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# Red Wine Industry of Supply Chain Management for Distribution Center Using Neural Networks

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***Abstract:***

*The management of the red wine sector for environmental cooperation and sustainability through neural networks is an integral part of the red wine industry's stock management. The new competent approach is based on neural networks to optimize stocks in the red wine sector to manage the supply chain for environmental cooperation. We also focus on identifying the complexities of predicting stock levels and bottlenecks, optimizing stocks in the red wine sector, from supply chain management to environmental cooperation to reduce the total cost of the red wine sector to managing the supply chain. We use our methods in the red wine industry in supply chain management for an optimization model studied in environmental cooperation. The proposed method was implemented and its performance was evaluated by MATLAB.*

***Keywords:** - Supply Chain, Packaging Points, distribution centres and Neural networks.*

## 1. Introduction

The supply chain in the wine sector includes all parties directly or indirectly involved in meeting a customer's request. The wine sector's supply chain includes not only producers and suppliers, but also transport companies, packing points, retailers and customers. For example, in every organization, such as a producer, the wine supply chain includes all the functions needed to receive and respond to a customer's request. A multilevel supply chain in the wine sector consists of several stages and possibly many actors at each stage. The lack of coordination of parcel size decisions throughout the wine supply chain leads to high costs and more cycle inventory than necessary. The purpose of the rigging system is to reduce total costs by coordinating orders in the wine supply chain. The wine sector's entire supply chain can be reduced if the producer synchronizes the product so that it is ready for shipment to the retailer in a timely manner. In such cases, the manufacturer maintains less inventory and does not have to deal with bottlenecks. Thus, both benefit from a common decision-making policy.

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The value of the supply chain in the wine sector is the difference between the value of the final product to the customer and the cost that the supply chain imposes on the wine sector to meet customer requirements. The purpose of each supply chain in the wine sector is to create maximum value. For the majority of the commercial wine supply chain value will be closely correlated with the profitability of the wine chain industry, the difference between customer revenue and total costs. throughout the wine supply chain. The wine industry offers an unrivaled opportunity to explore these issues. There are major differences in the structure of the wine sector around the world. For example, there are 787,900 wine producers in France and the top ten markets control only 9% of the market. By contrast, four companies control 87% of the Australian wine market. Overall, there are obvious differences in the structure of the industry when comparing "New World" manufacturers with "Old World" companies. These structural differences are the result of institutional heterogeneity and controversial patterns of historical development. However, they are also determined by the competitive strategies of some companies. This last point is extremely important. Differences in the structure of the industry are almost exogenous; They are also the product of corporate strategies in the industry. Structural differences have widened recently as business consolidation has accelerated in some sectors, especially in New World markets. Why consolidate rapidly in a region that has been fragmented for centuries? There are two types of definitions. The term consists of drivers of reasonable economic consolidation (profit maximization). For example, the market power of the distribution channel is rising dramatically, and manufacturers are increasingly accessing training, size, and savings. The second set of factors can lead to consolidation, although it is not always profitable behavior. Companies in other sectors of the alcohol industry (i.e., beer and drink companies) purchase wineries and consolidate the maturing of the same market. They see entry into the wine industry as a way to stimulate sales growth. Zhou and Yang (2005) propose a model inventory with two warehouses and a demand-dependent inventory index. No bottles were allowed in the model, and transportation costs for moving items from RW to OW were considered to depend on the quantity transported. Lee (2006) developed two investment models with LIFO and FIFO shipping guidelines. Hsieh et al. (2008) proposed a definitive investment model for reducing items of two stocks while reducing the present value of total costs. Yadav and Swami, (2018). we developed an inventory index size model with time and fall adjustment costs for the weibull and an integrated supply chain model to reduce inventory-dependent items with linear demand in an undervalued and inflationary environment. Yadav and Swami, (2019). we have developed a flexible flexible model with two warehouses with variable price demand and inflation and an inventory model to instantly reduce items with variable maintenance costs below two warehouses. Yadav, et.al. (2019). a proposed supply chain accounting model for the decline of products with inflationary warehouses and turnovers. Yadav, et.al. (2019). created a chemical industry supply chain for storage with circulating centers using an artificial bee colonization algorithm. Yadav, et.al. (2017). we have proposed an Atmospheric Accounting Model for item decay within two storage systems. Yadav, et.al. (2016). Multi-objective optimization created for a model of electronic storage and rejection of two-storey objects using a genetic algorithm. Yadav, et.al. (2017). proposed an inventory model for two warehouses based on fuzzy products for rapidly declining products with allowable delays in

