IJDACR
International Journal Of Digital Application & Contemporary Research

Performance Analysis of Genetic Algorithm over Supply Chain Management

Kamlesh Prajapat
kamlesh.prajapat99@gmail.com

S. S. Chouhan
sschouhan@jitechno.com

Abstract— **Efficient and effective management of the supply chain improves the service provided to the end user. Efficient management is a complex process which comprises the management of whole supply chain. In this paper, a novel approach based on Genetic Algorithm has been proposed to solve supply chain. Simulation is of both long and short supply chain is done using proposed method. Result shows the impact of GA on supply chain management.**

Keywords—**Supply chain management, Genetic Algorithm, Optimization.**

I. INTRODUCTION

This All companies around the world are finding a powerful source of competitive advantage. It's called supply-chain management (SCM) and it comprises all of those integrated activities which bring product to market and satisfied customers. The Supply Chain Management Program contains topics from manufacturing operations, purchasing, transportation, and physical distribution etc. into a unified manner. Successful supply chain management coordinates and integrates all of these activities into a fine process. Simply stated, "The supply chain encompasses all of those activities associated with moving goods from the raw-materials stage through to the end user"[1]. Supply chains comes to the companies and the business activities needed to design, make, deliver, and use a product or service. Businesses depend on their supply chains to provide them with what they need to survive. Every business fits into one or more supply chains. The term "supply chain management" arose in the late 1980s and came into widespread use in the 1990s. Prior to that time, businesses used terms such as "logistics" and "operations management" instead. Some definitions of a supply chain are given as: "A supply chain is the alignment of firms that bring products or services to market" [2], while chopra and meindl said that "A supply chain consists of all stages involved, directly or indirectly, in fulfilling a customer request. The supply chain not only includes the manufacturer and suppliers, but also transporters, warehouses, retailers, and customers themselves" [3], according to Ganeshan and Harrison "A supply chain is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and the distribution of these finished products to customers" [4]. Thus we can say that the Supply chain management (SCM) is the management of a network of interconnected businesses involved in the provision of product and service packages required by the end customers in a supply chain. Supply chain management spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point of origin to point of consumption [5]. The concept of Supply Chain Management is based on two ideas. The first is that every product that reaches an end user represents the cumulative effort of all organizations. These all organizations are referred to collectively as the supply chain. The second idea is that while supply chains have existed for a long time, it should concerned that it delivers products to the final customer.

In this paper, a novel and efficient approach using Genetic Algorithm has been developed in MATLAB solving supply chain management. For Simulation we have taken two type of supply chain, one is short supply chain and long supply chain. Short supply chain has only one bridge between supply and demand, while long supply chain include three bridges as raw material distributer to manufacturing plant, manufacturing plant to supplier and supplier to demand places. Section two of this paper is the supply chain, section three describes genetic algorithm, section four describes the simulation and results and at the end conclusion.

II. SUPPLY CHAIN

There is a basic pattern for supply chain management. Each supply chain has its own unique set of market demands and operating challenges. Supply chain that we have consider here contains following:

IJDACR
ISSN: 2319-4863

IJDACR
International Journal Of Digital Application & Contemporary Research

International Journal of Digital Application & Contemporary research
Website: www.ijdacr.com (Volume 1, Issue 6, January 2013)

1. **Raw Material:** A raw material or feedstock is the basic material from which a good product is manufactured or made, frequently used with an extended meaning [5].
2. **Manufacturing**: Manufacturing is the process of converting raw material to good product. This is the most important process of a supply chain.
3. **Supplier:** To distribute the product to the end users, the link is known as supplier. Supplier is the key to deliver product to end user.
4. **Demand places:** This is the last part of supply chain, it is the group of end user who pays for product. Profit and loss depends on this part of supply chain.

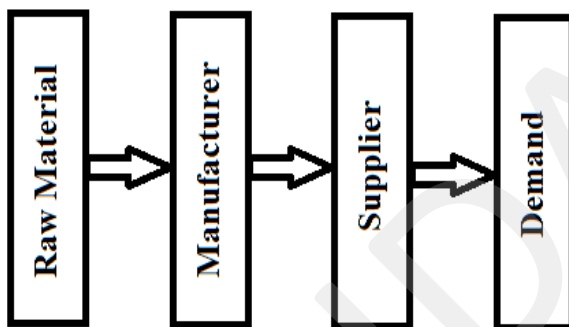Thus we can conclude supply chain as shown figure below:

Fig. 1- Basic Block of Supply Chain

III. GENETIC ALGORITHM

Genetic algorithm is a heuristic search method for optimization. The Genetic Algorithms (GAs) are proposed based on Darwin's principle of survival of the fittest by Professor J. H. Halland in 1975 to solve larger scale optimization problem. GA generates a set of solution which is known as initial population where each individual is candidate solution and population including all individuals are exanimated simultaneously then best solution is achieved by repeating employing three GA operations: selection, crossover and mutation [6],[7].

GAs start with selecting an initial population, then iteratively apply operators to reproduce new populations, valuate these populations, and decide whether or not the algorithms should stop.

A typical genetic algorithm can be stated as follows:

1. Generate an initial population which is random.
2. Evaluate the population of using a fitness function.
3. Select the subset of chromosomes with better fitness value as parents.
4. Crossover the pairs of parents with given probability (Pc) to produce new population.
5. Mutate the chromosomes of new with probability (Pm) to avoid early trap into local solutions.
6. Again evaluate the fitness values of offspring.
7. Terminate algorithms if the stopping criteria are satisfied else go to step 2.

