Green Supply Chain Management For Warehouse With Particle Swarm Optimization Algorithm

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Abstract- *Green Supply Chain management for Green warehouse a technique based on Particle Swarm Optimization algorithm to optimize inventory in the whole Green supply chain. We focus on to specifically determine the dynamic nature of the excess stock level and shortage level required for inventory optimization in the Green supply chain such that the total Green Supply Chain management for Green warehouse cost is minimized. The complexity of the problem increases when more products and multiple agents are involved in Green Supply Chain management for Green warehouse process that has been resolved in this work. Here, we are proposing an optimization methodology that utilizes the Particle Swarm Optimization algorithm, one of the best optimization algorithms, to overcome the impasse in maintaining the optimal stock levels at each member of the Green Supply Chain management for Green warehouse. We apply our method on six member of Green Supply Chain management for warehouse studied model for optimization*.

Keywords- Green Supply Chain, one green warehouse, one green distribution centres, one-green agents and Particle Swarm Optimization algorithm

I. INTRODUCTION

Green Supply chain management can be defined as "Green Supply chain management can is the coordination of production, inventory, location and transportation among the participants in a Green Supply chain management 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 Green Supply chain management 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, 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 management can. Unfortunately, the researchers who studied the market changes did not concern about this key issue of the supply chain management.

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 management using environmental collaboration can of technology-related industries.

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 neighborhood of the particles the process is known as the local version of PSO

II. LITERATURE REVIEW

Yadav (2017) kept working on Electronic component inventory optimization for warehouse and economic load dispatch using genetic algorithm is a significant component of supply chain management. we have discussed a method based on economic load dispatch genetic algorithm to optimize Electronic component inventory in supply chain management and warehouse we also focus on how to specifically determine the most probable excess stock level and shortage level required for Electronic component inventory optimization in the supply chain and warehouse such that the total supply chain cost and warehouse is minimized .we apply our methods on Seven Stages - 10 Member Supply Chain, Raw material, Storage, Producer, Transporter-1 (in-bound), warehouse, Transporter-2 (out-bound), distribution centers-1, distribution centers-2, Agents-1, Agents-2 studied model for optimization. The proposed method was implemented and its performance was evaluated using MATLAB. Yadav et al (2017) explored a deterministic two-warehouse inventory model for non-instantaneous deteriorating items with constant demand and permissible delay period in payment is proposed under assumption that the items are transported from RW to retails shop under continuous release pattern with the objective of maximizing the total profit function of the inventory system. First, a crisp model is developed with fixed value of parameters and corresponding fuzzy model is developed in a fuzzy environment where the parameter's values are fluctuating around a crisp value. It is observed that profit function is influenced by selling price, purchase cost, demand and holding cost rates in RW. In the different cases and sub cases discussed in the model, it is observed that in some cases, the crisp model provide the optimal solution while in some cases fuzzy model. Now it depends upon the decision maker to take decision according to the situation to optimize the profit function. Furthermore the proposed model can be used in inventory control of certain non- instantaneous deteriorating items and may be further extended by incorporating time dependent demand, probabilistic demand pattern and variable holding cost etc. Yadav (2017) kept working on inventory optimization for warehouse with logistics and economic load dispatch using genetic algorithm is a significant component of supply chain management. We have discussed a method based on economic load dispatch genetic algorithm to optimize inventory in supply chain management and warehouse with logistics we also focus on how to specifically determine the most probable excess stock level and shortage level required for inventory optimization in the supply chain and warehouse with logistics such that the total supply chain cost and warehouse with logistics is minimized .we apply our methods on Eight stage supply chain, Raw material, Storage, Producer,Transporter-1 (in-bound), warehouse, Transporter-2 (out-bound), distribution centers, Agents studied model for optimization. The proposed method was implemented and its performance was evaluated using MATLAB. Yadav, et al (2017) explored a new Genetic algorithms and Simulated Annealing has been proposed for the optimization of two warehouse inventory model with the objective of minimizing the total relevant cost. Two different cases have been considered to optimize the relevant cost. Furthermore the proposed Genetic algorithms and Simulated Annealing is very useful to optimize the cost. The Genetic algorithms and Simulated Annealing is implemented in MATLAB. The Genetic algorithms and Simulated Annealing is applied on mathematical model to optimize the cost. Consequently, it can be concluded that this Genetic algorithms and Simulated Annealing is a well-designed and promising method for optimization. Yadav, (2017) this study incorporates some realistic features that are likely to be associated with the inventory of any material. Decay (deterioration) overtime for any material product and occurrence of shortages in inventory are natural phenomenon in real situations and Economic Load Dispatch Problem Using Genetic Algorithm. Supply chain inventory shortages are allowed in the model. In many cases customers are conditioned to a shipping delay, and may be willing to wait for a short time in order to get their first choice. Generally speaking, the length of the waiting time for the next replenishment is the main factor for deciding whether the backlogging will be accepted or not. The willingness of a customer to wait for backlogging during a shortage period declines with the length of the waiting time and Economic Load Dispatch Problem Using Genetic Algorithm. Thus, supply chain inventory shortages are allowed and partially backordered in the present chapter and the backlogging rate is considered as a decreasing function of the waiting time for the next replenishment. Demand rate is taken as exponential ramp type function of time, in which demand decreases exponentially for the some initial period and becomes steady later on. Since most decision makers think that the inflation does not have significant influence on the supply chain inventory policy, the effects of inflation are not considered in some inventory models and Economic Load Dispatch Problem Using Genetic Algorithm. However, from a financial point of view, an inventory represents a capital investment and must complete with other assets for a firm's limited capital funds. Thus, it is necessary to consider the effects of inflation on the supply chain inventory system. Therefore, this concept is also taken in this model. From the numerical illustration of the model, it is observed that the period in which inventory holds increases with the increment in backlogging and ramp parameters while inventory period decreases with the increment in deterioration and inflation parameters. Initial inventory level decreases with the increment in deterioration, inflation and ramp parameters while inventory level increases with the increment in backlogging parameter. The total average cost of the system goes on increasing with the increment in the backlogging and deterioration parameters while it decreases with the increment in inflation and ramp parameters and Economic Load Dispatch Problem Using Genetic Algorithm. The proposed model can be further extended in several ways. For example, we could extend this deterministic model in to stochastic model. Also, we could extend the model to incorporate some more realistic features, such as quantity discount or the unit purchase cost, the inventory holding cost and others can also taken fluctuating with time and Economic Load Dispatch Problem Using

