Article

A study of Covid-19 pandemic on beer industry supply chain inventory management using travelling salesman problem for simulated annealing

Ajay Singh Yadav[1], **Anupam Swami**[2], **Navin Ahlawat**[3], **Tarun Kumar Arora**[4], **Pavan Kumar Chaubey**[5], **Karan Pathak**[6]

[1]Department of Mathematics, SRM Institute of Science and Technology, Delhi-NCR Campus, Ghaziabad, Uttar Pradesh, India

[2]Department of Mathematics, Government Post Graduate College, Sambhal, Uttar Pradesh, India

[3]Department of Computer Science, SRM Institute of Science and Technology, Delhi-NCR Campus, Ghaziabad, U.P., India

[4]Department of Applied Science and Humanites, ABES Engineering College, Ghaziabad, Uttar Pradesh, India

[5]Department of Applied Science Humanites, Tula's Institute Dehradun, Uttarakhand, India

[6]SRM Institute of Science and Technology, Delhi-NCR Campus, Ghaziabad, Uttar Pradesh, India

E-mail:ajay29011984@gmail.com, swami.anupam@gmail.com, navinahlawat@gmail.com, tarunka007@gmail.com, pavan197@gmail.com, karanpathak18@gmail.com

Received 18 April 2021; *Accepted 23 May 2021*; *Published 1 December 2021*

Abstract

The impact of the Covid-19 epidemic on inventory management in the supply of the brewing industry is an important part of inventory management in the region and has been a key factor in the overall profitability of the industrial situation. It consists of several steps through which the material goes through different stages to reach the end customer. The impact of the Covid-19 epidemic on the supply chain management of the three-tier brewery industry includes low-cost beer, beer warehouses, and retail locations. A coordinated approach between rates is needed to adjust the chain for lower stocks and lower costs, and thus higher profits. In this paper, we discuss the impact of the three-step coordination of the Covid-19 scourge on the supply chain management of the brewery and one brewery that provides one type of product to distribution centers for each brewery and then for individuals beer industry retailer. The mathematical model is based on the coordinated effects of the Covid-19 catastrophe on the management of the brewery's supply chain, which is solved by using a traveling salesman to improve the ant colony with better values for decision-making and targeting operations. A numerical model is provided and the results obtained here are compared with these methods.

Keywords inventory; supply chain; beer industry factory sites; beer industry storage; beer industry retailer; travelling salesman problem for simulated annealing.

Network Pharmacology
ISSN 2415-1084
URL: http://www.iaees.org/publications/journals/np/online-version.asp
RSS: http://www.iaees.org/publications/journals/np/rss.xml
E-mail: networkpharmacology@iaees.org
Editor-in-Chief: WenJun Zhang
Publisher: International Academy of Ecology and Environmental Sciences

1 The Effects of Covid-19 Pandemic on Beer Industry Supply Chain Inventory Management Network Model of A Regionalized Beer Industry Banking System

