iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** VIII **Month of publication:** August 2019

DOI: http://doi.org/10.22214/ijraset.2019.8070

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue VIII, Aug 2019- Available at www.ijraset.com

Green Supply Chain Inventory System of Cement Industry for Warehouse with Inflation using Particle Swarm Optimization

Sachin Kumar[1], Ajay Singh Yadav[2], Navin Ahlawat[3], Anupam Swami[4]
[1]Research Scholar, Mewar University Raj. India
[2]Department of Mathematics, SRM Institute of Science and Technology, Delhi-NCR Campus Ghaziabad, Uttar Pradesh, India
[3]Department of Computer Science, SRM Institute of Science and Technology, Delhi-NCR Campus Ghaziabad, Uttar Pradesh, India
[4]Department of Mathematics, Government Post Graduate College, Sambhal, Uttar Pradesh, India

Abstract: Green Supply Chain inventory system of Cement industry for Warehouse with inflation using Particle swarm optimization to optimize inventory in the whole Green Supply Chain inventory system of Cement industry. We focus on to specifically determine the dynamic nature of the excess stock level and shortage level required for inventory optimization in the Supply Chain of Alcoholic beverage industry such that the total Green Supply Chain inventory system of Cement industry for Warehouse with inflation using Particle swarm optimization concerns cost is minimized. The complexity of the problem increases when more products and multiple agents are involved in Green Supply Chain inventory system of Cement industry for Warehouse with inflation using Particle swarm optimization concerns process that has been resolved in this work. Here, we are proposing an optimization methodology that utilizes the Particle swarm optimization, one of the best optimization algorithms, to overcome the impasse in maintaining the optimal stock levels at each member of the Green Supply Chain inventory system of Cement industry for Warehouse with inflation using Particle swarm optimization. We apply our method on four member of Green Supply Chain inventory system of Cement industry for Warehouse with inflation using Particle swarm optimization.
Keywords: Green Supply Chain, inventory system, inflation, Warehouse and Particle swarm optimization.

I. INTRODUCTION

Green Supply Chain inventory system of Cement industry for Warehouse with inflation using Particle swarm optimization can be defined as "Green Supply Chain inventory system of Cement industry for Warehouse with inflation using Particle swarm optimization can is the coordination of production, inventory, location and transportation among the participants in a Green Supply Chain inventory system of Cement industry for Warehouse with inflation using Particle swarm optimization can to achieve the best mix of responsiveness and efficiency for the market being served." After a literature review it is realized that there are some flaws in the earlier researches. In the area of integrated inventory models, above-mentioned situations are rarely put together with Supply Chain of Cement industry management of Cement industry for Warehouse with inflation using Particle swarm optimization can. On the other hand, minimization of the cost attracts the attention of few researchers in recent years for the inventory models, but they only considered one side of the Supply Chain of Cement industry, which is either the buyer or the vendor side. As it is mentioned earlier, nowadays integration of entities is really essential in order to be successful in the competitive market in a Green Supply Chain inventory system of Cement industry for Warehouse with inflation using Particle swarm optimization can. Unfortunately, the researchers who studied the market changes did not concern about this key issue of the Green Supply Chain inventory system of Cement industry. Based on all researches and shortcomings mentioned above, this thesis incorporates the integrated inventory model under with products experiencing continuous cost decrease for a successful Green Supply Chain inventory system of Cement industry for Warehouse with inflation using Particle swarm optimization can of technology-related industries.

A. Inflation

In case there is an expectation of inflation in time to come the EOQ model will not work. The reason being that due to inflation the interest rates will rise which will increase the carrying cost. The firm therefore can go for anticipatory buying that is trade in expectation of a price augment to procure goods at current lower costs. But there is cost of funds blocked in this extra inventory. The firm in this case has to trade off between expected price increase and the increasing carrying cost. The other alternative before the firm is that the expected increased carrying cost may consider finding out the EOQ. In the EOQ model value of 'c' i.e the carrying cost per unit per annum can be increased resulting in lower EOQ. It may be noted that in EOQ model cost per unit is not considered.

