The Importance of Transport and Logistics Services in Green Supply Chain Management.

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Abstract: ***This paper is focused on the importance of transportation & logistics in green supply chain management (GSCM).It is very important for all the related industries to realize the importance of implementing best practices to protect the health of our planet Earth. If no attention is given to the environmental consequences and to ways of addressing environmental challenges in that sector, the beautiful promises of a better lifestyle associated with the information age will be tarnished by the poor quality of our essential commodities – clean air, clear water, and pristine soils. Although GSCM has been comprehensively reviewed, there are areas around Green supply chain that still require further study. One is a gap in the literature in terms of the stakeholder's views towards green supply chain. Stakeholders would definitely have different views about this and can sometimes be conflicting from the company's point of view. Some stakeholders would go against green supply chain management and some would not. This paper recommends that researchers should focus more towards qualitative study such as interviews in understanding the different stakeholder views towards green supply chain management to portray the different views about the concept and how this, in the end, implicates management decisions. This is done with the help of four methodologies viz. Reverse Logistics, Calculating the amount of Co2 released, shipment consolidation and Environmental Performance Index(EPI).***

Index Terms: GSCM = [Green purchasing] + [Green manufacturing/materials management] + [Green Distribution / marketing through Shipment Consolidation] + [Reverse logistics]

1. INTRODUCTION

Green supply chain management (GSCM) is an emerging field that stands out of the traditional supply chain perspective. This may have occurred due to various factors like global warming, scarcity of resources, growing social pressure due to increase in awareness among people, governmental laws, etc. which is adding weight to the importance of implementing environment friendly strategies in managing the supply chain. In addition, the recent economic global crisis has accelerated the need for sustainable growth where better usage of natural resources creates the potential to develop a greener economy. The "quality revolution in the late 1980's and the supply chain revolution in the early 1990's" have sparked businesses to become environmentally conscious. GSCM has gained popularity with both academics and practitioners to aim in reducing waste and preserving the quality of product-life and the natural resources.

Manuscript Received on November, 2012

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Eco-efficiency and remanufacturing processes are now important assets to achieve best practice Global market demands and governmental pressures are pushing businesses to become more sustainable. Walton, Handfield and Melynyk even claim that "increasing government regulation and stronger public mandates for environmental accountability have brought these issues into the executive suites, and onto strategic planning agendas."

But hardly, very few of them have actually started working towards greenification of the supply chain and most of them still continue to use toxic substances & transportation practices that produce green house gases. Accordingly, greening the supply chain has become a major challenge in today's competitive business operations.

This paper primarily deals with the role of Transportation & Logistics in greenification of the supply chain. It also emphasizes how companies dealing with transportation & logistics can implement certain strategies towards the cause. In logistics systems, Transportation is the single main source of environmental hazards. The vehicles used for transportation not only emit toxic green house gases like Co2 but also cause noise pollution. That is why transport and logistics companies (3PLs) are increasingly being asked to respond to the challenges of green logistics by implementing more environmentally sustainable strategies. From the research point of view, on the one hand, it appears that the focus of environmental impact research has been almost exclusively on manufacturing industries rather than service. On the other, environmental initiatives have been mainly explored with reference to different stages of the supply chain with a specific focus on single functional areas. Environmental research specific to 3PLs has been neglected despite the fact that these companies have assumed a more critical role in supply chain orchestration and management.

Therefore, in order to meet the challenges of energy conservation, pollution abatement, waste reduction, etc., firms should also consider their supplier's environmental performance. Consequently, in order to reduce the environmental risks passed on through suppliers, firms are trying to green their supply management activities which ultimately enable them to purchase environmentally superior products as well as build common approaches to waste reduction and operational efficiencies. Thus Green Supply Chain Management is becoming an integral part of an environmentally conscious firm.

II. DEFINING GREEN SUPPLY CHAIN MANAGEMENT

Supply chain management has a variety of definitions varying from author to author and so does GSCM. Here are a few of the well-known definitions:

Supply chain management has traditionally been viewed as a process where in raw materials are converted into final products, and then delivered to the end-consumer. This process involves extraction and exploitation of the natural resources *(Srivastava, 2007).*

Managing supply and demand, sourcing raw

materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels, and delivery to the customer *(The Supply Chain Council)*

The planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. It also includes coordination with channel partners, which can be suppliers, intermediaries, third party service providers, and customers.

(Council of Supply Chain Management Professionals)

Green Supply Chain Management:

GrSCM is defined as 'integrating environmental thinking into supply-chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life'.(Shrivastava,2007)

From a broader perspective, this paper defines GSCM as *"implementing any practice that is environment friendly into the supply chain."*

III. METHODOLOGIES FOR ACHIEVING GREEN LOGISTICS FOR BETTER GSCM

i) Reverse Logistics:

Reverse Logistics (RL) is the opposite of traditional or forward logistics [5] Carter and Ellram (1998) define reverse logistics as a process where a manufacturer accepts previously shipped products from the point for consumption for possible recycling and re-manufacturing. Beamon (1999) illustrates the fundamentals of reverse logistics (See Figure 1). The diagram shows the works around RL involving managing the flow of materials towards remanufacturing and recycling, which in this sense reduces the costs of making new products (Dowlatshahi, 2000). Thierry, Wassenhove, Van Nunen and Salomon (1995) reports that reverse logistics have been widely used in automobile industries such as BMW and General Motors. Other companies such as Hewlett Packard, Storage Tek and TRW are also using reverse logistics as a supply chain process. Doing this would eventually help firms become more competitive in their own industry (Srivastava, 2007).