Since the beginning of the industrial revolution, various industries have established commercial relationships between them to meet marketing challenges or marketing channels. The sales center, which had no information on the needs and requirements of the customer, had conflicting objectives in the facility. Because of the lack of information the time to deliver goods to customers remains long and unpredictable. Because of the arrangement, such as depreciation of delivery time, quality or bulk shipping, it is common for the stock to exceed the stock, which increases the cost of facilities to meet demand. The impact of the Covid-19 epidemic on beer supply chain management includes several companies that provide products or services to the customer or end user. In other words, the impact of the Covid-19 epidemic on beer chain supply chain management is a network that represents the flow of raw materials, semi-finished and finished equipment. Goods are in the direction in front of the customer, when the information and cash flow are returned. The impact of the Covid-19 catastrophe on accounting management in beer Supply Chain Management (SCM) involves business processes providing value-added products, services, and information to customers and other stakeholders. Impact of the Covid-19 epidemic on compost management chain supply chain inventory management ensures that customer needs are met as well as distribution channels and impact phases of the Covid-19 epidemic. The effect of Covid-19 catastrophe on inventory management in the beer supply chain undoubtedly involves good management of facility interaction inventory. In addition, behaviors associated with poor inventory management inventory lead to a significant correlation between the effects of the Covid-19 epidemic on accounting management partners in the beer distribution chain. This will increase the risk that the Covid-19 epidemic will affect inventory management tools in the beer distribution chain (i.e., distributors, customers, etc). Researchers believed that demand was a flexible work of time and that unacceptable demand was a diminished work of waiting time. Many researchers in the inventory system have focused on products that do not exceed deterioration. Nevertheless, there are a number of things whose significance does not remain the same over time. The deterioration of these substances plays an important role and cannot be stored for long. Deterioration of an object can be described as deterioration, evaporation, obsolescence and loss of use or limit of an object, resulting in lower stock consumption compared to natural conditions. When commodities are placed in stock as inventory to meet future needs, there may be deterioration of items in the system of arithmetic that may occur for one or more reasons, etc (Yadav et al., 2014-2020). It is generally claimed that management owns a warehouse to store purchased inventory. However, management can, for a variety of reasons, buy or give more than it can store in its warehouse and name it OW, with an additional number in a rented warehouse called RW located near OW or slightly away from it (Yadav et al., 2014-2020). Inventory costs (including holding costs and depreciation costs) in RW are usually higher than OW costs due to additional costs of handling, equipment maintenance, etc. To reduce the cost of inventory it will economically use RW products as soon as possible. Actual customer service is provided only by OW, and in order to reduce costs, RW stocks are first cleaned. Such arithmetic examples are called two arithmetic examples in the warehouse (Yadav and Swami, 2013-2019). Many other studies included an example with two warehouses depreciation of items and storage costs under particle upgrade and an example with two warehouses of material damage and storage costs in inflation and soft computer techniques (Singh et al., 2016); an example of depreciation of goods and services of various types and costs of holding down a Business-Loan and an inventory model with sensitive needs of prices, holding costs in contrast to loans of business expenses under inflation (Swami et al., 2015); delayed alcohol supply management and refinement of particles and green cement supply system and inflation using particle enhancement and electronic inventory calculation system and distribution center using genetic calculations (Kumar et al., 2019); the improvement of supply and deficit inventory, inflation, and a calculation model based on a genetic calculation of scarcity and low inflation by PSO (Gupta et al., 2015); Marble Analysis Improvement of industrial reserves based on genetic engineering and multi-particle improvement (Pandey et al., 2019); Cuckoo Search problems (Yang and Deb, 2009, 2010); best policy for importing damaged items immediately and payment of conditional delays under the supervision of two warehouses (Singh et al., 2016); an example of depreciation inventory with two warehouses and stock-based stocks using a genetic inventory and vehicle inventory system for demand and inflation of stocks with two distribution centers using genetic inventory (Chauhan and Yadav, 2020); white wine industry in supply chain management using nervous networks (Ahlawat et al., 2020), and other studies (Kirkpatrick et al., 1983; Wang et al., 2003; Tiwari et al., 2014).

2 Modelling Beer Industry Supply Chain Inventory Management

According to the basic assumptions, we reduce and define a mathematical model. The calculation model makes it possible to identify the natural world of the cash flow problem associated with the impact of the Covid-19 epidemic on the supply chain management of the brewery industry at various levels. This amount is presented in the form of mathematical concepts and designed for the model below. The model is solved with digital presentation by using the problem of the traveling merchant and photography imitated and the results obtained are compared.

The subsequent kind and assumptions are measured for the model.

1. Deterministic demand.
2. Instantaneous replenishment rate. Beer industry storage inventory is an integer multiple of medical canters' inventory.
3. Beer industry factory sites inventory is an integer multiple of beer industry storage inventory.
4. No shortages are allowed.

D=Demand rate in units for each unit time where $D = \left(e^{bT} - C19\right)$

γ_0=Beer industry factory sites ordering cost.

γ_1=Beer industry factory sites unit cost.

λ_0=Replenishment quantity at the Beer industry factory sites in units.

β_0=Beer industry Storage ordering cost.

β_1=Beer industry Storage unit cost.

ϕ_0=Beer industry Storage ordering quantity in units.

α_0=Medical centers ordering cost.

α_1=Medical centers unit cost.

α_2=Medical centers ordering quantity in units.

ϕ=Beer industry Storage replenishment quantity to Beer industry Retailer replenishment quantity.

λ=Beer industry factory Sites replenishmentquantity to Beer industry Storage ordering quantity.
ζ=Carrying charge

θ=Beer industry Retailer selling price

TC_{BIF} =The yearly total applicable cost of the Beer industry factory sites

TC_{BIS} = The yearly total applicable cost of the Beer industry Storage

TC_{BIR} = The yearly total applicable cost of the Beer industry Retailer

TC_{BISC} = The yearly total applicable cost of the Beer industry supply chain

3 Model Formulation

3.1 Beer industry retailer

The total yearly costs of beer industry retailer result from the sum of the yearly ordering and transportation costs of beer industry retailer and can be represented by:

$$\alpha_0=\sum_0^{T_n}\left(\alpha_0-C19\right)$$

$$\alpha_1=\sum_0^{T_n}\left(\alpha_1-C19\right)$$

$$\alpha_2=\sum_0^{T_n}\left(\alpha_2-C19\right)$$

$$TC_{BIR}=\sum_0^{T_n}\left\{\frac{\alpha_0 D}{\alpha_2}+\frac{\alpha_1\alpha_2\zeta}{2}\right\}$$

$$TC_{BIR}=\sum_0^{T_n}\left\{\begin{array}{l}\dfrac{\left[\left(\alpha_0-C19\right)\left(e^{bt}-C19\right)\right]}{\left(\alpha_2-C19\right)}+\\ \dfrac{\left[\left(\alpha_2-C19\right)\left(\alpha_1-C19\right)\left(\zeta-C19\right)\right]}{2}\end{array}\right\} \tag{1}$$

