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A Structured Approach to Optimize Outbound Supply Chain Cost in an Automotive Industry

C. P. Aruna Kumari[1], Y. Vijaya Kumar[2]

[1]Research Scholar, JAIN University, Bangalore, India

[2]Principal, Shirdi Sai Engineering College, Bangalore, India

Abstract: ***Most of the companies are focusing on cost reduction to ensure that there is an effective supply chain. For this there is a need for Indian markets to improve their supply chain processes. In the case of automobile industries, there is complexity in supply chain due to design and build vehicles globally. The complexity often stands in the way of profitability and higher shareholder value etc. In a highly challenging and competitive environment, where supply chain is required for organizational competitiveness, an efficient and effective supply chain strategy is a must. To improve profitability and efficiency, automotive players are seeking ways to achieve operational excellence, reduce operating cost and enhance customer service through efficient supply chain management. In this paper an attempt has been made to provide a structured approach to Supply Chain cost management in the form of mathematical format in order to conclude to optimize outbound supply chain cost with the given set of different costs.***

Keywords: Supply Chain Strategy, Cost Reduction, Total Cost, Structured Approach, Operational Excellence, Complexity

1. Introduction

Every supply chain has its unique set of demands and challenges. In the recent trend most of the companies make decisions individually and collectively regarding their actions in areas like production, inventory, location, transportation and information in a supply chain. Some of these decisions will define the effectiveness and capabilities of a company's supply chain. Optimization for low cost or responsiveness depends on the company's strategy i.e. either to compete on the basis of price or compete on the basis of customer service and convenience. Effective supply chain management will be effective if all the areas which drive are understood well and the operation of each one is known. Each driver has the ability to directly affect the supply chain and enable certain capabilities.

As India is a developing country, there has been an upward trend of realization of supply chain optimization. SCM solution market has been making inroads in India and it is being established widely by many automobile industries in the country, particularly manufacturing ones where inventory carrying cost is very high. Several automobile manufacturers in India have taken positive actions to manage their logistics cost and get better customer services and measures have been undertaken by Indian companies to develop their supply chain. Auto manufacturers in India and all tiers of the supply chain have immense opportunities to enhance their entire supply chain process with the successful implementation of SCM solution.

In the Indian economy, auto industry occupies a prominent place. It has a strong multiplier effect and is capable of being the driver of economic growth. As India is a developing country, and fascinatingly, there has been an upward trend of realization of supply chain optimization. SCM solution market has been making inroads in India and it is being established widely by many automobile industries in the country, particularly manufacturing ones where inventory carrying cost is very high. Several automobile manufacturers in India have taken positive actions to manage their logistics cost and get better customer services and measures have been undertaken by Indian companies to develop their supply chain (Kamala and Doreswamy, 2007). Many organizations believe in myths like an “informal program for cost reduction is fine”; or even that reducing costs have a negative impact on quality. Nothing could be further from the truth. The most efficient cost reduction programs are those that very formal / specific and have clear objectives & accountabilities attached to it.

2. Goals and Objectives

The Main objectives and goals of the study are:

1. It is important to stay focused and the key area of Supply chain management that accounts for the major 80% of costs. This is possible by focusing the processes of SCM and involving everyone from top to the bottom which is very important.
2. It is imperative that cost reduction have a negative impact on quality, to take care of this the most cost efficient reduction programs with very formal specific objectives and accountabilities to be implemented.
3. To get a solution mathematically for cost reduction of supply chain.

3. Identify Supply Chain Costs

According to the survey made in 2006 'India Value Chain Study', over 55% of costs come from transportation whether outbound or inbound. Other major costs include inventory carrying costs and warehousing costs. The supply chain costs in India can be divided into In-bound (28%) and Out-bound (28%) transportation costs which is of 55% of total costs, and other costs include Warehousing cost (7%). Inventory carrying cost (13%), Cost of transist losses (5%), Cost of damages (5%), Other costs (insurance, international freight & clearances) (6%). The Total Cost concept is a key to effectively reduce the total cost of logistics activities rather than focusing on minimizing each activity in isolation.

The Total Cost Model by Lambert and Stock (2001) presented six major logistics cost categories that are driven by a number of key logistics activities required to facilitate the flow of a product from the point of origin to the point of consumption.

4. Key Cost Drivers

Even though the Supply Chain Management has been broadly classified into two parts like Inward and outward, a small contribution is made towards optimizing the outward supply chain performance, since the outward has lot of constraints and uncertainties compared to the inward supply chain where everything is in the hands of the organization. The present work focuses on optimizing performance of outward Supply Chain by optimizing the critical parameters which influences the performance.

The following are the some of the important key cost drivers which influences the performance of outward supply chain (Shank & Govindrajan):

Structural*:* these drivers relate with the strategic choices made by the company

- Economies of Scale
- Scope: the extent of vertical integration in the firm
- Learning and experience curve effects
- Technology requirements
- Complexity/broadness of the product line

Execution: these drivers are related to the organizational skills i.e. they depend on the way management uses the resources available to meet the customer needs

- Capacity utilization
- Workforce Involvement and commitment to continuous change
- Efficiency of plant layout, production processes and other internal operations
- Efficiency of linkages with suppliers and customers
- Time-to-market of new products
- Commitment of workforce towards quality

5. Opportunities for Cost Reduction:

Cost reduction is a direct function of controlling the cost drivers related to each activity in the value chain. Hence the team needs to clearly identify the areas for cost elimination/reduction by quantifying each of them and perform a cost-benefit analysis for each cost reduction opportunity. Then classify the opportunities based on two criteria: investment required and time taken to implement. It is advisable to first target the quick hits and then address the other identified areas.

