Optimization Of Supply Chain Logistics Network Using Genetic Algorithm

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Abstract- *In General third logistics service providers (3PLs) are becoming more vital in supply chain management. Most number of clients, particularly in warehousing and transportation services, expect 3PLs to improve lead times, fill rates, inventory levels, and so on. As a result, these 3PLs are under pressure to satisfy a variety of clients' service needs in a fast-paced and unpredictable mark etc. As a result, in this paper, we propose a hybrid optimization approach to allocate the customers to the warehouses at an optimized manner for 3PLs in consideration of the performance of the warehouses. The optimization model uses a genetic algorithm and MATLAB7.0 get the optimized result to this problem dynamic distribution network structures.*

Keywords- 3PLs, MATLAB 7.0, Algorithm, WH, GA

I. INTRODUCTION

1.1 Supply Chain Management

A supply chain is a network of facilities and distribution options that handle the sourcing of materials, their transformation into intermediate and finished goods, and their distribution to consumers.

Executives and managers in manufacturing, buying, and investment management may benefit from supply chain management methods, software, and techniques.

The central aim of supply chain management, to have the right products in the right qualities at the moment at minimal cost, is translated into the interrelated issues of customer satisfaction, inventory management, and flexibility.

The locations of manufacturing, storage, and transportation-related facilities, as well as the allocation of capacity and functions to each facility, are all part of the supply chain network design process. Since network design decisions decide the supply chain structure and set constraints under which inventory, transportation, and information can be used, they have a major impact on performance.

1.2 Logistics

The term "logistics" means movement of material associated with storing, transporting, and distribution a firm's goods to its customers. The art and science of managing and controlling the movement of products, energy, information, and other resources from the point of origin to the point of sale is known as logistics. Companies must effectively store, transfer, and transport goods while maintaining inventory levels low to keep supply chains running smoothly. Outsourcing necessitates a greater degree of participation from logistics service providers in maintaining an entire facility, supplying fast transpiration services, or executing sub-processes. Inbound and outbound costs must be reduced at the same time, while procedures, flexibility, and customer support must be enhanced.

This whole situation must be sponsored across the supply chain, whether you're dealing with a distribution center or a manufacturing warehouse.

1.2.1 Process of Logistics

- Complete stock transparency, to allow companies to know what is in the warehouse.
- Trace and track the history of the warehouse processes in Detail for each individual article
- Improve the accuracy of deliveries, thus increasing customer satisfaction.
- Option to use mobile data entry and work in a paper - free environment.
- Build optimal loads with the routing and scheduling allowing a close collaboration between shipper and carrier via optimized carrier selection and tendering
- Operational shipping, manifesting, freight costing, freight settlement, and foreign trade are always transparent to company.

1.2.2 TYPES OFLOGISTICS

Logistics is divided into two types based on its working.

They are as follows.

- Inbound Logistics
- Outbound Logistics

Here inbound logistics meant specially for material handling and the outbound is mainly for transportation. Our problem deals with the outbound logistics.

1.2.3 OUTBOUNDLOGISTICS

Once produced, goods need to be delivered to customers in a cost - effective way that still meets expectations regarding service and availability. The outbound Logistics puts its extensive experience in warehousing and distribution of finished goods at the disposal of clients worldwide.

The increase in competition and the swings in the economy in the last few years are forcing Indian firms to cut costs and improve customer service. With the induction of technology and better manufacturing practices in the last few years, many firms feel the scope to improve efficiency within the factory premises has substantially narrowed. However, the situation is quite different when it comes to outbound logistics.
The outbound logistics mainly focus on the transportation of the good from the manufacturer to the customer through warehouses. In this time the allocation of the customer to the warehouses is an essential one. So, the outbound logistics firm mainly focuses on warehouse allotment.