3.2 Beer industry storage

The yearly total beer industry storage costs result from the sum of the yearly ordering and transport costs in beer industry storage and can be expressed as follows:

$$\beta_0 = \sum_0^{T_n} (\beta_0 - C19)$$

$$\beta_1 = \sum_0^{T_n} (\beta_1 - C19)$$

$$\phi_0 = \sum_0^{T_n} \left(\frac{\alpha_2 + 1}{C_{19}} \right)$$

$$TC_{BIS} = \sum_0^{T_n} \left\{ \frac{\beta_0 D}{\phi \alpha_2} + \frac{(\phi)\alpha_2 \beta_1 (\zeta)}{2} \right\}$$

$$TC_{BIS} = \sum_0^{T_n} \left\{ \begin{array}{l} \dfrac{\left[(\beta_0 - C19)\left(e^{bt} - C19\right) \right]}{\left[(\phi - C19)(\alpha_2 - C19) \right]} + \\ \dfrac{\left[(\phi - C19)(\alpha_2 - C19)(\beta_0 - C19)(\zeta - C19) \right]}{2} \end{array} \right\} \quad (2)$$

3.3 Beer industry factory sites

The yearly total costs of the beer industry factory sites result from the sum of the yearly order and the transport costs to the beer industry factory sites and can be expressed as follows:

$$\gamma_0 = \sum_0^{T_n} (\gamma_0 - C19)$$

$$\gamma_1 = \sum_0^{T_n} (\gamma_1 - C19)$$

$$\lambda_0 = \sum_0^{T_n} (\alpha_2 - C19)$$

$$TC_{BIF} = \sum_0^{T_n} \left\{ \frac{\gamma_0 D}{\lambda \lambda_0} + \frac{(\lambda - C19)\lambda_0 \{\gamma_0 \zeta\}}{2} \right\}$$

$$TC_{BIF} = \sum_0^{T_n} \left\{ \frac{\gamma_0 D}{\lambda \lambda_0 \phi} + \frac{(\lambda - C19)\phi \lambda_0 \{\gamma_0 \zeta\}}{2} \right\}$$

$$TC_{BIF}=\sum_{0}^{T_n}\left\{\frac{\left[(\gamma_0-C19)\left(e^{bt}-C19\right)\right]}{\left[(\lambda-C19)(\alpha_2-C19)(\phi-C19)\right]}+\frac{\left[(\phi-C19)(\lambda-C19)(\alpha_2-C19)(\gamma_1-C19)(\zeta-C19)\right]}{2}\right\} \quad (3)$$

3.4 Yearly total applicable cost of the beer industry supply chain

The applicable yearly beer industry supply chain total costs result from the sum of the individual applicable yearly total costs at beer industry factory sites, beer industry storage andbeer industry retailer and can be expressed as:

$$TC_{BISC}=TC_{BIA}+TC_{BIS}+TC_{BIF}$$

$$TC_{BISC}=\sum_{0}^{T_n}\left[\begin{array}{l}\left\{\frac{\left[(\alpha_0-C19)\left(e^{bt}-C19\right)\right]}{(\alpha_2-C19)}+\frac{\left[(\alpha_2-C19)(\alpha_1-C19)(\zeta-C19)\right]}{2}\right\}+\\ \left\{\frac{\left[(\beta_0-C19)\left(e^{bt}-C19\right)\right]}{\left[(\phi-C19)(\alpha_2-C19)\right]}+\frac{\left[(\phi-C19)(\alpha_2-C19)(\beta_0-C19)(\zeta-C19)\right]}{2}\right\}+\\ \left\{\frac{\left[(\gamma_0-C19)\left(e^{bt}-C19\right)\right]}{\left[(\lambda-C19)(\alpha_2-C19)(\phi-C19)\right]}+\frac{\left[(\phi-C19)(\lambda-C19)(\alpha_2-C19)(\gamma_1-C19)(\zeta-C19)\right]}{2}\right\}\end{array}\right] \quad (4)$$

