

# International Journal of Advance Research in Computer Science and Management Studies

Research Article / Survey Paper / Case Study

Available online at: [www.ijarcsms.com](http://www.ijarcsms.com)

Special Issue: National Conference on Management, Economics & Social Science (NCMESS 2018)

Organized by: Department of Business Administration, ST. JOSEPH'S COLLEGE (AUTONOMOUS), Tiruchirappalli - 620002, India

## *Green Supply Chain Management in Petroleum Logistics*

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*Abstract: Environmental issues such as global warming, carbon emissions, toxic substance usage, and resource scarcity has escalated over the past decades. The Government, Policy makers and Non Government Organization are advocating for going green. The entire humanities have responded to this by applying green principles. Logistics involves all the activities that move products and information to, from and among the members of supply chain. The supply chain provides a framework for business and their suppliers who team-up to reach goal services and information efficiently to ultimate consumers. This process involves in petroleum logistics also but there are more issues related to leakage exploitation of the natural resources. The waste and emissions caused by the supply chain have become one of the main sources of serious environmental problems including global warming and other health problem of human being. So the researcher has very much interested for to identify the problem of petroleum logistics and other issues in the daily business life.*

*Keywords: Environment, Logistics, Supply chain management, and Green Practice management.*

### I. INTRODUCTION

Logistics deals with reaching products or services where they are wanted and when they are wanted. Any manufacturing or marketing activities is difficult to achieve without any logistical planning. The logistics involves co-ordinate efforts of transportation, warehousing, packaging and inventory management. Logistics define “ the Process of planning, implementing, and controlling the efficient effective flow and storage of goods, services, and related information from of origin to point of consumption for the purpose of conforming to customer requirements” The above definition includes inbound, outbound, internal, and external movements, and return of materials for environmental purposes. 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 freight transport, storage, inventory management, material handling and all the related information. The supply chain management practices and strategies that reduce the environmental and energy footprint of freight distribution. It focuses on material handling, waste management, packaging and transport. Firms have come to realize that recycling, reduce energy requirement, reduce gaseous & solid pollutants & conserve raw materials. As a result of adopting environment friendly logistics practices, these firms have also become competitive & improved their financial performance.

### II. BACKGROUND OF THE STUDY

An increasing number of consumers and businesses are choosing safe and environmentally friendly products when making a purchase decision. In addition, global health and environmental legislations and standards are requiring compliance by

manufacturers, retailers, brand managers, traders, and distributors. Diffusion of environmental practices throughout the supply chain has garnered significant attention over the past couple decades (Sarkis et al., 2011).

Initially, organizations focused on reactive internal initiatives to improve environmental performance through the introduction of environmental management systems and compliance with regulations (Hoffman, 1997; Revell, et al., 2010). This internal focus on improvement of environmental operations and performance has started to shift to inter-organizational collaboration within the broader supply chain, as organizations increasingly realize that the savings from low-hanging fruit of internal environmental operations improvements have been increasingly harder to come by (Carter & Rogers, 2008; Walley & Whitehead, 1994).

Business all over the world is currently threatened by globalization of markets, short product life cycles, and need of lower costs and ever increasing demands of the customer. The environment, in particular, global warming, is attracting considerable attention today from the media, academics, analysts, and the business community.

Companies are optimizing transportation operations and reducing their energy consumption. They are exploring ways to recycle and reduce packaging in their products. The expansion of green consciousness globally makes the business case for green a compelling one. Capturing the green advantage involves incorporating green strategies into planning, processes, products and promotions, reducing costs in some areas and improving materials and ingredients in others and making sure customers understand the benefits of being green (Green Supply Chain Forum, 2008).

### III. GREEN SUPPLY CHAIN MANAGEMENT

Green supply chain management (GSCM) is an emerging field that strands out of the traditional supply chain and environmental perspectives. 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. Global market demands and governmental pressures are pushing businesses to become more sustainable (Guide & Srivastava, 1998; Gungor & Gupta, 1999).