B. Particle Swarm Optimization

Particle swarm optimization is initialized by a population of random solution and each potential solution is assigned a randomized velocity. The potential solutions called particles are then flown through the problem space. Each particle keeps track of its coordinates in the problem space which are associated with the best solution or fitness achieved so far the fitness value is also stored this value is called p-best. Another best value that is tracked by the global version of the PSO is the overall best value and its location obtained so far by any particle in the population. This value is termed g-best.

Thus at each time step the particle change its velocity and moves towards its p-best and g-best this is the global version of PSO when in addition to p-best each particle keeps track of the best solution called n-best or l-best attained within a local topological neighbourhood of the particles the process is known as the local version of PSO.

II. LITERATURE REVIEW

Narmadha at. al. (2010) proposed Multi-Product Inventory Optimization using Uniform Crossover Genetic Algorithm. Radhakrishnan et. al. (2009) gives a inventory optimization in Supply Chain Management using Genetic Algorithm. Singh and Kumar (2011) gives a inventory optimization in Efficient Supply Chain Management. Priya and Iyakutti (2011) proposed Web based Multi Product Inventory Optimization using Genetic Algorithm. Thakur and Desai (2013) a study inventory Analysis Using Genetic Algorithm In Supply Chain Management. Khalifehzadeh et. al. (2015) presented a four-echelon supply chain network design with shortage: Mathematical modelling and solution methods. Kannan et. al. (2010) Discuss a genetic algorithm approach for solving a closed loop supply chain model: A case of battery recycling. Jawahar and Balaji (2009) Proposed A genetic algorithm for the two-stage supply chain distribution problem associated with a fixed charge. Zhang et. al. (2013) presented A modified multi-criterion optimization genetic algorithm for order distribution in collaborative supply chain. Che and Chiang (2010) proposed A modified Pareto genetic algorithm for multi-objective build-to-order supply chain planning with product assembly. Yimer and Demirli (2010) Presented A genetic approach to two-phase optimization of dynamic supply chain scheduling. Wang, et. al. (2011) Proposed Location and allocation decisions in a two-echelon supply chain with stochastic demand – A genetic-algorithm based solution. Humphreys, et. al. (2009) presented Reducing the negative effects of sales promotions in supply chains using genetic algorithms. Sherman et. al. (2010) gives a production modelling with genetic algorithms for a stationary pre-cast supply chain. Ramkumar, et. al. (2011) proposed Erratum to "A genetic algorithm approach for solving a closed loop supply chain model: A case of battery recycling". Ye et. al. (2010) Proposed Some improvements on adaptive genetic algorithms for reliability-related applications. Guchhait et. al. (2010) presented Multi-item inventory model of breakable items with stock-dependent demand under stock and time dependent breakability rate. Changdar et. al. (2015) gives an improved genetic algorithm based approach to solve constrained knapsack problem in fuzzy environment. Sourirajan et. al. (2009) presented A genetic algorithm for a single product network design model with lead time and safety stock considerations. Jiang et. al. (2015) gives Joint optimization of preventive maintenance and inventory policies for multi-unit systems subject to deteriorating spare part inventory. Dey et. al. (2008) proposed Two storage inventory problem with dynamic demand and interval valued lead-time over finite time horizon under inflation and time-value of money. Jawahar and Balaji (2012) proposed A genetic algorithm based heuristic to the multi-period fixed charge distribution problem. Pasandideh et. al. (2010) gives a parameter-tuned genetic algorithm for multi-product economic production quantity model with space constraint, discrete delivery orders and shortages. Yadav et. al. (2016) proposed a cooperative Two-Warehouse Inventory Model for Deteriorating Items with Variable Holding Cost, Time-Dependent Demand and Shortages. Consider a similar model, Two Warehouse Inventory Model with Ramp Type Demand and Partial Backordering for Weibull Distribution Deterioration. put forward a model, A two-storage model for deteriorating items with holding cost under inflation and Genetic Algorithms. Singh et. al. (2016) proposed a Two-Warehouse Model for Deteriorating Items with Holding Cost under Particle Swarm Optimization. Consider a similar model, A Two-Warehouse Model for Deteriorating Items with Holding Cost under Inflation and Soft Computing Techniques. Yadav et. al. (2016) analyzed a Multi Objective Optimization for Electronic Component Inventory Model & Deteriorating Items with Two-warehouse using Genetic Algorithm. Sharma et. al. (2016) focused an Optimal Ordering Policy for Non-Instantaneous Deteriorating Items with Conditionally Permissible Delay in Payment under Two Storage Management. Yadav et. al. (2016) analyzed a Analysis of Genetic Algorithm and Particle Swarm Optimization for warehouse with Supply Chain management in Inventory control.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue VIII, Aug 2019- Available at www.ijraset.com

