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A study of operations research in relation to the logistics sector and rising fuel prices

Saksham Batra
saksham.batra567@nmims.edu.in
SVKM's Narsee Monjee Institute of Management Studies, Bengaluru, Karnataka

Ragini Thapa
ragini.thapa329@nmims.edu.in
SVKM's Narsee Monjee Institute of Management Studies, Bengaluru, Karnataka

Pranav Arora
pranav.arora348@nmims.edu.in
SVKM's Narsee Monjee Institute of Management Studies, Bengaluru, Karnataka

Sambhav Agarwal
sambhav.agarwal584@nmims.edu.in
SVKM's Narsee Monjee Institute of Management Studies, Bengaluru, Karnataka

Khushi Rastogi
khushi.rastogi231@nmims.edu.in
SVKM's Narsee Monjee Institute of Management Studies, Bengaluru, Karnataka

ABSTRACT

Problem resolution based on assumptions of a simple cause-and-effect relationship is insufficient in a complex activity like logistics. One of the highest costs contributing to "reducing transportation costs" concerns is the price of fuel. To avoid a substantial rise in operational expenses, it is important to adapt and develop a plan while simultaneously pursuing reduced costs. This necessitates the use of operational research technique that is based on mathematical processes. The cost of fuel consumption is determined by the distance travelled and the road conditions (in the case of poor road conditions, the width of the road can impact the vehicle's speed as well as the amount of fuel consumed). This article focusses on strategically evaluating on how to reduce these costs in the logistics sector by using relevant Operations Research Techniques in order to achieve profitability without affecting the operation and customer service.

Keywords: *Operations Research, logistics, fuel consumption, transportation costs, Location Routing Problem (LRP)*

1. INTRODUCTION

The Indian logistics industry is evolving rapidly. In many nations, logistics and operations cost management are the primary drivers of economic development. Given the importance of transportation and logistics in economic growth, the transportation and logistics industry accounts for about 14% of India's GDP (Gross Domestic Product).

Road transport is the main form of transportation in India, and it is frequently utilised for logistics chain transit. Because this form of transportation relies on fuel for energy, it has significant transportation expenses. Currently, logistics expenditures are an activity that necessitates a large budget. To avoid a substantial rise in operational expenses, it is important to adapt and develop a plan while simultaneously pursuing reduced costs, which may be accomplished by solving the Location Routing Problem (LRP).

One of the most important topics in Optimization and Operations Research is routing. The term "routing" in theoretical/mathematical programming refers to the process of determining an optimum set of cycles inside a graph or network. Routing issues emerge in distribution and transportation planning in practise. LRP is a supply chain management solution that combines two problems: the location selecting problem and vehicle routing problem.

The Location Selecting Problem, also known as location analysis, is a branch of operations research and computational geometry concerned with the best location of facilities to reduce transportation costs while taking into account factors like avoiding hazardous materials near housing and competitors' facilities.

The Vehicle Routing and Scheduling (VRS) technique is an essential tool that many businesses have been using to decrease operational expenses using software applications. The study's subject organisation provides transportation services and use the VRS technique to aid in route planning.

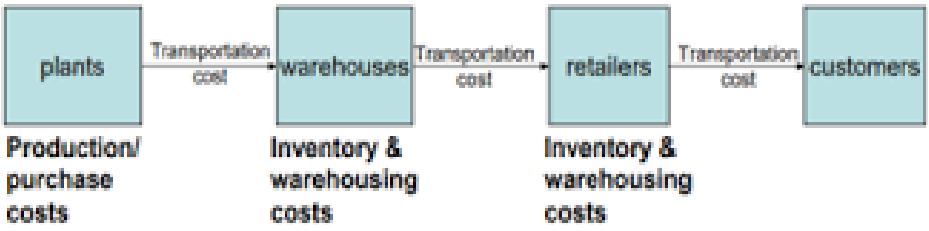

Fig. 1: Typical Logistics Configuration

2. LITERATURE REVIEW

The problem entails determining the best option for refuelling the vehicle while on the road, considering cost and distance variables, as well as the feasibility of deviating from the route to refuel at a station with a lower price per litre, due to the fact that, by failing to consider these factors, the litre price alone is usually taken into account, while the kilometres run and refuelled are usually ignored. As the world economy recovers from the Covid-19 epidemic, the price of crude oil has increased substantially in 2021 based on a rebound in worldwide demand. Brent crude has increased by 37.1 percent to almost $71 per barrel, up from $51.8 per barrel at the start of the year. The price of petrol and diesel is based on a 15-day rolling average of international petrol and diesel prices.

Increasing fuel prices represent a problem for logistics and transportation businesses, who are now preparing to raise their service rates in order to maintain profits. Fuel prices account for 40-60% of each individual transporter's or company's operational costs, according to industry observers. These companies' operating costs have grown by 10% to 20%.

Harsh Vaidya, Founder, and CEO of WareIQ says “Rising fuel prices typically force businesses in the logistics industry to either raise prices or suffer a financial loss. If the prices continue to increase, the trucking companies, couriers, and packaging material providers will have no option but to increase the cost of their services – which will eventually begin to reflect on the prices of our services as well.”

3. ANALYSIS AND FINDINGS

Following the rise in fuel and diesel costs, transporters and logistics operators are putting pressure on companies in the consumer-facing industries. Transportation expenditures can account for a large portion of a company's entire logistics budget. So, based on the observations of the selected industry and the problem identified, here are a few suggestions for how logistics chains may reduce overall costs to prepare for the increase in fuel prices:

(a) Single Modes Aren't Enough: Increasing your flexibility and adaptability in your transportation options might help you overcome losses in ways you may not have considered. Sea freight is generally significantly less expensive than air freight. Although rail transportation is less expensive than trucks, a unique mix of the two may be the key to keeping on schedule and on budget.

(b) Shipments Consolidation: Consolidating shipments is one method that transportation managers may employ to make fewer trips while reaping the benefits of reduced prices based on bigger shipments.

(c) Consider warehousing services: If you're transporting a large number of items from point A to point B, especially over a long distance, you may keep things closer to your consumers and save money on transportation.

4. CONCLUSION

It's crucial to note that logistics businesses have to organize a massive quantity of data and make a number of managerial decisions in order to maximize efficiency and reduce expenses. Both of these procedures heavily rely on techniques from Operational Research. To tackle real-world logistics issues, operations research uses a variety of scientific approaches mixed with rational planning. Whether in manufacturing or services, large or small, public, or private, multinational or SMB, logistics is at the heart of any firm.

Several applications of models from the subject of operations research were observed and how they might be applied efficiently via this project. The model and scenario studies yield two conclusions about the impact of oil prices on the structure of logistic networks. First, the ideal distribution network structure is determined by the price of oil. Second, the value of traded products has a significant influence on the sensitivity of the network reaction to changes in oil prices.

5. LIMITATIONS

- Because the routes are longer and truck utilisation is often worse on outward than inbound transports, centralised networks incur higher transportation costs than decentralised networks.
- Although the link between transportation costs and oil price is represented as linear, the degree of centralization is not consistently reliant on oil price within the model.
- Because the impact of growing oil prices on logistics structure is restricted within the expected range, the need for fundamental adjustments in logistics networks in the face of rising oil prices is debatable and dependent on the network's existing maturity. The impact of high oil prices on the logistics system, such as a general reduction in demand, appears to be more important than the increase in transportation costs.

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