



INTERNATIONAL JOURNAL OF RESEARCH IN COMPUTER APPLICATION AND MANAGEMENT

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- Schemenner, R.W., Huber, J.C. and Cook, R.L. (1987), "Geographic Differences and the Location of New Manufacturing Facilities," Journal of Urban Economics, Vol. 21, No. 1, pp. 83-104.

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PERFORMANCE OF SUSTAINABLE LOGISTIC PRACTICES OF SMES IN DELHI**SANJEEV KUMAR****RESEARCH SCHOLAR****DEPARTMENT OF MECHANICAL ENGINEERING
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With growing worldwide awareness of environmental protection, eco/sustainable logistics has become an important issue for almost every enterprise and will determine the sustainability in the long term. The work presented in this paper is based on the case study in the field of manufacturing industry. Consumers and legislation have pushed industries to re-design their logistic method in order to mitigate negative environmental impacts. Concern for the environment has led many industries to define policies that protect the environment within which they operate. This environmental concern is reflected in all the activities of the product life cycle, both in those of direct logistics as well as reverse logistics. In order to set up environmentally friendly practices, industries must maintain collaborative relations both upstream and downstream. Many authors have proposed quantitative models taking those changes in the logistics environment into account. Furthermore, work can contribute for a better 'green image' in industry. Various green legislations are forcing industries to take back their used, end-of-life products, or products under warranty to minimize wastes and conserve resources. The objective in the design of logistic networks has changed, therefore, from cost minimization only, to cost and environmental impact minimization. The objective of this paper is to develop a framework for the design and evaluation of sustainable logistic, in which profitability as well as environmental impacts are also balanced.

KEYWORDS

Environmental impact, logistic, SMEs, Sustainable supply chain.

INTRODUCTION

Greening the supply chain is increasingly a concern for many business enterprises and a challenge for logistics management in the 21st century. Of particular concern is how to arouse organizational environmental awareness and put environmental activities into practice in the logistics activities of their supply chains. In the past years, consumers, enterprises and governments have increased their attention towards the environment. Now a day's society is also more aware of environmental damage caused by human actions due to increased exposure in the media on e.g. global warming and depletion of natural resources. Improvement in environmental quality does not come for free. Industries invest more in the assessment and reduction of the environmental impact of their products and services. (J. Quariguasi Frota Neto , G. Walther , J. Bloemhof , J.A.E.E. van Nunen ,T. Spengler, 2009) [3]. Implementation of legislation, social responsibility, corporate imaging, environmental concern, economic benefits and consumer awareness are forcing manufacturers not only to provide more environmentally friendly products but also to take back used products at its end of life. Products can also be returned for reasons such as customer dissatisfaction and warranty. Such products can be sorted for reuse, remanufacture, recycle and disposal. Reuse of used products by some value addition is not a new concept. (Akshay Mutha , Shaligram Pokharel, 2009) [1]. In recent years, consumers and governments have been pressing industries to reduce the environmental impact of their products and processes. The members of the European Union (EU), for instance, have committed themselves to develop, implement and enforce legislation that makes producers responsible for the collection, treatment, recycling and environmentally safe disposal of all electrical and electronic equipment (J. Quariguasi Frota Neto, J.M. Bloemhof-Ruwaard, 2008) [4]. A number of Indian industries have also pro-actively acted in favor of a more sustainable development. Their assertive approach toward the environment has helped them to reap the benefits of an environment-friendly image, e.g. to gain or retain environment-conscious consumers, to comply with the sometimes cumbersome and blurry current legislation, and to anticipate necessary changes to cope with future legal environmental standards. In the environment of global economy, enterprises must configure and utilize worldwide resources to keep the advantages of competition. How to source products from the most appropriate manufacturing facility, how to keep the balance between inventory, transportation and manufacturing costs, and how to match supply and demand under uncertainty are concerned by each industry. It is impossible to realize the strategic goal without a well developed and realizable logistics system. High efficient international logistics system will become the core competence for an enterprise to control cost, reach high-level consumer service, and hence realize global business successfully. The importance of logistics network design, and the need for the coordination of production and distribution decisions, has long been evident. Facility location, as the decision at the strategic level in logistics system, plays an important role. Some strategic decisions concerned by facility location include selecting the right suppliers, determining the appropriate number of facilities such as plants and warehouses, determining the location of each facility, determining the size of each facility, determining sourcing requirements, i.e., assigning activities to the facilities, determining distribution strategies, i.e., the flows of raw materials and finished products in the network. (Lothar Schulze, and Li Li, 2009) [5]. Green is rapidly becoming a measuring stick for supply chain success. The "greening" of the supply chain will have strong and increasing effects on both strategic and tactical aspects of supply chain management. Industries must act now to begin their green supply chain initiatives, and they must also take action to address the growing range of threats to the continuous operation of their supply chains. (The State of Logistics Outsourcing 2008)[6]. Also the assessments presented here are based on parts of the data and information collected through the execution of the Competitive Strategies and Best Practices Benchmarking Questionnaire (logistic design based) from small & medium size manufacturing industry.