III. PREDICTION ANALYSIS CEMENT INDUSTRY FOR WAREHOUSE WITH INFLATION USING PARTICLE SWARM OPTIMIZATION

The proposed method uses the Particle swarm optimization to study the stock level that needs essential inventory control. This is the pre-requisite idea that will make any kind of inventory control effective. For this purpose, we are using K-mean clustering as assistance. In practice, the supply chain is of length n, means having n number of members in supply chain of Cement industry such as factory of Cement industry, Warehouse of Cement industry, distribution centers of Cement industry, suppliers of Cement industry, Agents of Cement industry and so on. Here, for instance we are going to use a four stage supply chain that is illustrated in the figure 1. Our exemplary supply chain consists of a factory of Cement industry, Warehouse of Cement industry, distribution center of Cement industry and Agents of Cement industry. In the supply chain we are illustrated, the factory is the massive stock holding area where the stocks are manufactured of Cement industry as per the requirement of the Warehouse of Cement industry. The Warehouse of Cement industry is the massive stock holding area where the stocks are manufactured of Cement industry as per the requirement distribution center of Cement industry. Then the distribution center of Cement industry will take care of the stock to be supplied for the Agents of Cement industry. As earlier discussed, the responsibility of our approach is to predict an optimum stock level by using the past records and so that by using the predicted stock level there will be no excess amount of stocks and also there is less means for any shortage. Hence it can be asserted that our approach eventually gives the amount of stock levels that needs to be held in the three members of the supply chain of Cement industry, factory of Cement industry, Warehouse of Cement industry, distribution center of Cement industry and Agents of Cement industry.

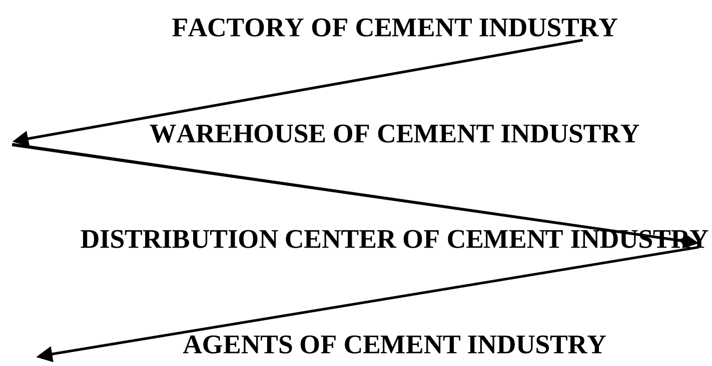

Fig 1. Four Stages Supply Chain of Cement industries

In our proposed methodology, we are for Warehouse with inflation using Particle swarm optimization for finding the optimal value. The flow of operation of our methodology is clearly illustrated, which depicts the steps applied for the optimization analysis. Initially, the amount of stock levels that are in excess and the amount of stocks in shortage in the different supply chain of Cement industry contributors are represented by zero or non-zero values. Zero refers that the contributor needs no inventory control of Cement industry while the non-zero data requires the inventory control of Cement industry. The non-zero data states both the excess amount of stocks as well as shortage amount. The excess amount is given as positive value and the shortage amount is mentioned as negative value.

