on society as a whole. Economic principles are well-suited for describing this concept and Harvey Rosen provides a useful definition of externalities: "When the activity of one entity (a person or a firm) directly affects the welfare of another in a way that is outside the market mechanism, that effect is called an externality."

By this definition, externalities occur outside the typical market process, and therefore cause a form of market failure, since actors in the market do not incur the full costs of production and consumption. As a result members of the society may be negatively impacted by the activities for which the full social cost is not incurred. Of note is that the concept of externalities can also be applied to beneficial impacts; however in the case of transportation many of the significant externalities are negative.

Logistics providers are not typically forced to pay the full social cost of their activities, which includes the costs of the above listed externalities. Inefficiency results and the public is negatively impacted.

The number of studies estimating the impacts of freight transportation on the environment continues to grow, revealing in greater detail the negative impacts which are occurring. A fairly large body of data has been produced by various organizations, showing that freight logistics carriers are a significant source of pollutants causing environmental impacts. Some studies have analyzed the problem at the small-scale by generating data for individual vehicles, whereas others have focused on the net impacts of freight transport at national and international levels. From an even broader perspective, other researchers have assessed the long-term trends regarding the growth of demand and emissions from freight logistics networks.