1.2.4 Functions of Outbound Logistics

- Transportation of the goods.
- Allocation of warehouses
- Warehouse management
- Material handling
- Order picking
- Labeling
- Customer Service

1.3 STATERGY OFLOGISTICS

1.3.1 Outsourcing

Outsourcing is nothing new. For a decade companies that don't consider the movement and storage of goods to be core competency have outsourced these activities to 3PL firm. Outsourcing is nothing but the purchase of material or any other mean form the other domestic or international firm in order to concentrate in their core part. Outsourcing does not involve only the materials and goods and also include the transportation, marketing etc. Sourcing is simply defined as buying a product or service from outside the other organization, rather than producing or providing it within the organization.

Most of the companies purchase materials outside the firm either domestically or internationally. The reason for outsourcing ranges from lower cost to better quality. The various reasons are given below

- Focus on core competencies
- Logistics cost reduction
- Improved customer service
- Productivity improvement
- Assessing to emerging technology
- Diverting capital investment

1.3.2 Third Party Logistics(3pl)

The term third party logistics has come to be more and more widely used; it doesn't have a standard definition. In general, it can be divided into two parts. The first one is the "Logistics". The general meaning of the Third Party is an "a person other than the two main people concerned in an agreement, contract and law case etc". Also, it can be termed as a person who were not directly related to the company

A third-party logistics provider is a firm that provides outsourced or third-party logistics services to companies for part or sometimes all of their supply chain management function. Third party logistics providers typically specialize in integrated warehousing and transportation services that can be scaled and customized to customer's needs based on market conditions and the demands and delivery service requirement for their products and materials.

1.3.3. Fourth Party Logistics(4pl)

Fourth - party logistics (4PL), Lead Logistics Provider or 4th Party Logistics, is a term coined by global consulting firm Accenture:

"A 4PL is an integrator that assembles the resources, capabilities, and technology of its own organization and other organizations to design, supply chain solutions." of their supply chain management function A 4PL uses a 3PL to supply service to customers, owning only computer systems and intellectual capital. It has been argued that a 4PL is the same thing as a "Non Asset - Based3PL.".

1.4 PROBLEMS FACEDINDUSTIES

We made a pre structured interview with the officials of various 3PL service provider and with reference to the various journals se found that the 3PL provider are facing the following problem like Balancing allocation of customers to the warehouses So we made a study for the Supply chain management and a decision-making system for the optimized customer allocation in warehouse using MATLAB 7.0 is basis of Genetic Algorithm

II. METHODOLOGY

In an integrated distribution system, a warehouse serves a variety of functions. It can be used as a transportation hub Warehousing also acts as a reservoir for the production overflow. This function, known as stockpiling, can take a variety of forms, including seasonal production, level demand, level production and seasonal demand. Warehouse also acts as products mixing sites. The facilities can stock a variety of production lines, Warehouse also facilities in the production. A ware house can assist production by receiving products almost complete, and then performing final subassembly based on local customer demand. Warehouse act as safety valves implant strikes, supplies is likely the warehouses to re extra inventory to reduce the chance of a stock out at the consumer level.

Basic function of warehouse includes the movement, storage, and information transfer. To store a product properly, movement is necessary. It takes place in four distinct areas.

- Receiving in bound goods from the transportation carriers and performing quality and quality checks.
- Transferring goods from the receiving docks and moving them to specify to specific storage locations throughout the warehouse.
- Order selecting the products for the filling customers orders including checking, packing, and transporting to the outbound dock.
- Shipping the goods out bound to customers by some forms of transportation.