Srivastava (2007) defines GSCM 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.

In India, ground water, air, human and animals healthy and safety and land damage present examples of the main environmental challenges caused by petroleum products, activities and services with levels of pollution ranging from toxic industrial waste, oil and gas leakages, end-of-life lubricant packages, product spills, tanker accidents, fires, emissions to the atmosphere, interceptor effluence and illegal oil makeshifts (depots) which cause greater environmental burden. The solution to reduce this pollution and to restore the quality of the environment lies in adoption of contemporary tools of environmental management such as green supply management, eco design, cleaner production, environmental accounting and life cycle analysis.

There are different motivators for companies to switch to greening their supply chains. Although some of the motivators are quite unclear (Wu & Dunn (1995) suggest that some organizations are simply doing this because it is the right thing to do for the environment. Perhaps some are more radical to environmental change, but others may not (Wu & Dunn, 1995). Studies, however, have shown that profitability and cost reduction are some of the main motivators for businesses to become 'green' in the supply chain (Srivastava & Srivastava, 2006; Srivastava, 2007; Damall et al., 2008). Johnson (1998) argues that reverse logistics are motivated primarily by economic factors and not concerns about protecting the eco-system.

The United States Environmental Protection Agency (EPA) issued a guide entitled 'The Lean and Green Supply Chain: A Practical Guide for Materials Managers and Supply Chain Managers to Reduce Costs and Improve Environmental

Performance” (McDaniel et al. 2000). This guide provides a systematic approach to implementing a green Supply Chain. The proposed model is created through a collaboration program with US industry, trade associations, research institution, and government agencies. In a manufacturing process, the company can apply green by several methods to reduce the energy and resource consumption. This is where reuse and recycling are referred.

The Chinese sugar refinery and Indian paper firm case studies brilliantly apply the green ‘3R’ s principle of ‘Reduce, Reuse and Recycle’; with both firms diversified into related industries like sugar, paper, alcohol, cement and ethanol and utilize the waste products of other industries as raw material or for power generation. For example, in a Chinese sugar manufacturer, Guitang Group can reduce the wastes and improve their financial performance by using waste from the upstream as raw materials for downstream production (Zhu & Cote, Integrating Green Supply Chain into An Embryonic Eco-Industrial Development: A Case Study of the Guitang Group, 2004).

Environmental issues under legislation and directives from customers are an important concern in the oil industry in India. To survey current green activities in the petroleum marketing firms in Kenya, 29 firms will be studied to provide an in- depth interview on green procurement, green manufacturing and remanufacturing, green distribution, waste management and reverse logistics. The petroleum products traded include bitumen, fuel oil, industrial diesel oil, premium, regular, kerosene, diesel, LPG and lubricants. Also involved are suppliers, customers, petroleum waste oil collectors, petroleum package dealers, waste packages, illegal depots, disassembly/recycle plants, and final chemical treatment/landfill companies ((PIEA, 2010 & Industry of Green Supply Chain Management Model and Content-Enterprise Resource Papers,2011)

**Logistics** is defined as “The process of planning, implementing, and controlling the efficient effective flow and storage of goods, services, and related information from of origin to point of consumption for the purpose of conforming to customer requirements” This definition includes inbound, outbound, internal, and external movements, and return of materials for environmental purposes. 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 freight transport, storage, inventory management, material handling and all the related information.

**Green Logistics:** Is the supply chain management practices and strategies that reduce the environmental and energy footprint of freight distribution. It focuses on material handling, waste management, packaging and transport. Firms have come to realize that recycling, reduce energy requirement, reduce gaseous & solid pollutants & conserve raw materials. As a result of adopting environment friendly logistics practices, these firms have also become competitive & improved their financial performance.