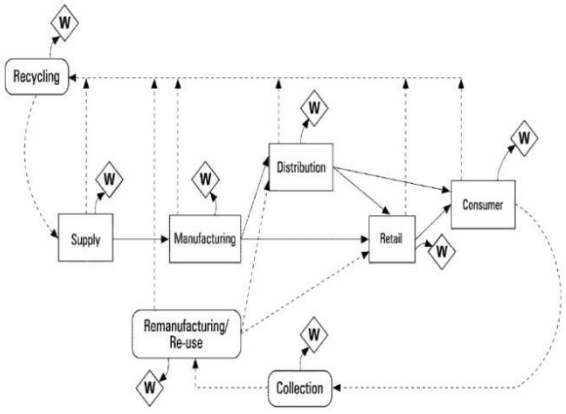

Figure: 1 Schematization of Reverse Logistics Source: Beamon (1999)

Rogers and Tibben-Lembke (1999, 2) define RL as 'the process of planning, implementing, and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal', while Maruglio (1991, 57) defines waste minimization as 'the reduction of hazardous waste which is generated (during production and operations) or subsequently treated, stored or disposed '.

Especially during the last decade, reverse logistics has obtained recognition both as a research field and as a practice. During the early nineties, the Council of Logistics Management published two studies on reverse logistics. The first by Stock (1992) recognized the field of reverse logistics as being relevant for business and society in general. One year later Kopicki et al. (1993) paid attention to the discipline and practice of reverse logistics, pointing out opportunities on reuse and recycling. In the late nineties, several other studies on reverse logistics appeared. Kostecki (1998) discusses the marketing aspects of reuse and extended product life. Stock (1998) reports in detail how to set up and how to carry out reverse logistics programs. Rogers and Tibben-Lembke (1999) presented a broad collection of reverse logistics business practices, giving special attention to the US experience, where the authors carried out a comprehensive questionnaire. During the last years, many articles dedicated to the optimization and management of reverse logistics appeared, like Guide et al. (2000) on the characteristics of reverse logistics for remanufacturing systems. With the recent developments in e-commerce, the role of RL becomes even more prominent.

How RL works:

A product is developed and goes into production following the supply chain with the purpose of reaching a customer. However, at any moment, the product may go back in the chain. From this moment on, the chain does not deal any longer with supply alone, but also with recovery-related activities. Ergo, we refer to it as the supply chain loop. This denomination underlines the possible integration of forward and reverse flows. Furthermore, it embraces both the closed loop supply chains, where supposedly the reverse flow goes back to the original user or original function, as well as open loop supply chains.

Products may reverse direction in the supply chain for a variety of reasons as listed below:

1. Manufacturing returns
2. Commercial returns (B2B and B2C)
3. Product recalls
4. Warranty returns
5. Service returns
6. End-of-use returns
7. End-of-life returns

The Case of Kodak: Green Technological Advancement by using RL

Since the early 1990's, the need for technological advancement to Green Operations is becoming more popular. Wu and Dunn (1995) claim that the 'new economy' has encouraged firms to be more environmentally sustainable and eco-efficient. Kodak is an example of a company that has a remanufacturing line to the supply chain (See Figure 2). It is reported that 310 million single-use cameras have been returned since 1990 (Kodak, 1999; Guide, Jayaraman & Linton, 2003). Although the timing of returns of single use cameras is unknown, Kodak has managed to allocate 310 million single use cameras back into their production line. The reason for this success came from its own product design (Guide et al., 2003). Kodak's single-use cameras are simple, reusable and easy to recycle, and because of this, Kodak has managed to reuse their

products and save costs. Guide et al. (2003) also used Xerox Europe, US Naval Aviation and Kodak as case studies to Green Operations. Due to various legislation, companies are encouraged to have Green Logistics (Guide et al., 2003). Producer responsibility has been, and still is, a growing issue. This issue is important because organizations are now starting to become sensible to preserving the natural resources and the environment (Guide et al., 2003; Umeda et al., 2003, Srivastava, 2007).

ii) Impact of Calculating Co2 in GrSCM:

The main effect of transportation in supply chain is the release of Green house gases which is the greatest threat. A supply chain management should have a minimum idea how to calculate the amount of co2 released by their fleet which brings awareness in them to implementing the green strategies which helps in reducing greater environmental threats and also promoting GrSCM.

Recent empirical studies show that the presence of mass transit systems in our larger cities has encouraged more resource efficient land use and personal activity patterns, and if public transit's mode share can be increased by a few percentage points, it can lead to considerable GHG reductions.

The recent stats shoe us the raise of co2 levels in a decade this shows that the green house gases emitted from the transport company raise a serious alarm in Environmental consideration.