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modeling the supply chain and supply chain for two warehouses with soft computer optimization and the impact of infrastructure on two warehouses of inventory models to reduce time-consuming items and disadvantages. Yadav, et.al. (2020). combines the electronic components of electronic storage warehouse development and its environmental impact using a particle optimization algorithm. Sahooa, et.al. (2012) developed a genetic algorithm based on a more objective optimization of reliability in a transitional environment.

## 2. Prediction analysis using Neural networks

The proposed method employs neural networks to investigate the level of stocks where the essential 6-phase red wine industry, consisting of 18 phases, requires stock control management along the supply chain through environmental collaboration. This is the notion that any type of 6-phase, 18-member red wine industry will provide supply chain management with environmental efficiency. For this we use the neural network method. In practice, the red wine sector in the supply chain is m, meaning that m is the number of members of the red wine sector in the supply chain, such as the farm red wine industry, producer red wine sector, red wine distribution points, distribution center red wine industry, distribution center red wine industry, Distribution center red wine industry and Distribution center red wine industry. In addition, each red wine sector at the distribution center is made up of different representatives of the red wine sector, but as shown in the example, each sector of the red wine distribution center has one representative red wine sector. For example, a total of three Distribution Center1 red wine agents, Distribution Center 3 red wine industry, Distribution Center red wine industry, Distribution Center red wine industry, Distribution Center red wine industry, Distribution Center red wine industry, Red wine industry Center, Red Wine Distribution Center 1, Red Wine Industry 3 Distribution Center and Red Wine Industry 3 Distribution Center, Red Wine Industry Distribution Center 2, Red Wine Distribution Center 2, Red Wine Industry Distribution Center Center 3 and so on. Each red wine sector or agent center also has different red wine sectors for packing products. For example, here we will use the six links of the supply chain, the 10-member red wine sector shown in Figure 1. In our example, six six steps, the 10-member red supply chain wine industry consists of a red wine farm, a red wine producer. Industry, red wine industry at packing points, red wine industry at distribution centers-1, red wine industry at distribution centers-2, red wine industry at distribution centers-3, red wine industry at distribution centers-3, red wine industry-Agents-1, red wine industry or agents-2, Agent-3 red wine industry, product packaging red wine industry

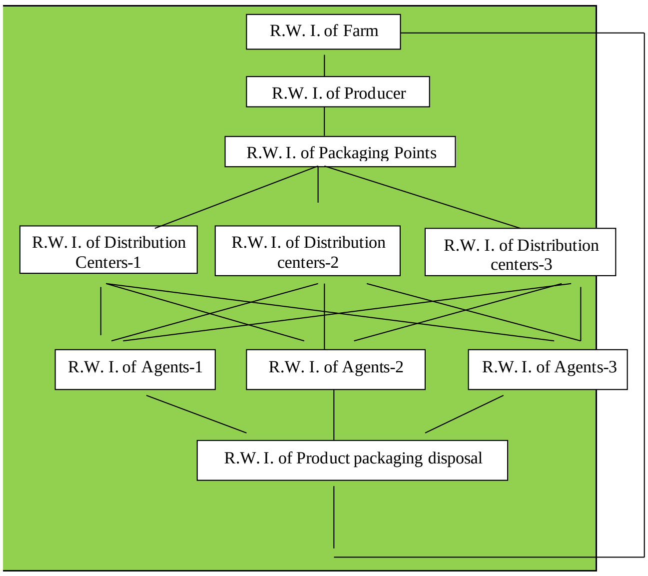


Fig 1. Six Stages - 10 Member Red wine industry of Supply Chain

In six steps, a 10-member supply chain management of wine in the wine sector, through our environmental cooperation, we have been