The first process needs to do is the clustering that clusters the stock levels that are either in excess or in shortage and the stock levels that are neither in excess nor in shortage separately. This is done simply by clustering the zero and non-zero values. For this purpose we are using, the efficient Particle swarm optimization. After the process of Particle swarm optimization is performed, the work starts its proceedings on Particle swarm optimization, the heart of our work.

Inventory Analysis for Warehouse with inflation using Particle swarm optimization Algorithm

1: P: =0

2: $\{M_x, N_x, U_x, V_x\}_{x=1}^{X}$:= initialize()

3: for a:= 1: U

4: for b:= 1: X

5: for r:= 1: R

6: $n_{xc}^{(a+1)} = yn_{xc}^{a} + c_1 d_1 [V_{xc} - m_{xc}^{a}] + c_2 d_2 [U_{xc} - m_{xc}^{a}]$

7: $M_x^{a+1} = M_x^a + mN_x^a + \in^a$
8: end
9: M_x:= enforce Constraints(X)
10: Y_x := f(M_x)
11: if M_x ≰e ∀ e ∈ P
12: P:= {e ∈P/ e⊀M_x }
13: P:= P∪M_x
14: end
15: end
16: if $M_x \leq V_x \vee (XM_x \nprec V_x \wedge V_x \nprec M_x)$
17: V_x := M_x
18: end
19: U_x := selectGuide(X , A)
20: end
We are using those basic steps for finding the optimal resources for an organization in Medium range prospective using MATLAB software package

IV. IMPLEMENTATION RESULTS

We have implemented the analysis based on Particle swarm optimization for optimal inventory control in the platform of MATLAB. As stated, we have the detailed information about the excess and the shortage stock levels in each Cement industry Supply Chain of Cement industry member, the lead times of product stock levels to replenish each Supply Chain of Cement industry member as well as raw material lead time. The sample data having this information is given in the Table 1.

Table 1: A sample data set along with its stock levels in each member of the Cement industry Supply Chain of Cement industry

TI	F.A.G.I	W.C. I	D. C.I	A. C.I
1	741	641	544	400
2	782	685	553	451
3	723	673	528	412
4	794	617	585	422
5	755	629	511	483
6	722	631	593	434
7	767	695	574	445
8	718	676	532	496
9	766	624	561	477
10	734	613	500	468

The Table 1 is having the Six Stages - 10 Member product ID, the Six Stages - 10 Member Transportation ID, the Six Stages - 10 Member stock levels which are in excess or in Six Stages - 10 Member shortage at each Six Stages - 10 Member Supply Chain of Cement industry member. Negative values represent shortage of Six Stages - 10 Member stock levels and positive values represent the excess of Six Stages - 10 Member stock levels. The Six Stages - 10 Member transportation ID mentioned in table is working as an index in extracting the lead times for Six Stages - 10 Member stocks and Six Stages - 10 Member raw material lead times. Table2 depicts the sample data which is having the Six Stages - 10 Member transportation ID and the Six Stages - 10 Member lead times for Six Stages - 10 Member stocks. For **6** member Six Stages - 10 Member Supply Chain of Cement industries, 17 Six Stages - 10 Member lead times can be obtained.

Table 2: Sample data from Database which is having inflation

TI	F.A.G.I	W.C. I	D. C.I	A. C.I
1	710	691	542	457
2	721	686	556	469
3	730	674	544	478
4	740	663	568	485
5	752	652	539	442
6	763	646	576	401
7	775	635	522	410
8	786	622	583	420
9	797	613	517	432
10	708	608	594	440

Table 2 depicts the sample data which is having the transportation ID and the inflation. For four member's Cement industry Supply Chain of Cement industry, three inflation can be obtained.
T2 is the inflation involved for movements of the product from F. C.I to W. C.I;
T3 is the lead time involved for movements of the product from W. C.I to D. C.I;
T4 is the lead time involved for movements of the product from D. C.I to A. C.I;

Table 3: Initial random individuals

TI	F.A.G.I	W.C. I	D. C.I	A. C.I
1	121	-246	351	125
2	155	218	310	-238

For Particle swarm optimization based analysis, we have to generate random individuals having 17 numbers of particles representing product ID and seven Cement industry Supply Chain of Cement industry members. Table 3 describes two random individuals.
Similarly, Table 4 represents random velocities which correspond to each particle of the individual.