4 Travelling Salesman Problem

The traveling merchant problem (TSP) is a widespread computer problem that involves finding a way to get to Hamilton at minimal cost. The TSP represented the interests of computer scientists and mathematicians, as the problem has not yet been completely resolved after half a decade of research. It can be used to solve many problems such as logistics, transportation, semiconductor industry, etc. A better TSP solution would ensure better performance of responsibilities and thus increase productivity. Because of its importance in many industries, TSP is still being studied by researchers from a variety of disciplines. It is known to be a complex NP. This means that no known algorithm will resolve the validity of all TSP conditions within a reasonable time of implementation. To find the right solution, they developed several heuristics and simulation algorithms for approximate problems. They facilitate the search for high-quality solutions and deadlines for change. Adding ant colonies is usually an improvement algorithm; Researchers start with one or more solutions to the problem involved and suggest ways to improve them. To solve the TSP problem, the researchers proposed a variety of technical methods, such as improving ant colonies to solve TSP.

$$A_{ij} = \begin{cases} 1 & \text{the path goes form city i to city j} \\ 0 & \text{otherwise} \end{cases} \tag{5}$$

$$\min \sum_{i=1}^{N} \sum_{j \neq i, j=1}^{N} D_{ij} A_{ij} \tag{6}$$

$$A_{ij} \in \{0,1\} \qquad \text{i, j-1,...........,N;} \tag{7}$$

$$B_i \in Z \qquad \text{i, =2,...........,n;} \tag{8}$$

$$\sum_{j \neq i, i=1}^{n} A_{ij} \in \{0,1\} \qquad \text{j=1,...........,N;} \tag{9}$$

$$\sum_{j \neq i, j=1}^{n} x_{ij} \in \{0,1\} \qquad \text{i=1,...........,N;} \tag{10}$$

$$B_i - B_j + NA_{ij} \leq N - 1 \qquad 2 \leq i \neq j \leq N \tag{11}$$

$$1 \leq B_i \leq N - 1 \qquad 2 \leq i \leq N \tag{12}$$

5 Simulated Annealing

The additional simulation technique (SA) (Yadav et al., 2019, 2020) was described in 1983 by Kirkpatrick et al. (1983). Imitated packaging is the oldest algorithm of high-level possibilities used to find the approximate solution to the search for a global problem. It is guided by the incorporation of minerals, which is a method of controlling the cooling of the material to reduce defects. A similar simulation algorithm starts with a random solution. Each iteration creates a solution almost randomly. If this solution is the best solution, it will replace the current solution. If this is a poor solution, you can choose to change the current solution and the probability that depends on the temperature parameter. When the algorithm is active, the temperature parameter decreases, which gives the inferior solution a less chance of changing the current solution. Allowing a poor solution at the beginning helps prevent the approach of the natives rather than the lower level of the world. The output of the algorithm is influenced by two parameters: initial temperature, temperature drop rate, and algorithm suspension parameters.

In the case of a traveling salesman, an additional imitation begins with a common initial comment. Objective work, viz. The total length of the visit) is equal to the current energy status of the system. It changes from one state to another, resulting in shorter visits. This is equivalent to slowing down. Changes that increase the length of the visit are only accepted by the possibility p (d, T) = exp (- d / T), where d is the change in the length of the visit and T is the system temperature. Temperature criterion controls the marking process. The TSP algorithm using SA has two parts. The first section deals with distribution distribution between processors and interactions between cities and each processor. The second section uses a type of connection program to transfer or relocate visit sites between processors. The whole SA process for resolving TSP is given as follows:

$$\left|\begin{array}{l}\Rightarrow \text{begin procedure SA} \Leftarrow \\ \Rightarrow \text{generate initial solutions} \Leftarrow \\ \Rightarrow \text{set temperature, and cooling rate} \Leftarrow \\ \Rightarrow \text{while}\left(\text{termination criteria not meet}\right) \Leftarrow \\ \Rightarrow \text{generate new solutions} \Leftarrow \\ \Rightarrow \text{access new solutions} \Leftarrow \\ \Rightarrow \text{if }\left(\text{accept new solution}\right) \Leftarrow \\ \Rightarrow \text{update storage} \Leftarrow \\ \Rightarrow \text{adjust temperature} \Leftarrow \\ \Rightarrow \text{end if} \Leftarrow \\ \Rightarrow \text{end while} \Leftarrow \\ \Rightarrow \text{post-process results and output} \Leftarrow \\ \Rightarrow end \Leftarrow \end{array}\right\rangle$$

6 Numerical Illustration

To understand the calculated effects of the proposed model, let us take a numerical presentation. This gives us a clear idea of how embedded embedding relates to the problem of a traveling merchant with the help of practical examples. The following numerical figures are considered in the corresponding supply problem shown to illustrate the model presented.

$\alpha_2 = \text{EUR250/order}$ $\alpha_1 = \text{EUR240/unit}$ $\phi_0 = \text{EUR225/order}$ $\beta_1 = \text{EUR290/unit}$ $\lambda_0 = \text{EUR250/setup}$

$\gamma_1 = \text{EUR250/unit}$ $\zeta = \text{EUR0.3/Re/Months}$ $D = 8,000$ units

Using model improvement and passenger vendor problem in the data above, we solve equation (4) to obtain the best values for decision change and target work, and the results are presented in Table 1.