2.1 CUSTOMER ALLOCATION INWAREHOUSE

The allocation of the customers is an important one in maintaining the balance of the supply chain. Here every customer should be allocated to any one of the warehouses at least. Same time warehouses should contact all the customers. A typical allocation of the warehouse to the customers as shown in .Fig1

1. The number of customers is ‘n’
2. The number of warehouses is ‘m’

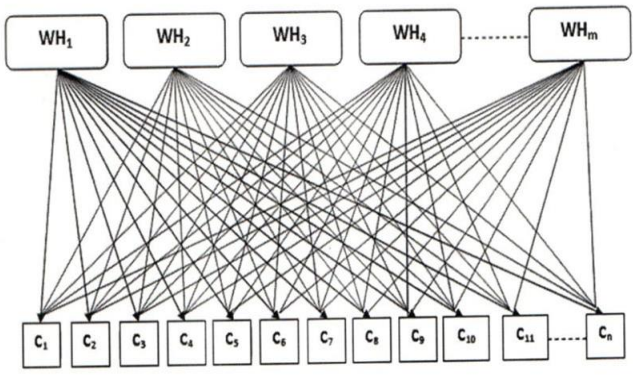


Fig.1

2.2 SINGLE ECHELON SUPPLY CHAIN ALLOCATION

In this we have to allocate the customer in the ware house in minimum cost. But is impossible to do manually, because the no ofcustomerandthenoofwarehouseissomanyfora3PLprovider so the manipulation of the customer is so difficult.

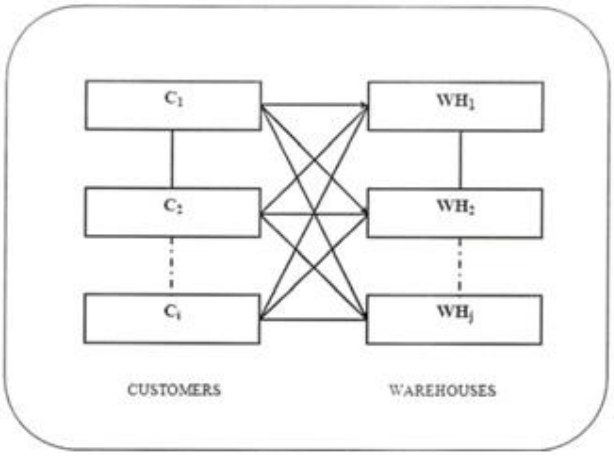


Fig.2

Indices

i = number of customers, i € {1,2,….i}
j = number of warehouse, j € {1,2,….j}

2.3 PROPOSEDGA

The solution procedure for the proposed GA is developed using MATLAB. The following steps are typical representation of how we have solved the problem. Here the steps are illustrated with 2 customers and 5warehouses.

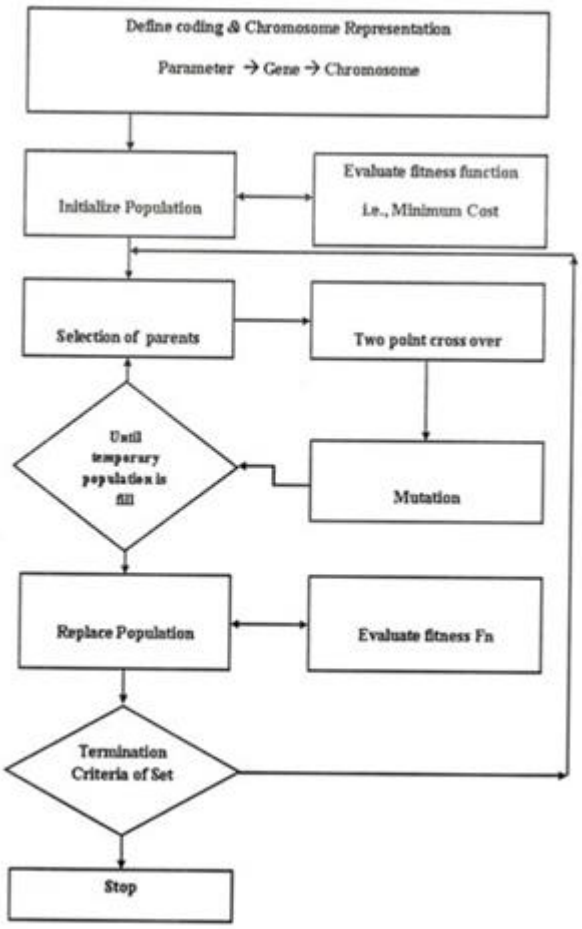


Fig.3

2.3.1 INITIALIZATION

In this application, the chromosomes is as shown below corresponds to det of shipment from warehouse to customers. The length of the string is based on the number of warehouse and j customers, the length of string is given as shown in equation

$$\text{Length of string} = i * j$$

E.g. If there two warehouse and five customers, the length of the string will be Ten. The Chromosomes are selected randomly.