### **Oil supply and demand in India**

The oil and gas sector is among the six core industries in India and plays a major role in influencing decision making for all the other important sections of the economy. In 1997–98, the New Exploration Licensing Policy (NELP) was envisaged to fill the ever-increasing gap between India’s gas demand and supply. India’s economic growth is closely related to energy demand; therefore the need for oil and gas is projected to grow more, thereby making the sector quite conducive for investment. The Government of India has adopted several policies to fulfill the increasing demand. The government has allowed 100 per cent Foreign Direct Investment (FDI) in many segments of the sector, including natural gas, petroleum products, and refineries, among others. Today, it attracts both domestic and foreign investment, as attested by the presence of Reliance Industries Ltd (RIL) and Cairn India.

#### IV. MARKET SIZE IN INDIA

India is expected to be one of the largest contributors to non-OECD petroleum consumption growth globally. Total oil imports declined by 10 per cent year-on-year in February 2017. Fuel consumption in India increased by 10.7 per cent to a 16-year high of 196.48 million tones (MT) in 2016. India is the fourth-largest Liquefied Natural Gas (LNG) importer after Japan, South Korea and China, and accounts for 5.8 per cent of the total global trade.<sup>3</sup> Domestic LNG demand is expected to grow at a CAGR of 16.89 per cent to 306.54 MMSCMD by 2021 from 64 MMSCMD in 2015. The country's gas production is expected to touch 90 Billion Cubic Metres (BCM) in 2040 from 23.09 BCM in FY2016-17 (till December 2016). Gas pipeline infrastructure in the country stood at 15,808 km in December 2015. State-owned Oil and Natural Gas Corporation (ONGC) dominates the upstream segment (exploration and production), producing around 25.93 MT of crude oil, which is approximately 60.5 per cent of the country's 36.95 MT oil output, as of March 2016.

- Oil consumption is estimated to expand at a CAGR of 3.3 per cent during FY2008–16E to reach 4.0 mbpd by 2016
- Due to the expected strong growth in demand, India's dependency on oil imports is likely to increase further
- Rapid economic growth is leading to greater outputs, which in turn is increasing the demand of oil for production and transportation
- With rising income levels, demand for automobile is estimated to increase
- India will overtake Japan to become the world's third largest oil consumer behind the

US and China by 2025. India has approx 56, 190 petrol stations as on March 2016. Almost 25 000 of these belong to Indian Oil, 13 000 each to Bharat Petroleum and Hindustan Petroleum. The Tamil Nadu has 4, 278 number of petrol station. (Latest update: June, 2017)

#### V. RESEARCH DESIGN

Under this convenience sample method is used. The study is conduct on the basis of survey carried out in Trichy Districts. The data for survey is collect through direct personal interview with dealers in All Tamil Nadu petroleum dealers Association & truck driver.

**Objectives & Goals:** The main objective of logistics is to co-ordinate these activities in way that meets customer requirements at minimum cost. In the past this cost has been purely monetary terms. As concern for the environment crises, companies must take more account of the external costs of logistics associated mainly with climate change, air pollution, noise vibration and accidents. This research project is examining ways of reducing these externalities and achieving a more sustainable balance between economic, environmental and social objectives.

**National and International importance:** The petroleum industry includes the global processes of exploration, extraction, refining, transporting and marketing petroleum products. All effort of a business organization to modify develops, produce and distribute products or services in such a manner so as to preserve and improve ecological environment for the sake of generations to come constitute a green business practices.

#### VI. OBJECTIVES

To identify the various problems faced during petroleum transit

To estimate the loss during petroleum transit

To estimate the effect of petroleum loss on environment

To understand various crisis in petroleum Retail Business

To develop an effective green logistics system in petroleum transit

To find out the financial loss due to evaporation loss

## VII. METHOD OF DATA COLLECTION

**Primary Source:** Primary data during the course of the project study is collect through interview method. Personal interview is made to collect data from the respondent.

**Secondary Source:** Secondary data is collecting from (i) Technical & Trade Journals (ii) Reference book, magazine & newspaper (iii) Articles from Net.

**Universe:** The Universe of research is all the petroleum dealers Tamil Nadu

**Sample Area:** For the minor level of research, I take Three Districts from Tamil Nadu such as Tiruchirappalli, Ariyalur and Pudukottai. The primary data collection only from the Tiruchirappalli district.