The Table 1 above shows a total comparison of the valid costs obtained from the two algorithms under consideration. The resulting stock ratio is given the full numerical guarantee of the number shown in the table. The values of the decision transformers and the targeted function are improved by both methods and then arranged separately. We find that the total supply cost caused by the problem with street vendors is lower than that incurred by the counterfeit calculation. Table 1 shows a sharp decrease in the total current cost in the value of a particular generation and shows a behavior characterized by an increasing number of generations.

Table 1 Best values of result variables and purpose function with and without management.

Item Description	Travelling salesman problem	Simulated annealing
α_2	487 units	469 units
ϕ_0	2161 units	838 units
λ_0	2161 units	838 units
ϕ	25	22
λ	20	20
TC_{BIF}	EUR 8356/-	EUR 8,198.5/-
TC_{BIS}	EUR 10872.9/-	EUR 9,614.1/-
TC_{BIA}	EUR 6813.9/-	EUR 8,032.3/-
TC_{BISC}	EUR 33,042.9/-	EUR 32,840.6/-

7 Conclusions

The present paper presents comparative research as part of a series of studies examining the best stock decisions about the impact of the Covid-19 catastrophe on stock management in the three-tier tier supply of the brewery industry to the brewer. The analogy is based on the calculation used to solve the three-step problem shown by the numerical model. The model compares the corresponding total cost in a brewery, beer store and brewery locations. It is considered that the renovation of a medical center is the largest with the imitation method of imitation and the same number of shipments as indicated by the positive numerical values. In addition, it should be noted that the difficulty of the traveling merchant compared to the improvement of the ant colony gives poor results for each implementation at the total cost of the whole chain. From comparative research, it can therefore be concluded that passenger distress sells better values for decision-making variables and targeting functions. The scope of the project has been described in industrial use as a conservation improvement in the industry.

References

Ahlawat N, Agarwal S, Pandey T, Yadav AS, Swami A. 2020. White wine industry of supply chain management for warehouse using neural networks. Test Engraining and Management, 83: 11259-11266

Binitha SS, Siva Sathya, 2012. A survey of bio inspired optimization algorithm. International Journal of Soft Computing and Engineering, 2(2)

Chauhan N, Yadav AS. 2020. An inventory model for deteriorating items with two-warehouse and stock dependent demand using genetic algorithm. International Journal of Advanced Science and Technology, 29(5s): 1152-1162

Chauhan N, Yadav AS. 2020. Inventory system of automobile for stock dependent demand & inflation with two-distribution center using genetic algorithm. Test Engraining and Management, 83: 6583-6591

Gupta K, Yadav AS, Garg, A, Swami A. 2015. A binary multi-objective genetic algorithm and PSO involving supply chain inventory optimization with shortages, inflation. International Journal of Application or Innovation in Engineering and Management, 4(8): 37-44

Gupta K, Yadav AS, Garg A. 2015. Fuzzy-genetic algorithm based inventory model for shortages and inflation under hybrid & PSO. IOSR Journal of Computer Engineering, 17(5): 61-67

Kirkpatrick S, Gelatt CD, Vecchi MP. 1983. Optimization by simulated annealing. Science, 220(4598): 671-680

Kumar S, Yadav AS, Ahlawat N, Swami A. 2019. Electronic components inventory model for deterioration items with distribution centre using genetic algorithm. International Journal for Research in Applied Science and Engineering Technology, 7(VIII): 433-443

Kumar S, Yadav AS, Ahlawat N, Swami A. 2019. Green supply chain inventory system of cement industry for warehouse with inflation using particle swarm optimization. International Journal for Research in Applied Science and Engineering Technology, 7(VIII): 498-503

Kumar S, Yadav AS, Ahlawat N, Swami A. 2019. Supply chain management of alcoholic beverage industry warehouse with permissible delay in payments using particle swarm optimization. International Journal for Research in Applied Science and Engineering Technology, 7(VIII): 504-509

Pandey T, Yadav AS, Malik M. 2019. An analysis marble industry inventory optimization based on genetic algorithms and particle swarm optimization. International Journal of Recent Technology and Engineering, 7(6S4): 369-373

Singh RK, Yadav AS, 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, 2(6): 858-864

Singh RK, Yadav AS, 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, 2(6): 869-876

Singh S. Yadav AS, 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, 147(1): 16-25

Swami A, Singh SR, Pareek S, Yadav AS. 2015. Inventory policies for deteriorating item with stock dependent demand and variable holding costs under permissible delay in payment. International Journal of Application or Innovation in Engineering and Management, 4(2): 89-99

Swami A, Pareek S, Singh SR, Yadav AS. 2015. Inventory model for decaying items with multivariate demand and variable holding cost under the facility of trade-credit. International Journal of Computer Application, 18-28

