GREEN LOGISTICS AND SUSTAINABILITY: CHALLENGES AND OPPORTUNITIES

Today and more so in the future, incorporating sustainability principles in supply chain management and in the way companies do business will be a requirement. Consumers and governments are demanding cleaner technologies, greener products, lower carbon footprints and environmentally and socially sustainable practices and processes. Freight logistics, urban distribution and particularly transportation, cannot lag behind.

Key facts on the topic

Logistics is the integrated management of all the activities required to move products through the supply chain. The supply chain of a typical product starts at the sourcing of the raw material and goes through the production and the final distribution of goods. Reverse logistics, the management of the waste produced through the supply chain, is also part of the process. Logistics activities include freight transport, storage, inventory management, materials handling and all the related information processing. Green logistics refers to a common set of practices aimed at reducing the environmental footprint and negative social impact of the freight industry and logistics services. As concerns on climate change grow, companies are venturing into green logistics, where they are beginning to internalize externalities produced by air pollution, noise, and production processes.

Transportation is the sector that contributes the most to greenhouse gas emissions, particularly road freight transport. In Latin America and the Caribbean, 30% of greenhouse gasses come from transportation. For example, in countries in Mesoamerica, road freight represents between 15 and 57 percent of imports and exports transported. The high dependency on road freight (where truck fleet average age is 20 years) and the low quality of diesel used in the region create a higher risk of high transportation emissions over time.

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<tbody>
<tr>
<td>Volume (mill.t)</td>
<td>2.58</td>
<td>6.22</td>
<td>3.83</td>
<td>1.45</td>
<td>2.42</td>
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<tr>
<td>% of total</td>
<td>15.3%</td>
<td>57.1%</td>
<td>20.5%</td>
<td>18.0%</td>
<td>43.1%</td>
<td>33.0%</td>
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<td>Volume (mill.t)</td>
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<td>4.64</td>
<td>14.71</td>
<td>6.55</td>
<td>3.18</td>
<td>6.89</td>
<td>19.73</td>
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<tr>
<td>% of total</td>
<td>84.2%</td>
<td>42.6%</td>
<td>78.9%</td>
<td>81.4%</td>
<td>56.7%</td>
<td>66.0%</td>
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<tr>
<td>Volume (mill.t)</td>
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<td>0.03</td>
<td>0.11</td>
<td>0.05</td>
<td>0.01</td>
<td>0.11</td>
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<tr>
<td>% of total</td>
<td>0.5%</td>
<td>0.2%</td>
<td>0.6%</td>
<td>0.6%</td>
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Introduction and Diagnosis

The growing tendency to positively evaluate the practices of corporate social responsibility (sustainable practices in social and environmental terms) has popularized the notion of the "Triple Bottom Line". International agreements and preferences of consumers towards more sustainable products have exerted...
strong pressure on corporate social responsibility practices. The Triple Bottom Line measures not only economic benefits but also how responsible a company is in its corporate practices regarding the social and environmental aspects.

- Sustainability, green logistics and corporate priorities must be aligned. Green logistics involves adopting strategies and practices in managing supply chains that reduce externalities imposed on the environment and the carbon footprint in the distribution process. The actions focus on material handling, waste management, packaging and freight. However, there are paradoxes to be resolved when adopting green logistics practices.

- Logistics efficiency aims to lower costs (traditionally transportation and inventory management costs) but in many cases the strategies adopted disagree with environmental considerations.

- Time is essential in logistics and is increasingly a requirement, reducing it creates efficiencies and profit but overall, profit in time was obtained through the use of more polluting means of transportation (road and air versus maritime and railroad) and less energy efficient. Reliability is crucial in the logistics industry and has been built from the use of the most polluting means of transportation.

- Modern logistics systems are based on the reduction of inventories. As a result, inventories are more and more in transit contributing to congestion and pollution. Environmental costs are being externalized and taken on by the environment and society.