Chromosomes	1	0	0	1	1	0	1	0	1	1

2.3.2 FITNESS ANDSELECTION

The fitness function minimize distribution cost and is directly taken as fitness value. A selection procedure an opportunity to deliver a gene of a goof solution to the next generation. In this application tournament selection is used.

2.3.3 CROSSOVER

The crossover operation exchanges information among the chromosomes at a crossover point, which is the meeting of substrings in this case. It states with the probability expected number of the randomly generated chromosomes that undergo the crossover operation. A typical case is illustrated in the.Fig.4

Typical two-point crossover for the proposed GA String before two-point mating

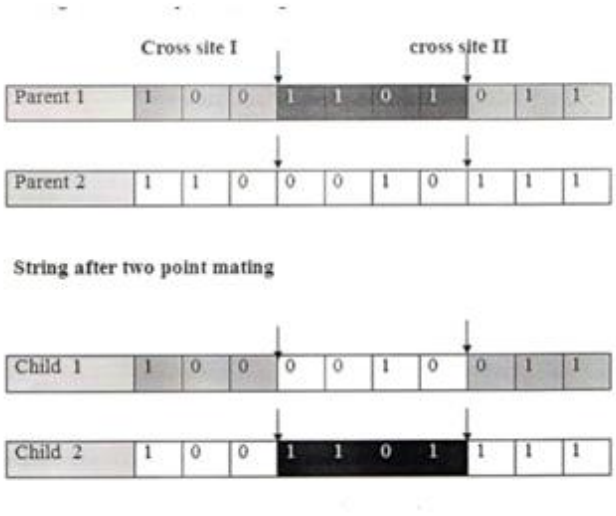
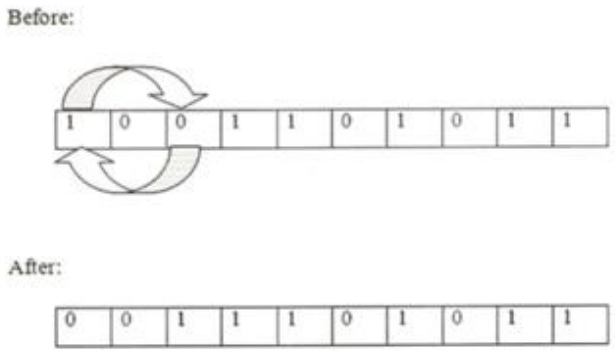


Fig.4

2.3.4 MUTATION

An important part of genetic algorithm is mutation, where each bit of the individuals in the new generation is reversed with a small probability. This mutation probability chosen to be around. 0.01. The idea of mutation is to increase the randomness of the algorithm, which again help stop prevent the convergence to a local optimum namely known as Gladson Exports. They were doing logistics throughout all over India. They are having warehouses in 10 major cities in India. They have a major problem in allocating their customer to the warehouse. So we are decided to take this problem as a case study and found a solution for that problem. The following figure.5 represents their branches all over India.

2.3.5 TERMINATTIONCRITERIA



In this application, the number of generations is used as a termination criterion, and the user may change it in the software. The program is allowed to run until the maximum of generation is equal to the termination criteria. In this case the termination criteria are Thousand generations.

III. ANALYSIS

We have taken this problem from a 3PL concern namely known as Gladson Exports. They were doing logistics throughout all over India. They are having warehouses in 10 major cities in India. They have a major problem in allocating their customer to the warehouse. So we are decided to take this problem as a case study and found a solution for that problem. The following figure.5 represents their branches all over India.