The problem is identified and all the parameters which have influence on performance of supply chain either through the literature survey or by collecting the information from the corporate are collected. In this case the objective of the problem and the constraints are identified. The secondary data may be required for identifying the problem. This may involve the following:

- Diagnosis of the problem from its symptoms if not obvious (i.e. what is the problem)
- Delineation of the sub problem to be studied. Often we have to ignore parts of the entire problem.
- Establishment of objective, limitations and requirements.

6. Development of Mathematical Model

The problem can be modeled in different ways, and the selection of an appropriate model may be crucial to the success of the problem. In addition to algorithmic considerations for solving the model, the availability and accuracy of the real-world data that is required as input to the model also must be considered. Note that the "data barrier" can appear here, particularly if people are trying to block the project. Often data can be collected / estimated, particularly if the potential benefits from the project are large enough. In this case a clear formulation is expected, where the objective function and the constraints are identified. An attempt also will be made to explore the various techniques to solve the same. In this Research, an attempt has been made to minimize the total Supply chain model cost (Outbound) for the given constraints. The costs like Transportation, Carrying, Ordering and Information Costs are the constraints in the problem, which will be minimized without disturbing the supply chain. After formulating the problem with the objective function and constraints, the same may be solved using the Lagrangian Method for getting initial solution. After reviewing the solution, the fine tuning of the solution will be done to suit the organization needs. The initial Supply chain model is as follows:

Total Supply Chain Cost = Transportation costs + Ordering costs + Carrying costs + Information costs + Constant

Equation

Objective Function: Minimize $Z = \beta1(Tc) + \beta2(Op) + \beta3(Vc) + \beta5(Ic) + \alpha$

Where α = constant
Tc = Transportation cost = No. of units x Transport cost per unit
Op = Order Processing cost = No. of orders x Order cost per order
Vc = Inventory carrying cost= No. of Units x Storing cost Per unit
Ic = Information Cost= Cost spent on collection of Information
$\beta1, \beta2, \beta3, \beta4, \beta5$, are the associated output elasticities.

The above mathematical model can be used in an automotive industry where multiple number of products are manufactured. The following assumptions will give clarity for the problem and also improves the accuracy of the problem. The problem formulation becomes as shown below:

Minimum total outbound supply chain cost = min Z = (transportation cost of all products of type 1) x $\beta1$ + (Ordering cost of all products of Type 2) x $\beta2$ + Carrying cost + Information Cost + Constant.

Subjected to

$X_1C_1 + X_2C_2 + \ldots\ldots\ldots\ldots XnCn \leq 0.02 * \text{Total cost}$
(2% of Total Manf. Cost)

$X_1Cc_1 + X_2Cc_2 + \ldots\ldots\ldots\ldots XnCcn \leq 0.02 * \text{Total cost}$

$(X_1 + X_2 + \text{------ Xn}) Ci \leq 0.01 * \text{Total cost}$

Non negativity restriction X_1, X_2 ---------- $Xn \leq 0$

7. Solution

Model validation involves running the algorithm for the model in order to ensure:

- Input data is free from errors.
- Results from the algorithm seem reasonable (or if they are surprising we can at least understand why they are surprising). Sometimes we feed the algorithm historical input data (if it is available and is relevant) and compare the output with the historical result.

8. Results and Discussion

On an average, Indian companies typically have more number of suppliers compared to global best practices. For example, in the automotive industry, typically an auto company sources materials from 250 suppliers compared to the best practice of 100 suppliers (According to a CII 2002 report). This increases the complexity of the whole sourcing and procurement process. Supplier consolidation not only simplifies the purchasing but also leads to better utilization of resources. A number of Indian automotive companies are reducing the number of suppliers to achieve this. The scholar has made an attempt to optimize the overall cost of the outbound supply chain, where plenty of suppliers are available in the automative industry by using O R Technique. The user has to substitute the numericals for calculating overall cost with component wise.

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Author Profile

Mrs. C.P.Aruna Kumari currently is working as Project Manager in M/s DELOPT, Bangalore and pursuing Ph. D as a Research Scholar in Jain University, who has done M.B.A at IGNOU and B.E (E.E.E) in Bangalore University.

Dr. Y. Vijaya Kumar currently working as Principal at Shirdi Sai Engineering college, Anekal, Bangalore who has graduated in Mechanical Engineering in the year 1984 from Sri Venkateswara University college of Engineering, S.V. University- Tirupati, A.P and subsequently acquired Masters Degree in Industrial Engineering from National Institute of Technology (NIT), Calicut (Kerala) in the year 1986 and Ph.D degree in Industrial Engineering (OR & SQC) from Sri Krishna Devaraya University - Anantapur A.P. During the year 2012, has been awarded "Best Educationist" and a certificate of Education Excellence by International Institute of Education & Management, Delhi".