- The use of information technologies in logistics (particularly those related to e-commerce) generates positive effects but at the same time distribution depends on road or air transportation.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Outcome</th>
<th>Paradox</th>
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<tbody>
<tr>
<td>Costs</td>
<td>Reduction of costs through improvement in packaging and reduction in waste, and optimization of distribution system</td>
<td>Environmental costs are externalized</td>
</tr>
<tr>
<td>Time/Flexibility</td>
<td>Just-in-time and door-to-door provide flexible and efficient distribution strategies.</td>
<td>Extend production, distribution and retailing that consume more energy, space and produce more emissions</td>
</tr>
<tr>
<td>Network</td>
<td>Increased system efficiency of distribution sector through hub-and-spoke structures</td>
<td>Concentration of environmental impacts are next to hubs and corridors.</td>
</tr>
<tr>
<td>Reliability</td>
<td>Reliable and on-time distribution of freight and passenger</td>
<td>Trucking and air transportation are less environmentally friendly.</td>
</tr>
<tr>
<td>Warehousing</td>
<td>Reducing the needs for warehousing facilities</td>
<td>Inventory shifted to roads contributes to congestion and space consumption.</td>
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</table>

The transport sectors carbon footprint plays a growing role in world energy and GHG emissions. In 2004, transport energy use amounted to 26% of total world energy use and the transport sector was responsible for about 23% of world energy-related GHG emissions. Transport energy comes from oil-based fuel, mainly diesel (31%) and gasoline (47%) that have moderate differences in carbon content. The
transportation sector, which accounts for 8 percent of total GHG emissions in LAC, plays an important role in the region's climate mitigation agenda. CO2 emissions from transport have increased more rapidly than from any other energy consuming sector as a consequence of rapid urbanization, increased vehicle ownership, an aging vehicle fleet, and fuel consumption patterns.

As urbanization accelerates and continues to grow in Latin America, urban freight becomes increasingly a challenge to green logistics. Urban freight distribution systems depend on the urban setting and its level of development, but in two main functional classes. The first class is consumer-related distribution, including: retailing, food deliveries and parcel and home deliveries. The second functional class of city logistics is producer-related distribution, including construction sites material supply, waste collection and disposal, and industrial and terminal haulage.

An often-neglected dimension of freight distribution concerns the array of goods moving within metropolitan areas, either to the point of final consumption, from a factory to a transport terminal, or through a city on their way to another location. Cities are often the last mile in freight distribution and, therefore, represent a unique set of challenges in supply-chain management that are often disregarded since they involve short distances and local carriers. Inversely, they are often the first mile in freight distribution since many production facilities are located within metropolitan areas, particularly in developing economies. Simplistically, city logistics is about the means to achieve freight distribution in urban areas by improving the efficiency of urban freight transportation, reducing traffic congestion, and mitigating environmental impacts.

Congestion is perhaps the most visible manifestation of the stress on transportation systems being seen in LAC countries today. With road infrastructure continually lagging the growth in number of vehicles on the road, speeds in urban areas have consistently dropped, especially in city centers. The economic impact of such congestion can be substantial. At this very low speeds and idling situations, all vehicles, but particularly freight distribution vehicles, consume much more fuel and generating higher levels of GHG. It is apparent that the urban environment plays an important role for the future of Latin America freight transportation as more goods are delivered to urban consumers.

Sustainability is a process spanning from supply of inputs for production to distribution channels of finished products (last mile) passing through the processes of production, packing, packaging, transport, and vehicle occupancy, among others. Key questions are addressed by green logistics: (a) Where and how to get the inputs for the production process?, (b) Production processes, are they sustainable?, (c) How to reduce the carbon footprint in the distribution process? and (d) How to adopt the concept of Reverse Logistics?. Significant opportunities for global supply chains arise if these questions are addressed.