**Sample size:** Total sample size is which include dealers, truck drivers and Salesmen Dealer 50, Driver 50 persons and salesmen 50 persons.

### Data Analysis (Petrol storage and Distribution)

1. Petroleum Terminal (Refinery outlet)
2. Petrol Distribution Centre-Retailer (Underground tank )
3. Motor Transport(petrol filling)

Most of retailers in this field are using the tanker trucks for bringing in petrol to the outlet, where they will be stored in underground containers for further distribution

The tanker truck's schedule is as follows:

- The tanker trucks reaches the refinery for filling in the fuel ordered by the retailer, where they follow in queue to reach their respective gate for fuel (normal waiting time is 2 to 3 hours)
- The computerized machine will fill the tanker of the truck fully ( 12 000 liters if it's a standard tank truck)within 15 minutes.
- The tanker with a definite time schedule reaches the retailer ( The time is specified by the oil company)
- The fuel in the tanker is transferred into the underground compartments of the retailer through unconventional means

The retailers supply the fuel to its customers through a machine which will take fuel from the compartment. As per our observation and interview we could found that there are two types of losses –operational loss & evaporation loss. The operational loss incurs during the retail sale to customer (which vary depends on the quantity of sales). The evaporation loss it happens at various levels. Firstly the loss incur while filling the underground tank of retailer from company vehicle (50-80 liters per load). Secondly loss occurs during the level checking of the petrol in the underground tank of retailer (5-10 liters loss due to variation in air pressure).

Petrol is a form of hydro carbon which is highly sensitive to temperature; Petrol is made up of aliphatic and aromatic hydrocarbons along with toluene and benzene. In this, toluene is an explosive and it is used as TNT (trinitrotoluene) in explosive. That's why petrol is highly inflammable and can explode when it comes in contact with fire.

The retail outlets face petrol losses in two forms;

1. Losses due to evaporation
2. Losses due to expansion

Petroleum Logistics involves procurement, transportation, inventory, customer service and distributions. The world forum of petroleum products continues to stress the importance of balancing a supply oriented fuel policy with continued environmental progress. Historically balancing a supply oriented fuel policy with continued environmental progress. Historically refinery planning begins with setting constraints, target & optimizing. The resulting optimized plan is made for short term time frame. However as we look beyond the refinery it include more of the supply chain which becomes long term objective. Petroleum Logistics is formed with one simple mission in mind- to bring value and increased profitability to clients business through highest quality products and outstanding service to clients every time conduct business. Petroleum logistics is an aviation fuel is an aviation fuel and lubricants supplier, along with providing solutions from bulk fuel storage to environmental solutions.

### VIII. FINDING

Problems in petroleum Transit:

- The amount of petrol that can be transported in a usual petrol tank truck is very limited ( 12 000 liters )
- The crude system for filling the truck tank from terminal
- Other problem related to transportation system is determine the route for transit
- Evaporation loss while filling the underground tank

### IX. SUGGESTIONS

- To develop a system of using high capacity tankers(24 000 liters capacity)
- Introduce token system for tank trucker to minimize the queue for filling
- Install GPS system in tankers to reduce the transit time by knowing the shortest as well as exact route
- The underground tank must be connected to a vapor recovery unit

### X. CONCLUSION

Petroleum is vital to many industries, and is of importance to the maintenance of industrialization civilization itself, and thus is critical concern to many nations. As petroleum is a non-renewable natural resource the industry is faced with an inevitable eventual depletion of the world oil supply. We should develop a strategy of green in usage as well as in the distribution of petrol. The environmental impact of petrol is that it produces greenhouse gases and other air pollutants as by-products. Pollutants include nitrogen oxides, sulphur dioxide, volatile organic compounds and metals. The best option for the logistics of petroleum is to apply green practice management in petroleum logistics.(i.e minimizing the petroleum loss during transit).

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