OPTIMIZATION OF SUPPLY CHAIN LOGISTICS COST

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ABSTRACT

Taking Six Sigma approach and using Operation Research theories of transportation models, this paper attempts to optimize the Inbound Logistic cost of Product (Four Wheeler) for an Automobile OEM. The suggested theories and concepts are used to develop a two dimensional matrix to understand the sensitivity of Raw materials’ (Components) distance and volumetric weight upon the Logistics cost. The Paper analyses the outcome or alternatives of Transportation model using Qualitative research methods from the perspective of the overall Product cost.

Keywords: Logistics cost, Sig Sigma approach, Transportation Model

INTRODUCTION

Four Wheeler manufacturers are continuously examining ways to reduce cost combined with higher performance and delivery. The role of efficient Supply Chain in the multi-site car manufacturing OEM becomes imperative. It demands to develop an optimize Logistic model of Raw material that better fulfills the prerequisites posed by dynamic supply chains in the automotive industry. It attaches great importance to the world automotive industry supply chain management, doing everything possible to reduce costs and expand profit margins. Supply chain Logistics influences National Economy (GDP, unemployment rate, inflation rate) factors either directly or indirectly [10]

Six Sigma Approach

Six Sigma is a process improvement set of tools and strategies, originally developed by Motorola in 1986. The term Six Sigma originated from terminology associated with manufacturing, specifically terms associated with statistical modeling of manufacturing processes.
Six Sigma Approach for the Reduction of Transportation Costs

Sigma was introduced as a business initiative to ‘produce high-level results, improve work processes, and expand all employees’ skills and change the culture. This introduction was followed by the well-revealed implementation of six sigma at General Electric beginning in 1995. Sigma is the Greek letter that is a statistical unit of measurement used to define the standard deviation of a population. It measures the variability or spread of the data. Six Sigma in general is also a measure of variability. It is a name given to indicate how much of the data falls within the customers’ requirements. The higher the process sigma, the more of the process outputs, products and services, meet customers’ requirements – or, the fewer the defects. This determination is shown in Figs. 1 and 2. [4, 5]

[1] Effects of moving the mean

With performance at 2 sigma level, - 69.146% of products and/or services meet customer requirements with 308,538 defects per million opportunities. With performance at 4 sigma level 99.379% of products and/or services meet customer requirements. But there are still 6,210 defects per million opportunities and with performance at 6 sigma levels, 99.99966% – as close to flaw-free as a business can get, with just 3.4 failures per million Opportunities (e.g., products, services or transactions).
DMAIC CYCLE

The six sigma method has two major perspectives. Its origin comes from statistics and statisticians. The real focus of six sigma methodology is to reduce potential variability in processes and products by define measure analyze improve control (DMAIC) cycle. DMAIC is an abbreviation which consists of first letters of lean 6 sigma improving process.

[3] Sigma level vs. cost of poor quality

This method consists of Define, Measure, Analyze, Improve and Control phases and is used to improve existing product and services to lean six sigma qualities. Recently, this approach has been used extensively in reducing completion times and scrap reduction especially in the automotive industry. For bringing out real root causes, it uses the data and appropriate statistical methods. Thus the effort which is needed will be minimized to generate and test solutions. This method in summary, Focuses on “real problems” directly related to the bottom-line.

- Realizes results in 4-6 months.
- Utilizes multiple tools and techniques including rigorous statistical methods.
- Sustains improvement over the long-term.
- Disseminates improvement throughout the organization.
- Acts as an agent of change.
PHASES OF DMAIC CYCLE

Define phase: In this phase, the purpose is to identify and/or validate the improvement opportunity develop the business processes, define critical customer requirements, and prepare them to be an effective project team.

Measure phase: The purpose of this phase is to identify critical measures that are necessary to evaluate the success meeting critical customer requirements and begin developing a methodology to effectively collect data to measure process performance. To understand the elements Of the Six Sigma calculations and establish baseline sigma for the processes the team is analyzing.