Table 4: Initial Random velocities corresponding to each particle of the individual

TI	F.A.G.I	W.C. I	D. C.I	A. C.I
1	0.121	0.151	0.121	0.141
2	0.211	0.241	0.251	0.231

The final individual obtained after satisfying the above mentioned convergence criteria is given in Table 5.

Table 5: database format of Final Individual

TI	F.A.G.I	W.C. I	D. C.I	A. C.I
1	124	-185	-236	238

The final individual thus obtained represents a product ID and excess or shortage stock levels at each of the seven members providing essential information for Cement industry Supply Chain of Cement industry inventory optimization.

V. CONCLUSION

Green Supply Chain inventory system of Cement industry for Warehouse with inflation using Particle swarm optimization is a significant component Supply Chain inventory management of Cement industry. The novel and proficient approach based on Particle swarm optimization to optimize inventory in Green Supply Chain inventory system of Cement industry for Warehouse with inflation using Particle swarm optimization. we also focus on to specifically determine the complexity in predicting the optimal stock levels and shortage level required for inventory optimization in the Green Supply Chain inventory system of Cement industry for Warehouse with inflation using Particle swarm optimization such that the total Cement industry Supply Chain inventory management of Cement industry cost is minimized .we apply our methods on Green Supply Chain inventory system of Cement industry for Warehouse with inflation using Particle swarm optimization studied model for optimization. The proposed method was implemented and its performance was evaluated using MATLAB.

REFERENCES

[1] Changdar, C., Mahapatra, G.S., and Pal, R.K. (2015) An improved genetic algorithm based approach to solve constrained knapsack problem in fuzzy environment Expert Systems with Applications, Volume 42, Issue 4, Pages 2276-2286.

[2] Che, Z.H. and Chiang, C.J. (2010) A modified Pareto genetic algorithm for multi-objective build-to-order Supply Chain planning with product assembly Advances in Engineering Software, Volume 41, Issues 7–8, Pages 1011-1022.

[3] Dey, J.K., Mondal, S.K. and Maiti, M. (2008)Two storage inventory problem with dynamic demand and interval valued lead-time over finite time horizon under inflation and time-value of money European Journal of Operational Research, Volume 185, Issue 1, Pages 170-194.

[4] Jawahar, N. and Balaji, A.N. (2009) A genetic algorithm for the two-stage Supply Chain distribution problem associated with a fixed charge European Journal of Operational Research, Volume 194, Issue 2, Pages 496-537.

[5] Jawahar, N. and Balaji, A.N. (2012) A genetic algorithm based heuristic to the multi-period fixed charge distribution problem Applied Soft Computing, Volume 12, Issue 2, Pages 682-699.

[6] Jiang, Y., Chen, M. and Zhou, D. (2015) Joint optimization of preventive maintenance and inventory policies for multi-unit systems subject to deteriorating spare part inventory Journal of Manufacturing Systems, Volume 35, Pages 191-205.

[7] Kannan, G., Sasikumar, P. and Devika, K. (2010) A genetic algorithm approach for solving a closed loop Supply Chain model: A case of battery recycling Applied Mathematical Modelling, Volume 34, Issue 3, Pages 655-670.

[8] Narmadha, S., Selladurai, V. and Sathish, G. (2010) Multi-Product Inventory Optimization using Uniform Crossover Genetic Algorithm International Journal of Computer Science and Information Security,Vol. 7, No. 1.