Consumers increasingly give preference (they are willing to pay a premium) for products and processes labeled as "green" which creates opportunities to reduce the environmental and social impact of supply chains. There is already evidence (and experience) that green logistics improve the performance of the logistics chain. Opportunities exist in: (a) Product design and production, (2) processes, (b) Product distribution, (c) Material handling during production and packaging, and (d) Reverse logistics processes.

What next?

The Private Sector Adoption of “Green Logistics”

There are challenges to implementing the principles of sustainability and green logistics: (a) Internalize externalities, that is to say environmental and social costs of the supply chain and not just to see it as an internal cost reduction, (b) How to measure outcomes and internalize them (e.g. Performance assessment
based on indicators associated with sustainability), (c) Understanding an integrated view of the supply chain. (d) The carbon footprint is increasingly becoming a key factor for competitiveness (in part due to consumer preferences).

By providing additional infrastructure capacity that allows for efficient logistics operations, based on intermodal more efficient rail and waterway networks companies can design logistics networks with an increase shift to cleaner modes of transportation. For example, the Programa Nacional de Logística e Transporte (PNLT) in Brazil is projecting significant shifts in mode transportation within the country.

**Figure 1 – Current and future freight transportation mix (in terms of tkm)**

![Figure 1](image)

One of the top three opportunities for reducing GHG emissions in transportation is the better design of logistics networks. Increasing local logistics capabilities can support this. Since logistics knowledge in Latin America is generally low, combined with deficient infrastructure, logistics networks are likely to have high opportunities to improve over all cost and fuel consumption.

There is a significant opportunity to improve vehicle operation, particularly improving fuel efficiency per ton-km by a better use of vehicle driving. Experiences in Mexico have shown that better driving practices can boost fuel savings (upwards of 10%). Public-Private partnerships (like the Smart Way program) allow on the ground documentation of

Unless environmental performance is consistently measured throughout the freight transportation system, there will be little incentive for firms to include it in regular decision-making. Thus encouraging environmental measurement of logistic operations through regular GHG benchmarking (via private or public-private partnerships) is needed.

The recent trends in urban freight logistics have led many voices to call for incorporation of “green logistics” into the industry’s regulatory framework. At the same time, large shippers and industry stakeholders are realizing that there are substantial economic gains to be realized from engaging in such practices --mainly those related to reverse logistics and better distribution practices that reduce energy consumption and thus the carbon footprint of goods distribution.

Information and communication technologies used in intelligent transport systems have more recently incorporated the notion of Smart Logistics. They are set to revolutionize and improve the efficiency of
logistics operations. A good example is software to improve the design of transport networks, enabling
centralized distribution networks and management systems that can facilitate flexible home delivery
services. Specific levers include intermodal shift -- moving to the most efficient type of transport-- eco-
driving, route optimization and inventory reduction.

Moreover, investing in urban logistics platforms provide a way to tackle this problem through an
integrated approach that incorporates these solutions in urban local development plans. This is particularly
key in Latin America and the Caribbean due to the unique characteristic of the region --high urban
concentration and upward congestion trends. As freight movement reaches urban areas, speed reduction
and idling will generate higher than average GHG emissions. Specifically, and as the UK experience
indicates, spatial concentration of logistics activities is a natural path to bring efficiency to the system. Urban
logistics platforms coupled with land-use regulation will allow for a more efficient design of logistics
networks.

Sustainability is an objective that is shared by many actors along the supply chain, and can also be a
requirement for supply chain integration. In many cases, such as in the food sector “greenness” has become
a prerequisite for suppliers of several manufacturers and retailers (e.g. organic and fair trade food). Another supply chain impact that is emerging is carbon footprint labeling. Down-stream players will increasingly need to measure and reduce their carbon footprint as the market demands carbon emissions labels along the distribution network and not only at manufacturing sites.