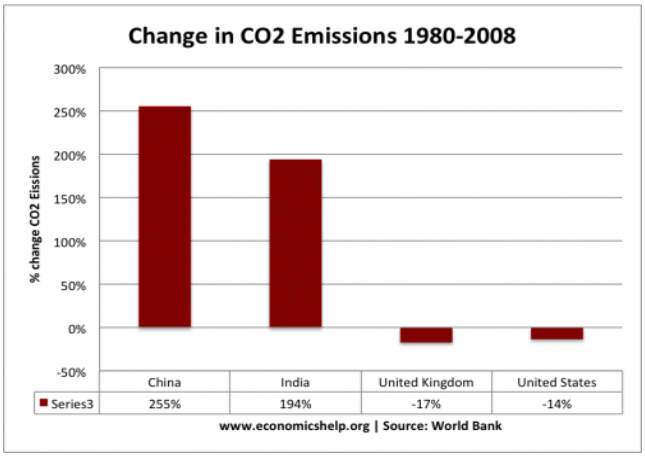

Figure 2: Graph showing raise in carbon dioxide percentage

In the literature, the calculation of CO emissions from transportation essentially is based on the weight of the load, the vehicle and type of fuel used, and the distance elapsed to carry that load.

There are calculators which fall under two categories each one reflecting various reporting of Green house gases.

1. Registry/inventory based calculators, most suitable for standardized voluntary reporting, carbon trading, and regulatory compliance.
2. Life cycle analysis (LCA) calculators, most suitable for pursuit of government funding and for demonstrating the benefits of transit over private automobile travel, or the advantages of one type of transit sub-mode or vehicle type over another.

iii) Shipment Consolidation:

SCL is an environmentally responsible logistics strategy that combines two or more orders (or shipments) so that a larger quantity can be dispatched on the same vehicle to the same market region. This can greatly reduce the transportation cost per item, per order, or per unit of weight. The appropriate use of SCL helps improve GSCM objectives in terms of less transport effort by employing fewer long-haul shipments, which results in higher ton-miles per vehicle per year and lower total vehicle-miles. The resulting economies of scale in transportation operations make it possible for shippers and/or carriers to line-haul larger shipments at lower rates per unit, thereby enabling discount economies to the customers.

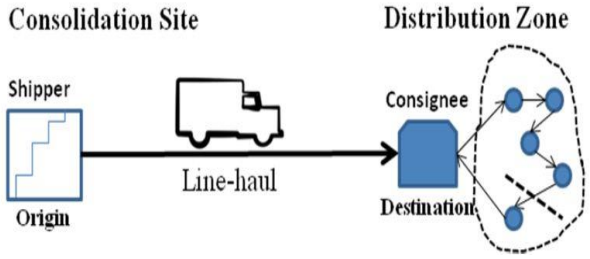

Figure 3: Schematization of SCL

For the modeling purposes of the DTB-SCL policy, consider a one tiered supply chain that consists of one shipper and one consignee. The transportation of freight such as a particular consumer good is performed by the shipper's private fleet of vehicles. The objective is to find the length of the SCL cycle that enables the most savings in both cost and carbon emissions. Assume that the orders received are unit-sized but with no restriction on their size relative to the vehicle capacity. Orders larger than the capacity of a single vehicle are allowed to be split among multiple vehicles, as long as those partial deliveries are made within the guaranteed delivery time. This is a plausible proposition and is indeed a practice implemented by distributors such as Amazon.com. In this section, without any loss of generality, the vehicle capacity is considered to be the weight capacity. The road vehicles (e.g., trucks) employed in the shipper's fleet are all of the same type, and it is assumed that the shipper has an ample number of them so that there is no need for outsourcing extra transportation.

iv) Environmental Performance Index (EPI):

It measures the effectiveness of national environmental protection efforts in 132 countries. Reflecting our belief that on the-ground results is the best way to track policy effectiveness, EPI indicators focus on measurable outcomes such as emissions or deforestation rates rather than policy inputs, such as program budget expenditures. Each indicator can be linked to well establish policy targets. The 2012 EPI ranks 132 countries on 22 performance Indicators that capture the best worldwide environmental data available on a country scale.

India Ranks at 125 of 2012 Environmental Performance Index, which is worst rank.

IV. CONCLUSION

GSCM can no longer be discarded by stakeholders in major companies as a methodology which prevents them in having a competitive edge with their fellow players in the market. They should realize that GSCM can reduce the ecological impact of industrial activity without sacrificing quality, cost, reliability, performance or energy utilization thus leading overall economic profit. GSCM throws a lot of challenges to practitioners, academicians and researchers as the strategies vary from industry to industry.

Optimizing transportation in the logistics system, which is the biggest contributor towards environmental pollution with the above discusses methodologies, especially through shipment consolidation & reducing Co2 emissions can make a huge difference to the environment. Also reverse logistics is an emerging field especially in developing countries like India where e-commerce has just begun to gain popularity.

V. ACKNOWLEDGEMENT

We wish to thank G.Karuna Kumar who guided us with his suggestions on this paper and all the people at the anonymous transport company who helped us with valuable information pertaining to the transport industry.

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