Swami A, Pareek S, Singh SR, Yadav AS. 2015. An inventory model with price sensitive demand, variable holding cost and trade-credit under inflation. International Journal of Current Research, 7(6): 17312-17321

Tiwari SP, Kumar S, Bansal KK. 2014. A survey of metaheuristic algorithms for travelling salesman problem. International Journal of Engineering Research and Management Technology, 1(5): 72-80

Wang KP, Huang L, Zhou CG, Pang W. 2003. Particle swarm optimization for traveling salesman problem. In: Proceedings of the International Conference on Machine Learning and Cybernetics. 1583-1585

Yadav AS. 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, 16(4): 208-219

Yadav AS. 2017. Analysis of supply chain management in inventory optimization for warehouse with logistics using genetic algorithm International Journal of Control Theory and Applications, 10(10): 1-12

Yadav AS. 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, 9(1): 33-44

Yadav AS, Abid M, Bansal S, Tyagi SL, Kumar T. 2020. FIFO & LIFO in green supply chain inventory model of hazardous substance components industry with storage using simulated annealing. Advances in Mathematics: Scientific Journal, 9(7): 5127-5132

Yadav AS, Ahlawat N, Agarwal S, Pandey T. Swami A. 2020. Red wine industry of supply chain management for distribution center using neural networks. Test Engraining and Management, 83: 11215 – 11222

Yadav AS, Ahlawat N, Dubey R, Pandey G, Swami A. 2020. Pulp and paper industry inventory control for Storage with wastewater treatment and Inorganic composition using genetic algorithm (ELD Problem). Test Engraining and Management, 83: 15508-15517

Yadav AS, Ahlawat N, Sharma S. 2018. Hybrid techniques of genetic algorithm for inventory of auto industry model for deteriorating items with two warehouses. International Journal of Trend in Scientific Research and Development, 2(5): 58-65

Yadav AS, Ahlawat N, Sharma S. 2018. A particle swarm optimization for inventory of auto industry model for two warehouses with deteriorating items. International Journal of Trend in Scientific Research and Development, 2(5): 66-74

Yadav AS, Ahlawat N, Sharma N, Swami A, Navyata. 2020. Healthcare systems of inventory control for blood bank storage with reliability applications using genetic algorithm. Advances in Mathematics: Scientific Journal, 9(7): 5133-5142

Yadav AS, Ahlawat N, Swami A, Kher G. 2019. Auto industry inventory model for deteriorating items with two warehouse and transportation cost using simulated annealing algorithms. International Journal of Advance Research and Innovative Ideas in Education, 5(1): 24-33

Yadav AS, Ahlawat N, Swami A, Kher G. 2019. A particle swarm optimization based a two-storage model for deteriorating items with transportation cost and advertising cost: the auto industry. International Journal of Advance Research and Innovative Ideas in Education, 5(1): 34-44

Yadav AS, Bansal KK, Kumar J, Kumar S. 2019. Supply chain inventory model for deteriorating item with warehouse & distribution centres under inflation. International Journal of Engineering and Advanced Technology, 8(2S2): 7-13

Yadav AS, Bansal KK, Shivani, Agarwal S. Vanaja R. 2020. FIFO in green supply chain inventory model of electrical components industry with distribution centres using particle swarm optimization. Advances in Mathematics: Scientific Journal, 9(7): 5115-5120

Yadav AS, Dubey R, Pandey G, Ahlawat N, Swami A. 2020. Distillery industry inventory control for storage with wastewater treatment and logistics using particle swarm optimization. Test Engraining and Management 83: 15362-15370

Yadav AS, Garg A, Gupta, K, Swami A. 2017. Multi-objective particle swarm optimization and genetic algorithm in inventory model for deteriorating items with shortages using supply chain management. International Journal of Application or Innovation in Engineering and Management, 6(6): 130-144

Yadav AS, Garg A, Gupta K, Swami A. 2017. Multi-objective genetic algorithm optimization in inventory model for deteriorating items with shortages using supply chain management. IPASJ International Journal of Computer Science, 5(6): 15-35

Yadav AS, Garg A, Swami A, Kher G. 2017. A supply chain management in inventory optimization for deteriorating items with genetic algorithm. International Journal of Emerging Trends and Technology in Computer Science, 6(3): 335-352

Yadav AS, Gupta K, Garg A, Swami A. 2015. A soft computing optimization based two ware-house inventory model for deteriorating items with shortages using Genetic Algorithm. International Journal of Computer Applications, 126(13): 7-16

Yadav AS, Gupta K, Garg A, Swami A. 2015. A two warehouse inventory model for deteriorating items with shortages under genetic algorithm and PSO. International Journal of Emerging Trends and Technology in Computer Science, 4: 40-48