OBJECTIVE OF PAPER

- To understand the concept and present scenario of eco-logistic practices of SMEs in Delhi as well as India.
- Contribution to the effective design of sustainable logistic networks balancing environment and also profit to manufactures and suppliers.

LITERATURE REVIEW

Sustainable logistics in India is as yet in its infancy and is currently an under researched area. Sustainable logistics is a key element in the development of environmentally conscious supply chain design. Transportation contributes to global climate change through emissions of carbon dioxide, methane & hydrocarbon, nitrous oxide and water vapour discharged by aircraft. Though transparent to sunlight, these reflect long-wave radiation normally emitted back into space by the earth. This may raise the temperature of the atmosphere. Eco-logistics is a form of logistics which is calculated to be environmentally and often socially friendly in addition to economically functional. In general logistic involves the movement of products from every step between raw materials and end consumer of a finished product. In case of eco-logistics, all the issues which pertain to regular logistics still apply, in addition to friendly environment factor. Logistic management encompasses several processes i.e. inbound and outbound transportation management, warehousing, inventory management, management of third party logistics service providers, sourcing and procurement, packaging and assembly and customer service (Francesco Ciliberti, Pierpaolo Pontrandolfo, Barbara Scozzi, 2008) [7]. Logistics is concerned with the efficient flow of raw materials, of work in process inventory, and of finished goods from supplier to consumer. In addition to transportation, logistics entails inventory control, warehousing, material handling, order processing, and related information activities involved in the flow of products. How these activities are managed and organized determines the quantity and quality of transportation demanded and the nature of the commercial relationships between shippers and transportation service providers. Freight transport in many economies due mainly to the flexibility and speed that the movement of freight by road offers when compared railway, marine. (Paul Ryan) [8]

SUSTAINABLE

Sustainability is capable of being continued with minimal long-term effect on the environment. Sustainable development is concerned with the development of a society where the costs of development are not transferred to future generations, or at least an attempt is made to compensate for such costs. [Pearce 1993]. As a result, this all encompassing definition of sustainability raised and pointed many questions:

- Effect on economic or cost of product.
- Resources require for next and future generations.
- Negative and positive effect on next and future generations.
- Substitute of depletable resources for future etc.....

METHODOLOGY

Given the large number of small & medium enterprises (especially in Delhi – capital of India), a survey was conducted among industries in the different sector in order to gather the necessary information to carry out the work of this research study. The primary information that allowed us to carry out the necessary analyses was gathered by means of a structured survey directed at the industries under study in Delhi. The Competitive Strategies and Best Practices Benchmarking Questionnaire were developed. The questionnaire consists of total 07 items. The model aims to explore possible near future developments in the competitive strategies of the industries by addressing their competitive priorities, logistics objectives and action plans. Item Reverse logistics considered in stock planning, Amount of goods delivered on time, Reducing the use of packaging considered, Packaging material recollection planned, Environmental issues considered in the design of logistic, Collection and distribution of products recycled, reused considered, Use of recyclable/reusable shipping and packaging materials all serve for the assessment of where the industry stands in terms of its practices and outcomes in the context of business excellence and best sustainable logistics practices. Information is collected through the 7 questionnaire. Performance and outcome measures are asked to be reported as point values. Majority of the qualitative information is collected by asking the respondent to respond to statements. Industries performance strategies will depend upon their aggregate score. All the measurement items are organized into a survey questionnaire administered to firms. The target respondents of our survey were requested to indicate, using a five-point Likert scale (1- not considering it, 2- planning to consider it, 3- considering it currently, 4 - initiating implementation, 5- implementing successfully) 'OR' 1 – Poor, 2 – Average, 3 – Good, 4 – Very good, 5 – Excellent.