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shown that the red wine raw material industry is a large-scale area where the on-farm red wine industry is located. The producer's red wine sector is a huge stake in which stocks are produced according to the packing point requirements of the red wine industry. Then the red wine industry Packing points will take care of providing a red wine distribution center. From the distribution center, the red wine sector's stock will be shifted to the corresponding red wine industry and, finally, the red wine industry processing available on the packaging of the products will be shifted to the corresponding farm red wine industry. As discussed earlier, our approach has the responsibility of predicting the optimum file level from previous records, so that the predicted file level does not use excessive amounts and each resource has less resources. This suggests that our approach ultimately leads to a stock level to be maintained in six steps - 10 Member Red wine sector supply chain management through environmental cooperation, red wine industry, red wine producer, red wine industry. Packing points, 1. Distribution center red wine industry, 2. Distribution center red wine industry, 3. Distribution center red wine industry, 3. Representative red wine industry, 1. Representative red wine industry, 2. Agent red wine industry and agent red wine industry- 3. Each distribution The center is also made up of different red wine agents, but as shown in the example, each red wine center has one red wine agent center. Thus, there are a total of three red wine industry, Distributor Center 1, Representative Red Wine Industry, Distribution Center Red Wine Industry, Distribution Center Red Wine Industry, Distribution Center Red Wine Industry, Red Wine Industry Red Wine Industry. distribution center 1 distribution center wine industry 2, distribution center 3 red wine industry and representative 3 red wine distribution center distribution center 1, distribution center 2 red wine industry, distribution center red wine industry , but as shown in the example, each red wine sector has one red wine industry available for product packaging. In the proposed methodology, we are neural networks to find the optimal value. What are the steps in the optimization analysis? Initially, stock levels that are too high and stock levels that are insufficient in the various supply chain red wine management sectors, with the help of environmental collaborators, are denoted as zero or zero. Zero indicates that the participant does not need inventory control, while non-zero data requires inventory control. Zero zero data determines both the amount of excess stock and the amount of deficit. The excess amount is reported as a positive value and the deficit amount is called a negative value.

The first process to do is clustering, which combines levels of classification files that have a surplus or a deficit, and file levels that are not yet too much still a deficit. You can do this simply by aggregating the zero and zero values. We use efficient neural networks for this purpose. After completing the neural network process, work begins its procedures on the neural networks that are at the heart of our work.

**Multilayer-feed forward neural networks**

$$net_x^l = \sum_{y=0}^{m} W_{xy}^0 C_y^0 \quad (1)$$

$$Y_x^l = f(net_x^l) \quad (2)$$

$$net_x^l = \sum_{y=0}^{H^l} W_{xy}^{l-1} C_y^{l-1} \quad (3)$$

$$Y_i^l = f(net_x^l) \quad (4)$$

$$net_x^{l-1} = \sum_{y=0} H^{l-2} W_{xy}^{l-2} C_y^{l-2} \quad (5)$$

$$Y_x^l = f(net_x^{l-1}) \quad (6)$$

$$e_y^{l-1} = t_y - Y_y^{l-1} \quad (7)$$

$$J = \frac{1}{2} \sum_{x-1}^{0} (e_x^{l-1})^2 \quad (8)$$

$$\frac{\partial J}{\partial W_{xy}^{l-2}} = \frac{1}{2} \sum_{x-1}^{0} \frac{\partial \left(e_x^{l-1}\right)^2}{\partial W_{xy}^{l-2}} \quad (9)$$