[9] Radhakrishnan, P., Prasad, V.M. and Gopalan, M.R. (2009) Inventory Optimization in Supply Chain management of chemical industry using Genetic Algorithm International Journal of Computer Science and Network Security, VOL.9 No.1.

[10] Ramkumar, N., Subramanian, P., Narendran, T.T. and Ganesh, K. (2011) Erratum to “A genetic algorithm approach for solving a closed loop Supply Chain model: A case of battery recycling” Applied Mathematical Modelling, Volume 35, Issue 12, Pages 5921-5932.

[11] Sharma, S., Yadav, A.S. and Swami, A. (2016) An Optimal Ordering Policy For Non-Instantaneous Deteriorating Items With Conditionally Permissible Delay In Payment Under Two Storage Management International Journal of Computer Applications Volume 140 –No.4.

[12] Singh, R.K., Yadav, A.S. and Swami, A. (2016) A Two-Warehouse Model for Deteriorating Items with Holding Cost under Particle Swarm Optimization International Journal of Advanced Engineering, Management and Science (IJAEMS) Volume -2, Issue-6.

[13] Singh, R.K., Yadav, A.S. and Swami, A. (2016) A Two-Warehouse Model for Deteriorating Items with Holding Cost under Inflation and Soft Computing Techniques International Journal of Advanced Engineering, Management and Science (IJAEMS) Volume -2, Issue-6.

[14] Singh, S.R. and Kumar, T (2011). Inventory Optimization in Efficient Supply Chain management of chemical industry International Journal of Computer Applications in Engineering Sciences Vol. 1 Issue 4.

[15] Wang, K.J., Makond, B. and Liu, S.Y. (2011) Location and allocation decisions in a two-echelon Supply Chain with stochastic demand – A genetic-algorithm based solution Expert Systems with Applications, Volume 38, Issue 5, Pages 6125-6131.

[16] Yadav, A.S., Mishra, R., Kumar, S. and Yadav, S. (2016) Multi Objective Optimization for Electronic Component Inventory Model & Deteriorating Items with Two-warehouse using Genetic Algorithm International Journal of Control Theory and applications, Volume 9 No.2.

[17] Yadav, A.S., Sharma, P. and Swami, A. (2016) Analysis of Genetic Algorithm and Particle Swarm Optimization for warehouse with Supply Chain management of chemical industry in Inventory control International Journal of Computer Applications Volume 145 –No.5.

[18] Yadav, A.S., Swami, A. and Singh, R.K. (2016) A two-storage model for deteriorating items with holding cost under inflation and Genetic Algorithms International Journal of Advanced Engineering, Management and Science (IJAEMS) Volume -2, Issue-4.

[19] Yadav, A.S., Swami, A., Kher, G. and Kumar, S. (2017) Supply Chain Inventory Model for Two Warehouses with Soft Computing Optimization International Journal Of Applied Business And Economic Research Volume 15 No 4.

[20] Yadav, A.S., Swami, A., Kumar, S. and Singh, R.K. (2016) Two-Warehouse Inventory Model for Deteriorating Items with Variable Holding Cost, Time-Dependent Demand and Shortages IOSR Journal of Mathematics (IOSR-JM) Volume 12, Issue 2 Ver. IV.

[21] Yadav, A.S., Tyagi, B., Sharma, S. and Swami, A., (2016) Two Warehouse Inventory Model with Ramp Type Demand and Partial Backordering for Weibull Distribution Deterioration International Journal of Computer Applications Volume 140 –No.4,

[22] Yimer, A.D. and Demirli, K. (2010) A genetic approach to two-phase optimization of dynamic Supply Chain scheduling Computers & Industrial Engineering, Volume 58, Issue 3, Pages 411-422.

[23] Zhang, H., Deng, Y., Chan, F.T.S. and Zhang, X. (2013) A modified multi-criterion optimization genetic algorithm for order distribution in collaborative Supply Chain Applied Mathematical Modelling, Volume 37, Issues 14–15, Pages 7855-7864.