Analyze phase: The purpose of this phase is to stratify and analyze the opportunity to identify a specific problem and define an easily understood problem statement. To identify and validate the root causes that assure the elimination of “real” root causes and thus the problem the team is focused on.

Improve phase: The purpose of this phase is to identify, evaluate, and select the right improvement solutions. To develop a change, management should approach to assist the organization in adapting to the changes introduced through the possible solution implementation.

Control phase: The purpose of this phase is to understand the importance of planning and executing against the plan and determine the approach to be taken to assure achievement of the targeted results. To understand how to disseminate lessons learned, identify replication and standardization opportunities/processes, and develop related plans. In this paper, the following tools are actively used: for define phase, fishbone diagrams (also called Ishikawa diagrams, cause-And-effect diagrams or Fishikawa) which Common uses of the fishbone diagram are product design and quality defect prevention, to identify potential factors causing an overall effect. Each cause or reason for imperfection is a source of variation. Causes are usually grouped into major categories to identify these sources of variation. For measure, analyze and improve phases, the mathematical software Minitab 15.0 is used. As explained before, in this paper, the elements of six sigma and the DMAIC cycle will be applied to a pipe Manufacturing Company in order to reduce its transportation costs. Its results and possible improvements of the transportation system will be explained [6]

Transportation Model: In a transportation problem, we have certain origins, which may represent factories where we produce items and supply a required quantity of the products to a certain number of destinations. This must be done in such a way as to maximize the profit or minimize the cost. It gets its name from its application to problems involving transporting products from several sources to several destinations. The formation can be used to represent scheduling problems as well as transportation and distribution problems. The two common objectives are to

- Minimize the cost of shipping \( m \) units to \( n \) destinations or
- Maximize the profit of shipping \( m \) units to \( n \) destinations.
Thus we have the place of production as origins and the place of supply as destinations. Sometimes the origins and destinations are also termed as sources and sinks. In this study Author formulates a “2 Dimensional model” (3*3 matrix) using distance of supplier location and volumetric weight of components. Then the transportation model is used as a statistical tool to minimize the Logistics cost [8]

Where,

Distance is categorized into 3 sub-groups (KMs) (X < 500 KM, 500< Y>2000, Z> 2000)
Part Volume is categorized into 3 sub-groups (Cubic Meters) (A < 0.1, 0.1 < B > 1, C>1)

Logistics Cost = Cost function of (AX + AY+AZ+BX+BY+BZ+CX+CY+CZ)

DECISION MAKING TOOLS

Multi-Criteria Decision Making (MCDM)
In order to take decision on the optimized solution, the multi criteria decision model is formulated .The change of supplier location to optimize the distance not only reduces the transportation costs, but also affects other cost Elements like the cost of the goods, inventory and reliability.

AHP: The AHP is a comprehensive and rational framework for structuring a multi-criteria decision problem. The advantages of using AHP in this problem are twofold: enabling relative supplier evaluation, and the embodiment of relative criteria significance in decision making. Typically an analytical evaluation function would evaluate each supplier independently, whereas in AHP they may be evaluated relative to each other. Criteria weights used to select suppliers may also be relative. [3]

GA: Using a genetic algorithm, we fine-tune the AHP process, so that the agents are able to optimize not only their decisions, but also their decision making strategy by gaining feedback through the objective functions. The embodiment of evolutionary MCDM to agents is a novel concept that could lead to agent decision optimality. [9]
CONCLUSION

In this study, two dimensional transportation models is proposed to find the best least cost distribution in order to optimise logistic cost and maximize revenue. The proposed model should offer potential opportunity to policy making, and achieve consistent, traceable decision making on raw material procurement strategy. There are, however, fundamental questions to be addressed before introduction of proposed transportation least cost solution to business applications. Typically supply chain Logistics interactions are complex and many. The strategy of choosing raw material supplier and changing supply base location to reduce the logistic cost involves multiple functions, competition and multiple optimization objectives. In line with these observations, Author has devised a model that involves multiple criteria decision making tools for Logistic cost minimisation and revenue maximisation.

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