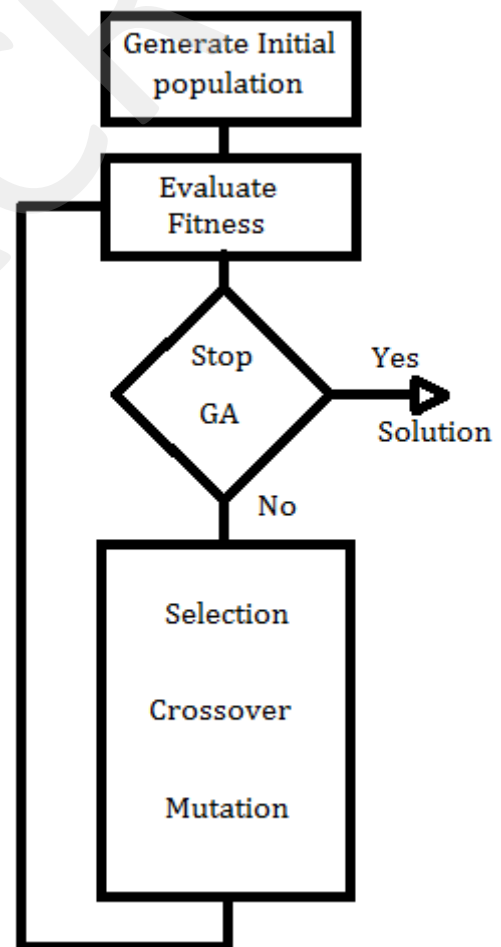All the steps which are stated above can be given as in figure below:

Fig. 2- Genetic Algorithm

IJDACR
International Journal Of Digital Application & Contemporary Research

International Journal of Digital Application & Contemporary research
Website: www.ijdacr.com (Volume 1, Issue 6, January 2013)

IV. SIMULATION AND RESULTS

Simulation is carried out using MATLAB R2009a. For Simulation we have taken two type of supply chain, one is short supply chain, has only one bridge between supply and demand and long supply chain which include three bridges as raw material distributer to manufacturing plant, manufacturing plant to supplier and supplier to demand places.

Simulation is performed over many supply chain problem, here we showing one of them, for short supply chain.

A. Problem

Number of supply points: 3
Number of demand points: 5

Capacity of Factory-1: 20
Capacity of Factory-3: 30
Capacity of Factory-3: 10

Demand at place-1: 7
Demand at place-1: 10
Demand at place-1: 10
Demand at place-1: 20
Demand at place-1: 3

Cost Matrix: Supply to demand:

	D1	D2	D3	D4	D5
F1	10	20	10	10	20
F2	8	10	21	20	6
F3	10	15	20	22	9

B. Arbitrary Solution
Supply Plan:

	D1	D2	D3	D4	D5
F1	3	0	6	10	0
F2	4	7	2	7	3
F3	0	3	2	3	0

Total Cost: 643

C. Solution by GA
Supply Plan:

	D1	D2	D3	D4	D5
F1	0	0	6	13	0
F2	7	9	0	7	3
F3	0	1	4	0	0

Total Cost: 589

V. CONCLUSIONS

We have proposed an efficient methodology that uses Genetic algorithm which is aimed at reducing the total supply chain cost. The proposed approach is implemented and its performance was evaluated using MATLAB 7.8. The performance of Genetic Algorithm was well as predicted. It is showing in results that cost of system is reduced with GA. This inspired us to apply GA on long supply chain and results for that is also satisfactory.

REFERENCES

[1] Sotiris Zigiaris, "Supply Chain Management", January 2000.

[2] Lambert, Stock, and Ellram, "Fundamentals of Logistics Management, 1998, Irwin/McGraw-Hill, Chapter 14.

[3] Supply Chain Management: Strategy, Planning, and Operations (Chopra, Sunil, and Peter Meindl, 2001, Supply Chain Management: Strategy, Planning, and Operations, Upper Saddle River, NJ: Prentice-Hall, Inc. Chapter 1).

[4] Ganeshan, Ram, and Terry P. Harrison, 1995, "An Introduction to Supply Chain Management," Department of Management Sciences and Information Systems, 303 Beam Business Building, Penn State University, University Park, PA.

[5] http://en.wikipedia.org/wiki/Supply_chain_management.

[6] D.E. Goldberg. Genetic Algorithms in Search, Optimization, and Machine Learning. (Addison-Wesley, New York, 1989).

[7] J.H.Holland, Adaptation in Natural and Artificial Systems (University of Michigan Press, 1975; MIT, London, 1992).

[8] Sarmiento, A. Rabelo, L. Lakkoju, R. Moraga, R., "Stability analysis of the supply chain by using neural networks and genetic algorithms", Proceedings of the winter Simulation Conference, 2007, pp. 1968-1976.

[9] Joines J.A., & Thoney, K, Kay M.G, "Supply chain multi-objective simulation optimization", Proceedings of the 4th International Industrial Simulation Conference Palermo,2008, pp. 125-132

[10] Beamon BM, (1998), "Supply chain design and analysis: models and methods", International Journal of Production Economics, Vol: 55, No.3, pp 281–294.

[11] Mileff, Peter, Nehez, Karoly, "A new inventory control method for supply chain management", 12th International Conference on Machine Design and Production, 2006.

[12] P.Radhakrishnan, M.R.Gopalan, N.Jeyanthi (2010), "Design of Genetic Algorithm Based Supply Chain Inventory Optimization with Lead Time" IJCSNS International Journal of Computer Science and Network Security, 2010 vol.10 , no.4,pp 238-246.