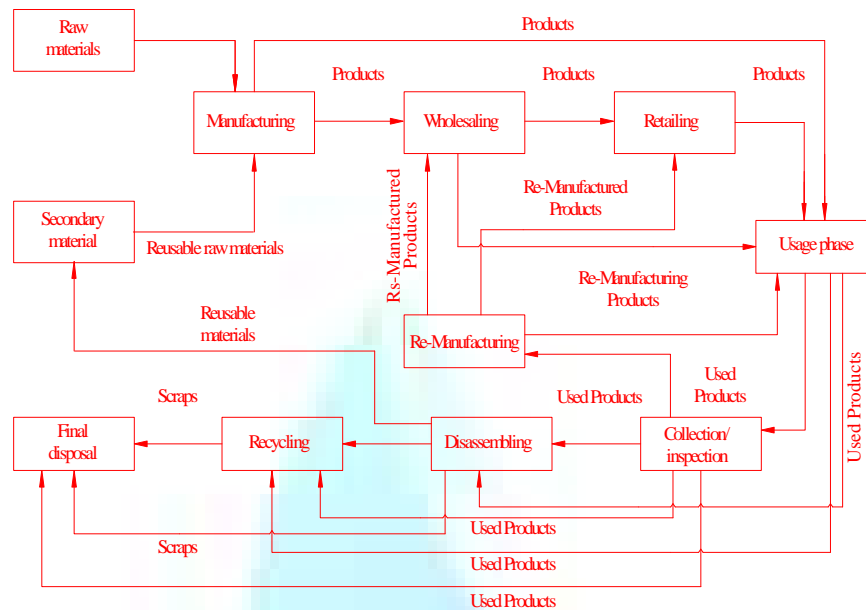
LOGISTIC NETWORK IN TERMS OF THE ENVIRONMENT AND COSTS

Logistics is that "part of the supply chain processes that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point of consumption in order to meet consumers' requirements." In short, industries depend on their logistics system to move materials among supply chain partners. Logistics covers a wide range of business activities, including:

- Transportation
- Warehousing
- Material handling
- Packaging
- Inventory management
- Logistics information systems. (Cecil C. Bozarth, Robert B. Handfield, 2008) [2].

A logistics network is a connected system of suppliers, distributors, transporters, third-party logistics providers (3PLs), ports, customs and customers on a mission to best meet supply with demand. In a logistic network, a number of actors will influence business costs and corresponding environmental impact. Suppliers, manufactures, consumers, logistic operators, as well as third parties operating in testing, refurbishing, recycling and energy production for the end-of-life products are the main players. These players perform majority of the activities impacting business and the environment. In general terms, the activities performed in a logistic network are related to manufacturing, transportation, usage and end-of-life products' destination. Fig. 1 depicts these activities. The decisions regarding these activities will, therefore, determine the network costs and environmental impact. These decisions are strategic (e.g. location of factories), tactical (e.g. the destination of products end-of-life) as well as operational (e.g. the choice of suppliers, third parties, etc.). Furthermore, it is clear that choosing the right activities in modeling specific logistic networks is crucial. Literature into logistic network design is mostly divided in two approaches: minimizing costs (or maximizing profits) and minimizing environmental impact. (J. Quariguasi Frota Neto, J.M. Bloemhof-Ruwaard, 2008) [4]

FIGURE: 1 (SOURCE: (J. QUARIGUASI FROTA NETO, J.M. BLOEMHOF-RUWAARD, 2008) [4])



MAIN ACTIVITIES INFLUENCING COSTS AND ENVIRONMENTAL IMPACT IN LOGISTIC NETWORKS:

Type of factor	Variables
Transportation	Transport from supplier to manufacturer and vice versa Transport from supplier to consumers and vice versa Transport from supplier to end-of life facilities and vice versa Transport from manufacturers to consumers and vice versa Transport from manufacturers to end-of-life facilities and vice versa Transport from consumers to end-of-life facilities and vice versa
Manufacturing	Manufacturing at suppliers Manufacturing at manufacturers
Product use	Product use by consumers
Testing	Testing
End-of-use alternatives	Re-use Refurbishing Recycling Energy production

STRENGTHS AND WEAKNESSES OF THE MAJOR TRANSPORTATION:

(Cecil C. Bozarth, Robert B. Handfield, 2008) [2], (The environmental effects of freight www.google.com) [7].