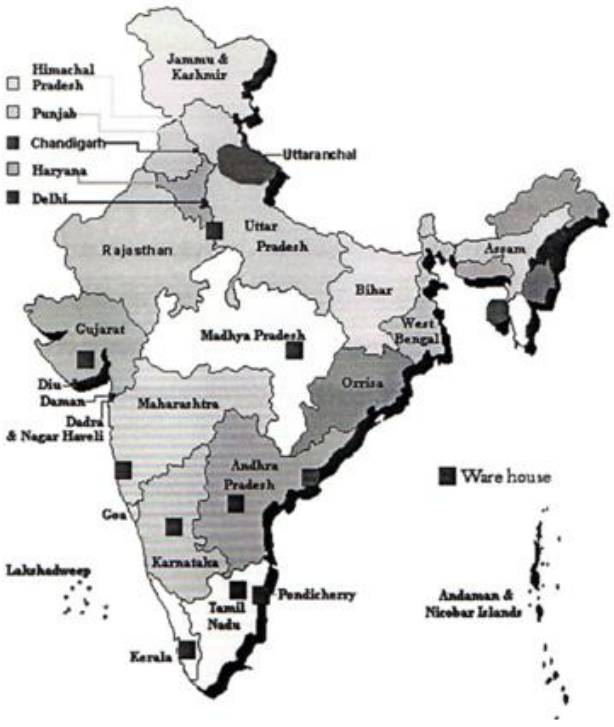


Fig.5

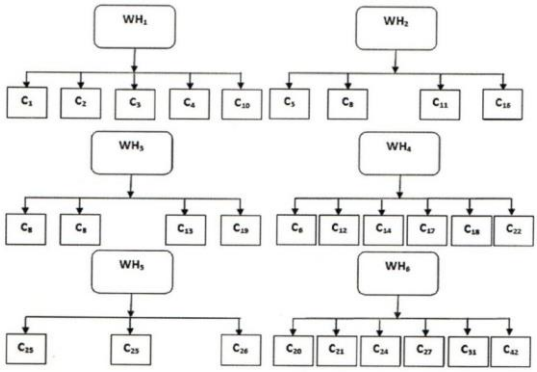
Now it is the time to articulate the research work with ideas gathered in above steps by adopting any of below suitable approaches:

3.1 Parameters for GA Computation

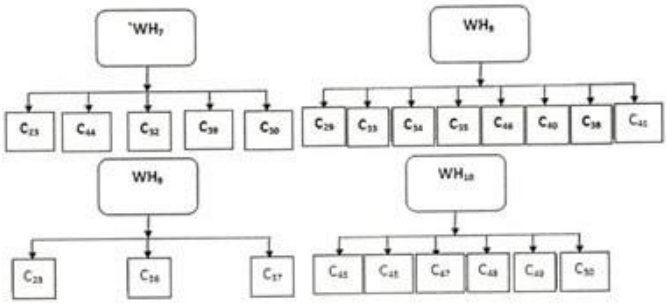
TOTAL NO OF GENERATIONS	1000
TOTAL NO OF POPULATION	20
CROSSOVER RATE (P_c)	0.9
MUTATION RATE (P_m)	0.01
REPERODUCTION	TOURNAMENT
CROSSOVER TYPE	TWO POINT
MUTATION TYPE	FLIP BIT
TOTAL NO OF CUSTOMERS	50
TERMINATION CRITERIA= NO OF GENERATIONS	1000

These above tables are the real time data obtained throughout; the program developed in MATLAB. The tables show the variation in the fitness value for every generation

3.2 Allocation of Warehouses



Total Transportation cost = Rs. 435.2/-



IV. CONCLUSION

The balanced allocation problem to date has received little attention from academicians alike despite practical importance to a seem less supply chain practice. In our project

we decision supporting system using genetic algorithm to solve the allocation of customer to the warehouses which is known to be NP- hard problem. Future research endeavors can also tackle the allocation problem of varying capacity and commodities of distribution centers.

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