Yadav AS, Johri M, Singh J, Uppal S. 2018. Analysis of green supply chain inventory management for warehouse with environmental collaboration and sustainability performance using genetic algorithm. International Journal of Pure and Applied Mathematics, 118(20): 155-161

Yadav AS, Kumar S. 2017. Electronic components supply chain management for warehouse with environmental collaboration and neural networks. International Journal of Pure and Applied Mathematics, 117(17): 169-177

Yadav AS, Kumar J, Malik M, Pandey T. 2019. Supply chain of chemical industry for warehouse with distribution centres using artificial bee colony algorithm. International Journal of Engineering and Advanced Technology, 8(2S2): 14-19

Yadav AS, Kumar A, Agarwal P, Kumar T, Vanaja R. 2020. LIFO in green supply chain inventory model of auto-components industry with warehouses using differential evolution. Advances in Mathematics: Scientific Journal, 9(7): 5121-5126

Yadav AS, Mahapatra RP, Sharma S, Swami A. 2017. An inflationary inventory model for deteriorating items under two storage systems. International Journal of Economic Research, 14(9): 29-40

Yadav AS, Maheshwari P, Garg A, Swami A, Kher G. 2017. Modeling and analysis of supply chain management in inventory optimization for deteriorating items with genetic algorithm and particle swarm optimization. International Journal of Application or Innovation in Engineering and Management, 6(6): 86-107

Yadav AS, Maheshwari P, 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, 145(5): 10-17

Yadav AS, Maheshwari P, Swami A, Pandey G. 2018. A supply chain management of chemical industry for deteriorating items with warehouse using genetic algorithm. Selforganizology, 5(1-2): 41-51

Yadav AS, Maheshwari P, Swami A, Kher G. 2017. Soft computing optimization of two warehouse inventory model with genetic algorithm. Asian Journal of Mathematics and Computer Research, 19(4): 214-223

Yadav AS, Maheshwari P, Swami A, Garg A. 2017. Analysis of six stages supply chain management in inventory optimization for warehouse with artificial bee colony algorithm using genetic algorithm. Selforganizology, 4(3): 41-51

Yadav AS, Navyata, Sharma N, Ahlawat N, Swami A. 2020. Reliability consideration costing method for LIFO inventory model with chemical industry warehouse. International Journal of Advanced Trends in Computer Science and Engineering, 9(1): 403-408

Yadav AS, Navyata, Ahlawat N, Pandey T. 2019. Soft computing techniques based hazardous substance storage inventory model for decaying items and inflation using genetic algorithm. International Journal of Advance Research and Innovative Ideas in Education, 5(9): 1102-1112

Yadav AS, Navyata, Ahlawat N, Pandey T. 2019. Hazardous substance storage inventory model for decaying items using differential evolution. International Journal of Advance Research and Innovative Ideas in Education, 5(9): 1113-1122

Yadav AS, Navyata, Ahlawat N, Pandey T. 2019. Probabilistic inventory model based hazardous substance storage for decaying items and inflation using particle swarm optimization. International Journal of Advance Research and Innovative Ideas in Education, 5(9): 1123-1133

Yadav AS, Navyata, Ahlawat N, Pandey T. 2019. Reliability consideration based hazardous substance storage inventory model for decaying items using simulated annealing. International Journal of Advance Research and Innovative Ideas in Education, 5(9): 1134-1143

Yadav AS, Pandey T, Ahlawat N, Agarwal S, Swami A. 2020. Rose wine industry of supply chain management for storage using genetic algorithm. Test Engraining and Management, 83: 11223-11230

Yadav AS, Pandey G, Ahlawat N, Dubey R, Swami A. 2020. Wine industry inventory control for storage with wastewater treatment and pollution load using ant colony optimization algorithm. Test Engraining and Management, 83: 15528-15535

Yadav AS, Selva NS. Tandon A. 2020. Medicine manufacturing industries supply chain management for blockchain application using artificial neural networks. International Journal of Advanced Science and Technology, 29(8s): 1294-1301

Yadav AS, Sharam S, Swami A. 2016. Two warehouse inventory model with ramp type demand and partial backordering for Weibull distribution deterioration. International Journal of Computer Applications, 140(4): 15-25

Yadav AS, Swami A, Kher G. 2019. Blood bank supply chain inventory model for blood collection sites and hospital using genetic algorithm. Selforganizology, 6(3-4): 13-23

Yadav AS, Swami A, Ahlawat N. 2018. A Green supply chain management of auto industry for inventory model with distribution centers using Particle Swarm Optimization. Selforganizology, 5(3-4): 10-18

Yadav AS, Swami A, Gupta CB. 2018. A supply chain management of pharmaceutical for deteriorating items using genetic algorithm. International Journal for Science and Advance Research in Technology, 4(4): 2147-2153