TABLE: 1

Transportation mode	Strengths	Weaknesses	Effect on environment
Highway	Flexibility to deliver where and when needed. Often the best balance among cost, flexibility, and reliability/speed of delivery.	Neither the fastest nor the cheapest option.	The environmental impacts of trucking have received a great deal of attention, particularly in comparison with the impacts of rail. Trucking poses threats to the environment from two major quantifiable sources, air pollution and noise. In addition, the use of trucks contributes to land-use related environmental stresses and to the environmental impacts of accidents.
Water	Highly cost effective for bulky items. Most effective when linked to a multimodal system.	Limited locations. Relatively poor delivery reliability/speed.	Shipping poses threats to the environment both on inland waterways and the ocean. These problems come from six major sources; routine discharges of oily bilge and ballast water from marine shipping; dumping of non-biodegradable solid waste into the ocean; accidental spills of oil, toxics or other cargo or fuel at ports and while underway; air emissions from the vessels power supplies; port and inland channel construction and management; and ecological harm due to the introduction of exotic species transported on vessels.
Rail	Highly cost effective for bulky items. Can be most effective when linked to a multimodal system.	Limited locations, although less so than water. Better reliability/speed of delivery than water.	Railway travel is generally held up as a less environmentally damaging mode of land transportation than trucking. Data on air pollution certainly confirm this. For noise it is somewhat less evident, but rail may be less harmful in that respect as well.
Air	Quick mode of delivery. Flexible, especially when linked to the highway mode.	Often the most expensive mode on a per-pound basis.	While air cargo accounts for a very small portion (less than one percent) of world-wide freight, it is growing rapidly. Moreover, with increasing concern about global warming, concern about aircraft emissions has grown. Air freight therefore warrants consideration beyond its current importance as a means of transport.

ENVIRONMENTAL IMPACT

The environmental impact of the total stress is determined by the nature of the receiving environment. Ambient characteristics such as physical ecosystem characteristics, density of the human population affected, and whether the receiving ecosystem is considered critical or includes endangered species will determine both the physical impact of the stress and willingness to pay to prevent it.

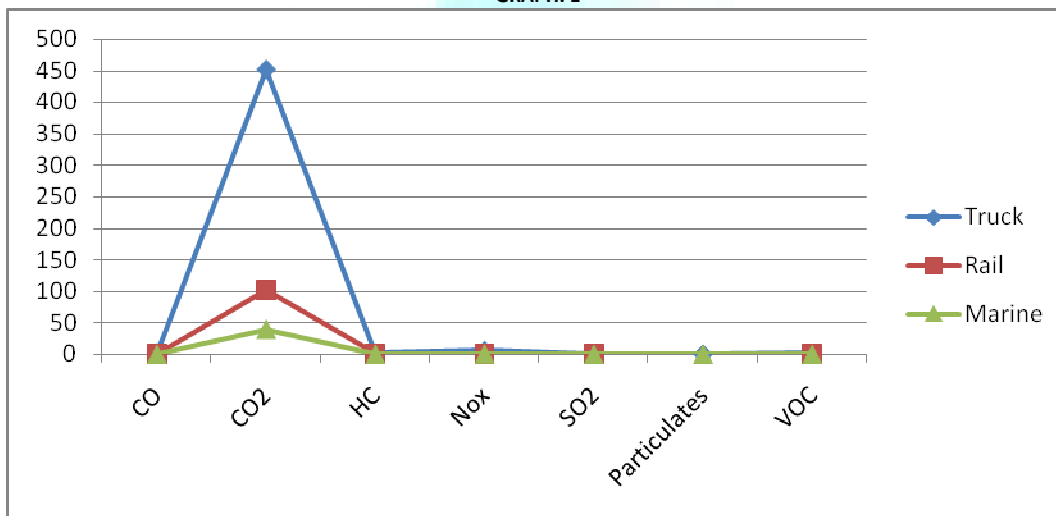
As the table: 2 & graph: 1 below shows, despite substantial variation among the estimates within each transport mode, trucks are clearly much more polluting than rail or boats. This applies across all pollutants. The data suggest that rail may be more harmful than marine transport; however this is much less clear. (www.google.com.)[7]

(Source: The environmental effects of freight www.google.com) [7].