The many dimensions of sustainability in logistics can be individually or jointly implemented. Since they
involve varied stakeholders, coordinated efforts are so far uncommon, as each link in the supply chain
pursues strategies that are most effective for them individually. Green logistics initiatives should incorporate
public and private interaction to achieve results that cannot be attained by single actors. Smarter logistics
systems and approaches, which typically require both public and private sector support, include:

- **Shipping less:** Implementing demand-responsive systems where supply chains are tightly integrated so
  that the goods being delivered are the outcome of an expressed demand.

- **Shipping scheduling:** Adapt the scheduling of flows to ensure a greater level of existing asset utilization.
  Allow greater shipping time and outside congested periods

- **Modal Shift:** Use a mode or a route that is more energy and environmentally efficient, which can
  involve a change in the routing of cargo.

- **Real time supply chain integration systems:** Route optimization software; tag and track throughout the
  supply chain; information systems to provide drivers with real-time routing; vehicle and load
  management systems to identify unused capacity within the supply chain.

- **Electronic freight:** Exchanges to allow for the “auction” of spare space on vehicles.

- **Collaborative planning:** Forecasting and replenishment systems for users to share the same transport
  network.

**Urbanization and City Logistics**

A particular challenge for city logistics is that urban infrastructure is overused during rush hours but
tends to be underused during the evening and the night. Using urban roads more effectively outside
normal periods requires specifically designed urban freight modes and urban consolidation facilities. A
better consolidation of loads would also benefit city logistics.
Table 3: Expected benefits of city logistics projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Expected Benefits</th>
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<tbody>
<tr>
<td>Rationalization of deliveries</td>
<td>Better use of existing transport assets.</td>
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<tr>
<td></td>
<td>Better matching of trip sequences (deliveries &amp; pickups).</td>
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<tr>
<td></td>
<td>Less congestion.</td>
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<tr>
<td>Freight facilities</td>
<td>Facilities better adapted to urban freight distribution.</td>
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<tr>
<td></td>
<td>More efficient (time and energy) urban deliveries.</td>
</tr>
<tr>
<td>Modal adaptation</td>
<td>Vehicles better suited for urban deliveries.</td>
</tr>
<tr>
<td></td>
<td>Less congestion and energy consumption.</td>
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</table>

However there are important barriers for implementing these recommendations:

- **Lack of consistent information.** It is very hard to obtain consolidated GHG freight information across countries. This makes policy making harder since world or national averages may not reflect local operational conditions. There is considerable variation in freight transport around the world, depending on geography, available infrastructure and economic development. The United States’ freight transport system, which has the highest total traffic in the world, is one in which all modes participate substantially. Russia’s freight system, in contrast, is dominated by rail and pipelines, whereas Europe’s freight systems are dominated by trucking with a market share of 72% (tkm) in EU-25 countries, while rail’s market share is just 16.4% despite its extensive network China’s freight system uses rail as its largest carrier, with substantial contributions from trucks and shipping. Similar variations are also present in Latin America.

- **Lack of experience on environmental public private partnerships.** The SmartWay program in the United States was successful in great part because of the Environmental Protection Agency (EPA) ability to bring together different stakeholders from the logistics sector. It is unclear if Latin America has the right institutions to support this kind of partnership.

- **Informal processes.** While there are good conditions for implementing improvements in operating conditions and management, there are still informal contracts between partners in the supply chain and their relationship with small operators. The adoption of measures to improve environmental management of logistics must be partnered with processes of formalization in the provision of freight services.
This note is based on several research initiatives funded by the Inter-American Development Bank between 2010 and 2012.

Diesel used in Mesoamerica has very high concentrations of sulfur. The use of this type of fuel on modern fuel efficient engines reduces the life time of the engines, thus transporters choose to use older more contaminating truck fleets.

Estimated from data collected by Advanced Logistics Group for the Mesoamerica Regional Logistics Assessment Study and Action Plan

Rodrigue, Jean-Paul et al. "The Paradoxes of Green Logistics" (2001)