Genetic Algorithm. Yadav, (2017) proposed a cooperative Electronic component inventory optimization for warehouse and Economic Load Dispatch using genetic algorithm Particle Swarm Optimization Algorithm is a significant component of supply chain management. we have discussed a method based on economic load dispatch genetic algorithm to optimize Electronic component inventory in supply chain management and warehouse we also focus on how to specifically determine the most probable excess stock level and shortage level required for Electronic component inventory optimization in the supply chain and warehouse such that the total supply chain cost and warehouse is minimized .we apply our methods on Seven Stages - 10 Member Supply Chain, Raw material, Storage, Producer, Transporter-1 (in-bound), warehouse, Transporter-2 (out-bound), distribution centers-1, distribution centers-2, Agents-1, Agents-2 studied model for optimization. The proposed method was implemented and its performance was evaluated using MATLAB. 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.

III. PREDICTION ANALYSIS USING PARTICLE SWARM OPTIMIZATION ALGORITHM

The proposed method uses the Particle Swarm Optimization algorithm to study the stock level that needs essential 6-Stages and 6-Member Green Supply chain inventory control management using environmental collaboration. This is the pre-requisite idea that will make any kind of 6-Stages and 6-Member Green Supply chain inventory control management using environmental collaboration effective. For this purpose, we are using Particle Swarm Optimization algorithm method as assistance. In practice, the Green supply chain is of length m, means having m number of members in green supply chain such as Green Storage, Green Producer, Green warehouse, Green Distribution Center. Each Green distribution center further comprises of several Green agents but as stated in the example case, each Green Distribution center is having one Green agent. So, in aggregate there are one Green agents, Green Agent for Green Distribution Center so on. Each Green agents further comprises of several Green Product packaging disposal. Here, for instance we are going to use a 6-Stages and 6-Member Green Supply Chain that is illustrated in the figure 1. Our exemplary 6-Stages and 6-Member Green Supply Chain consists of a Green Storage, Green Producer, Green warehouse, Green distribution center, Green Agent, Green Product packaging disposal.