Yadav AS, Swami A, Kher G. 2017. Multi-objective genetic algorithm involving green supply chain management International Journal for Science and Advance Research in Technology, 3(9): 132-138

Yadav AS, Swami A, Kher G. 2017. Multi-objective particle swarm optimization algorithm involving green supply chain inventory management. International Journal for Science and Advance Research in Technology, 3: 240-246

Yadav AS, Swami A, Pandey G. 2017. Green supply chain management for warehouse with particle swarm optimization algorithm. International Journal for Science and Advance Research in Technology, 3(10): 769-775

Yadav AS, Swami A, Kher G, Garg A, 2017. Analysis of seven stages supply chain management in electronic component inventory optimization for warehouse with economic load dispatch using genetic algorithm. Selforganizology, 4(2): 18-29

Yadav AS, Swami A, Gupta CB, Garg A, 2017. Analysis of electronic component inventory optimization in six stages supply chain management for warehouse with ABC using genetic algorithm and PSO. Selforganizology, 4(4): 52-64

Yadav AS, Swami A, Kumar S. 2018. Inventory of electronic components model for deteriorating items with warehousing using genetic algorithm. International Journal of Pure and Applied Mathematics, 119(16): 169-177

Yadav AS, Swami A, Kher G. 2018. Particle swarm optimization of inventory model with two-warehouses. Asian Journal of Mathematics and Computer Research, 23(1): 17-26

Yadav AS, Swami A., Kumar S, Singh RK. 2016. Two-warehouse inventory model for deteriorating items with variable holding cost, time-dependent demand and shortages. IOSR Journal of Mathematics, 12(2): 47-53

Yadav AS, Swami A, Singh RK. 2016. A two-storage model for deteriorating items with holding cost under inflation and Genetic Algorithms. International Journal of Advanced Engineering, Management and Science, 2(4): 251-258

Yadav AS, Swami A, Kher G, Kumar S. 2017. Supply chain inventory model for two warehouses with soft computing optimization. International Journal of Applied Business and Economic Research, 15(4): 41-55

Yadav AS, Rajesh Mishra, Kumar S, 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, 9(2): 881-892

Yadav AS Swami A, Kumar S. 2018. A supply chain inventory model for decaying items with two ware-house and partial ordering under inflation. International Journal of Pure and Applied Mathematics, 120(6): 3053-3088

Yadav AS, Swami A, Kumar S. 2018. An inventory model for deteriorating items with two warehouses and variable holding cost. International Journal of Pure and Applied Mathematics, 120(6): 3069-3086

Yadav AS, Taygi B, Sharma S, Swami A. 2017. Effect of inflation on a two-warehouse inventory model for deteriorating items with time varying demand and shortages. International Journal Procurement Management, 10(6): 761-775

Yadav AS, Sharma S, 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, 10(11): 107-123

Yadav AS, Swami A. 2013. A partial backlogging two-warehouse inventory models for decaying items with inflation. International Organization of Scientific Research Journal of Mathematics, 6: 69-78

Yadav AS, Swami A. 2013. Effect of permissible delay on two-warehouse inventory model for deteriorating items with shortages. International Journal of Application or Innovation in Engineering and Management, 2(3): 65-71

Yadav AS, Swami A. 2013. A two-warehouse inventory model for decaying items with exponential demand and variable holding cost. International of Inventive Engineering and Sciences, 1(5): 18-22

Yadav AS, Swami A. 2014. Two-warehouse inventory model for deteriorating items with ramp-type demand rate and inflation. American Journal of Mathematics and Sciences, 3(1): 137-144

Yadav AS, Swami A. 2018. Integrated supply chain model for deteriorating items with linear stock dependent demand under imprecise and inflationary environment. International Journal Procurement Management, 11(6): 684-704

Yadav AS, Swami A. 2018. A partial backlogging production-inventory lot-size model with time-varying holding cost and weibull deterioration. International Journal Procurement Management, 11(5): 639-649

Yadav AS, Swami A. 2019. An inventory model for non-instantaneous deteriorating items with variable holding cost under two-storage. International Journal Procurement Management, 12(6): 690-710

Yadav AS, Swami A. 2019. A volume flexible two-warehouse model with fluctuating demand and holding cost under inflation. International Journal Procurement Management, 12(4): 441-456

Yadav AS, Tandon A, Selva NS. 2020. National blood bank centre supply chain management for block chain application using genetic algorithm. International Journal of Advanced Science and Technology, 29(8s): 1318-1324

Yang XS, Deb S. 2009. Cuckoo Search via Lvy Flights. In: Proceedings of World Congress on Nature and Biologically Inspired Computing (NaBIC 2009, India). IEEE Publications, 210-214

Yang XS, Deb S. 2010. Engineering optimisation by Cuckoo Search. International Journal of Mathematical Modelling and Numerical Optimisation, 3: 330-343