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Editorial

Green Logistics Design Considering Transportation

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Introduction

Supply chain contains suppliers, manufacturers, warehouses, distribution centers, retailers and customers. Raw materials are procured, and items are produced at one or more factories. Then they are transported to warehouses and distribution centers and finally they are shipped to retailers and customers. Money and information are shipped to up-stream (Figure 1).

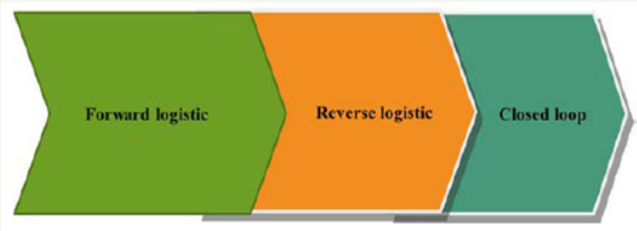

Figure 1: Supply chain network design.

a. Reverse logistic: The customers give back the used products in order to recovery or remanufacturing or reuse.

b. Closed loop: If both of the flows are integrated.

What is Green Logistics?

Logistics is the integrated management of all the activities required to move products through the supply chain. For a typical product this supply chain extends from a raw material source through the production and distribution system to the point of consumption and the associated reverse logistics. The logistical activities comprise transport, storage, inventory management, materials handling and all the related information processing.

a. Today, global warming, created by large scale emissions of greenhouse gasses, is a top environmental concern.

b. The production, transportation, storage and consumption of all these goods, however, have created large environmental problems

c. We deal with all aspects of logistics such as transportation, warehousing and inventories, and address the related environmental aspects such as emissions of greenhouse gases, noise and use of scarce resources.

d. Identify the trade-offs between environmental aspects and costs.

e. Very often, much reduction in emissions can be achieved with only a marginal increase in costs.

f. With respect to the environment, transportation is the most visible aspect of supply chains.

g. Transportation CO_2 emissions amount to some 41% of total emissions

h. Transportation is also a main source for NOx, SO_2, and PM (particulate matter or fine dust) emissions.

3. Types of Green Transportation Problems

We examine five choices with respect to transportation which are supported by Operations Research models, namely, Mode choice (or modal split): One of the main choices in transport is the mode of transportation, viz. transport by plane, ship, truck, rail, barge or pipelines.

In reality, the choices are limited, as the transport mode is often determined by the type of product (e.g. liquid, bulk or package) and the distance to be travelled. Time sensitive goods are often supplied by air, while large volumes of commodities (like coal, iron ore) are transported by rail, inland barge or pipeline (in case of gas or oils).

a. Technological innovations such as cooled (reefer) containers

b. Each mode has different characteristics in terms of costs, transit time, accessibility, and also different environmental performance (Table 1).

Trucks meeting the highest standard to date are much cleaner than most ships and trains. Ocean going ships emit huge amounts of NOx. It is estimated that ship emissions will surpass total emissions generated by all land-based mobile, stationary and other sources by 2020 unless drastic measures are taken.

Table 1: Energy use and emissions for typical transport units of different modes.

Energy use/ Emissions g/t/km	PS-type Container Vessel (11,000 TEU)	S-type Container Vessel (6.600 TEU)	Rail-Electric	Rail-Diesel	Heavy Truck	Boeing 747-400
KW h/t/km	0.014	0.018	0.043	0.067	0.18	2.00
CO_2	7.48	8.36	18	17	50	552
SOx	0.19	0.21	0.44	0.35	0.31	5.69
NOx	0.12	0.162	0.10	0.00005	0.00006	0.17
PM	0.008	0.009	n/a	0.008	0.005	n/a