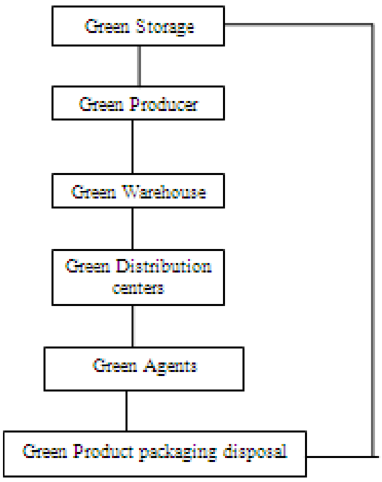

Fig 1. Six Stages - 6 Member Green Supply Chain

In the 6-Stages and 6-Member Green Supply chain inventory control management we are illustrated, the Green Raw material is the massive stock holding area where the stocks are Green Storage. The Green Producer is the massive stock holding area where the stocks are manufactured as per the requirement of the Green warehouse. Then the Green warehouse will take care of the stock to be supplied for the Green distribution center. From the Green distribution center, the stocks will be moved to the corresponding Green agents and last again recycle Green Product packaging disposal, the stocks will be moved to the corresponding Green Storage. 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 6-Stages and 6-Member Green Supply chain inventory control management using environmental collaboration, Green Storage, Green Producer, Green warehouse, Green Distribution centers, Green Agents and Green Product packaging disposal. Each distribution center further comprises of several Green agents but as stated in the example case, each Green Distribution center is having one Green agent. So, in aggregate there are one Green agents, Green Agent for Green Distribution Center. Each Green agent further comprises of several Green Product packaging disposal but as stated in the example case, each Green agent is having one Green Product packaging disposal. In our proposed methodology, we are Particle Swarm Optimization algorithm for finding the optimal value.

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 Green Supply chain inventory control management contributors are represented by zero or non-zero values. Zero refers that the contributor needs no inventory control while the non-zero data requires the inventory control. 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 algorithm. After the process of Particle Swarm Optimization algorithm is performed, the work starts its proceedings on Particle Swarm Optimization algorithm, the heart of our work.

Multi-Objective 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 $M_x \not\leq e \; \forall \, e \in P$
12: P:= {e ∈P/ e$\not\prec M_x$ }
13: P:= P∪M_x
14: end
15: end
16: if $M_x \leq V_x \vee (X M_x \not\prec V_x \wedge V_x \not\prec M_x)$
17: $V_x := M_x$
18: end
19: U_x := selectGuide(X , A)
20: end

IV. IMPLEMENTATION RESULTS

We have implemented the analysis based on Particle Swarm Optimization algorithm 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 supply chain member, the lead times of product stock levels to replenish each supply chain 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 supply chain

TI	GS	GP	GW	GD1	GA1	GPPD
1	10	20	30	40	50	10
2	20	21	31	41	51	11
3	15	21	35	45	55	25
4	12	22	32	42	52	32
5	22	22	37	46	57	45

The Table 1 is having the Green product ID, the Green Transportation ID, the Green stock levels which are in excess or in Green shortage at each Green supply chain member. Negative values represent shortage of Green stock levels and positive values represent the excess of Green stock levels. The Green transportation ID mentioned in table is working as an index in extracting the lead times for Green stocks and Green raw material lead times. Table2 depicts the sample data which is having the Green transportation ID and the Green lead times for Green stocks. For **seven** member Green supply chain, **six** Green lead times can be obtained.