TABLE: 2

Pollutant	Truck	Rail	Marine
CO	0.25 - 2.40	0.02 - 0.15	0.018 - 0.20
CO2	127 - 451	41 - 102	30 - 40
HC	0.30 - 1.57	0.01 - 0.07	0.04 - 0.08
NOx	1.85 - 5.65	0.20 - 1.01	0.26 - 0.58
SO2	0.10 - 0.43	0.07 - 0.18	0.02 - 0.05
Particulates	0.04 - 0.90	0.01 - 0.08	0.02 - 0.04
VOC	1.10	0.08	0.04 - 0.11

GRAPH: 1



(Graphical result of Table: 2)

BEST PRACTICES BENCHMARKING QUESTIONNAIRES

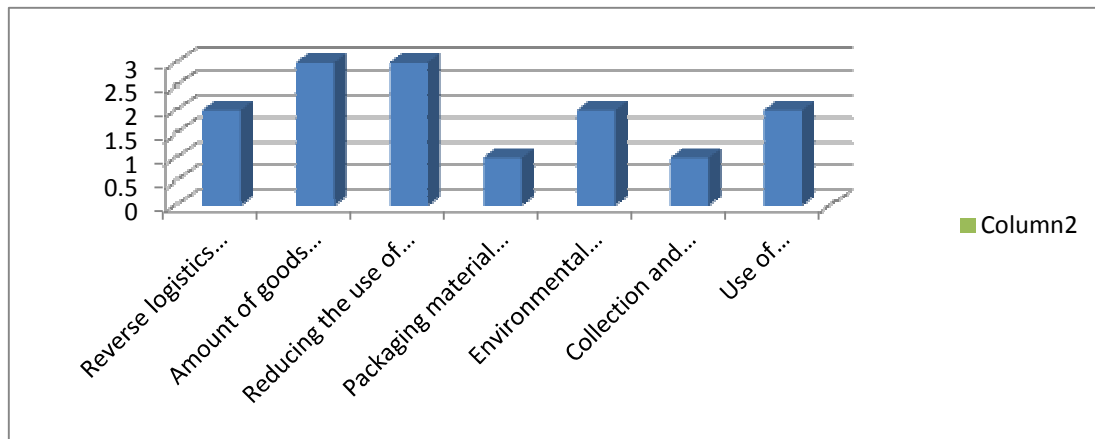
Best Practices Benchmarking Questionnaire were developed. The questionnaire consists of seven questions. (5 for excellent, 4 for very good, 3 for good, 2 for average, 1 for poor)

PERFORMANCE OF SMEs

TABLE: 3

Sl. No.	Description	Score/1	/2	/3	/4	/5
1	Reverse logistics considered in stock planning					
2	Amount of goods delivered on time					
3	Reducing the use of packaging considered					
4	Packaging material recollection planned	✓				
5	Environmental issues considered in the design of logistic.					
6	Collection and distribution of products recycled, reused considered	✓				
7	Use of recyclable/reusable shipping and packaging materials					

GRAPH: 2



(GRAPHICAL RESULT OF TABLE: 3)

CONCLUSION & FURTHER RESEARCH

This paper has attempted to summarize the environmental impacts of freight, in order to provide information concerning the impacts of trade liberalization on the environment through transport of goods. The concern of consumers, industries and governments with the environment has steadily increased in the last years. Cleaner process, re-use of products and components, and recycling are examples of initiatives to reduce environmental impact in logistic networks. Industries aiming to decrease the environmental impact of their logistic networks should, then, look for good trade-offs between environmental impact and costs. In this paper review the main activities influencing the environment and costs in logistic network, namely: transportation, product use, and end-of-use alternatives. This review has attempted to summarize the environmental impacts of freight, in order to provide information concerning the impacts of trade liberalization on the environment through transport of goods. The focus has been on describing the major mechanisms through which freight transportation can affect the environment, and identifying ways to quantify those links on a per-unit of good basis. (The environmental effects of freight, www.google.com) [7]. some clear conclusion can be drawn by comparing the detail in this paper (table: 1&2). As the table 1&2 shows, trucks are clearly more polluting than train or marine. The table: 1&2 also shows rail transport is more pollutant than marine. Also from the survey of the industry (table: 3), the score is not up to the mark. Industries should more concentrate their strategy on packaging material recollection planned, environmental issues considered in the design of logistic, collection and distribution of products recycled, reused considered etc. This will automatically improve the score card and thereby performance. Further research on the most relevant phases for improving eco-efficiency (i.e. in a logistics network, transportation, manufacturing, end-of-use etc.) has to be carried out.

Though the paper deals with environmental effect, yet there is scope for further research on environmental costs, assessing eco efficiency, balance between environment & business concern.

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With sincere regards

Thanking you profoundly

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