Table 2: Sample data from Database which is having lead times for stocks

TI	GS	GP	GW	GD1	GA1	GPPD
1	10	22	33	33	53	12
2	21	25	39	44	24	27
3	31	28	37	55	55	15
4	25	22	36	46	66	26
5	45	24	47	27	37	18

Table 2 depicts the sample data which is having the transportation ID and the lead times for stocks. For seven member supply chain, six lead times can be obtained.
T1 is the lead time involved for movements of the Green product from GS to GP
T2 is the lead time involved for movements of the product from GP to GW;
T3 is the lead time involved for movements of the product from GW to GD;
T4 is the lead time involved for movements of the product from GD to GA;
T5 is the lead time involved for movements of the product from GA to GPPD;
As initialization step of the PSO process, the random individuals and their corresponding velocities are generated.

Table 3: Initial random individuals

TI	GS	GP	GW	GD1	GA1	GPPD
1	25	-24	54	15	54	-10
2	54	21	31	-24	26	30

For PSO based analysis, we have to generate random individuals having 5 numbers of particles representing product ID and seven supply chain 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	GS	GP	GW	GD1	GA1	GPPD
1	0.12	0.54	0.24	0.45	0.58	0.69
2	0.24	0.45	0.54	0.31	0.87	0.01

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

Table 5: database format of Final Individual

TI	GS	GP	GW	GD1	GA1	GPPD
1	10	-80	-30	25	23	35

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 supply chain inventory optimization.

V. CONCLUSION

6-Stages 18-Member Green Supply Chain management for Green warehouse with sustainability performance using Particle Swarm Optimization algorithm is a significant component of Green Supply Chain inventory management. The novel and proficient approach based on Particle Swarm Optimization algorithm to optimize inventory in 6-Stages and 6-Member Green Supply Chain management for Green warehouse. we also focus on to specifically determine the complexity in predicting the optimal stock levels and shortage level required for inventory optimization in the 6-Stages and 6-Member Green Supply Chain management for Green warehouse such that the total Green Supply Chain inventory management cost is minimized .we apply our methods on 6-Stages and 6-Member Green Supply Chain management for Green warehouse 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] Priya, P. and Iyakutti , K. Web based Multi Product Inventory Optimization using Genetic Algorithm International Journal of Computer Applications (0975 – 8887) Volume 25– No.8.

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

[11] 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.

[12] 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.

[13] 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.

[14] 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.

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

[16] Thakur, L and Desai, A.A. Inventory Analysis Using Genetic Algorithm In Supply Chain Management International Journal of Engineering Research & Technology (IJERT) Vol. 2 Issue 7.

[17] 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.

[18] Yadav, A.S. (2017) Analysis of seven stages supply chain management in electronic component inventory optimization for warehouse with economic load dispatch

using genetic algorithm Selforganizology, Volume 4 No.2.

[19] Yadav, A.S. (2017) Analysis Of Seven Stages Supply Chain Management In Electronic Component Inventory Optimization For Warehouse With Economic Load Dispatch Using GA And PSO Asian Journal Of Mathematics And Computer Research volume 16 No.4.

[20] Yadav, A.S. (2017) Analysis Of Supply Chain Management In Inventory Optimization For Warehouse With Logistics Using Genetic Algorithm International Journal Of Control Theory And Applications, Volume 10 No.10.

[21] Yadav, A.S. (2017) Modeling and Analysis of Supply Chain Inventory Model with two-warehouses and Economic Load Dispatch Problem Using Genetic Algorithm International Journal of Engineering and Technology (IJET) Volume 9 No 1.

[22] 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.

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

[24] Yadav, A.S., Sharma, S. and Swami, A. (2017) A Fuzzy Based Two-Warehouse Inventory Model For Non instantaneous Deteriorating Items With Conditionally Permissible Delay In Payment International Journal Of Control Theory And Applications, Volume 10 No.11.

[25] 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.

[26] 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.

[27] 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.

[28] 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,

[29] 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.

[30] 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.