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$$\frac{\partial (e_x^{l-1})^2}{\partial W_{xy}^{l-2}} = 2 \times e_x^{l-1} \frac{\partial e_x^{l-1}}{\partial W_{xy}^{l-2}} \quad (10)$$

$$\frac{\partial \left(e_i^{l-1}\right)^2}{\partial W_{xy}^{l-2}} = 2 \times e_x^{l-1} \frac{\partial (t - Y_y^{l-1})}{\partial W_{xy}^{l-2}} \quad (11)$$

$$\frac{\partial (e_x^{l-1})^2}{\partial W_{xy}^{l-2}} = 2 \times e_x^{l-1} \frac{\partial (Y_y^{l-1})}{\partial W_{xy}^{l-2}} \quad (12)$$

$$\frac{\partial (e_x^{l-1})^2}{\partial W_{xy}^{l-2}} = 2 \times e_x^{l-1} f'(net_x^{l-1}) \frac{\partial (net_x^{l-1})}{\partial W_{xy}^{l-2}} \quad (13)$$

$$\frac{\partial (e_x^{l-1})^2}{\partial W_{xy}^{l-2}} = 2 \times e_x^{l-1} f'(net_x^{l-1}) C_y^{l-2} \quad (14)$$

$$\frac{\partial J}{\partial W_{xy}^{l-2}} = \frac{1}{2} \times 2 \times e_x^{l-1} f'(net_x^{l-1}) C_y^{l-2} \quad (15)$$

$$\frac{\partial J}{\partial W_{xy}^{l-2}} = \delta_x^{l-1} C_y^{l-2} \quad (16)$$

$$\Delta W_{xy}^{l-1} = -\eta \frac{\partial J}{\partial W_{xy}^{l-1}} \quad (17)$$

$$\Delta W_{xy}^{l-1} = -\eta \delta_x^{l-1} C_y^{l-2} \quad (18)$$

$$\frac{\partial J}{\partial W_{yk}^{l-3}} = \delta_x^{l-2} C_k^{l-3} \quad (19)$$

$$\Delta W_{yk}^{l-3} = -\eta \delta_x^{l-2} C_k^{l-3} \quad (20)$$

$$\Delta W_{yk}^{l} = -\eta \delta_x^{l+1} C_k^{l} \quad (21)$$

$$\delta_y^{l+1} = e_x^{l-1} f'\left(net_y^{l+1}\right) \quad (22)$$

$$e_y^{l+1} = \sum_{x=1}^{H^{l+2}} \delta_x^{l+2} W_{xy}^{l+2} \quad (23)$$

## 3. Implementation Results

For optimal inventory control on the MATLAB platform, we implement neural network-based analyzes. As mentioned above, we have detailed information on the over-supply and shortage of white wine in each supply chain, product delivery times to complement each supply chain member, and raw material delivery times. Table 1 shows examples of data containing this information.

Table 1. Sample data with records of each actor in the white wine supply chain

| DI | R.W. I.F | R.W. I.P | R.W. I.P.P. | R.W. I.D1 | R.W. I.D2 | R.W. I.D3 | R.W. I.A1 | R.W. I.A2 | R.W. I.A3 | R.W. I.PPD |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 901 | 801 | 301 | 101 | 101 | 101 | 101 | 101 | 101 | 901 |
| 2 | 990 | 890 | 390 | 190 | 190 | 190 | 190 | 190 | 190 | 991 |
| 3 | 991 | 891 | 391 | 191 | 191 | 191 | 191 | 191 | 191 | 811 |
| 1 | 980 | 880 | 380 | 180 | 180 | 180 | 180 | 180 | 180 | 381 |
| 5 | 981 | 881 | 381 | 181 | 181 | 181 | 181 | 181 | 181 | 111 |
| 6 | 930 | 830 | 330 | 130 | 130 | 130 | 130 | 130 | 130 | 931 |
| 7 | 931 | 831 | 331 | 131 | 131 | 131 | 131 | 131 | 131 | 811 |
| 8 | 910 | 810 | 310 | 110 | 110 | 110 | 110 | 110 | 110 | 311 |
| 9 | 911 | 811 | 311 | 111 | 111 | 111 | 111 | 111 | 111 | 101 |
| 10 | 910 | 810 | 310 | 110 | 110 | 110 | 110 | 110 | 110 | 971 |
| 11 | 911 | 811 | 311 | 111 | 111 | 111 | 111 | 111 | 111 | 801 |
| 12 | 960 | 860 | 360 | 160 | 160 | 160 | 160 | 160 | 160 | 301 |
| 13 | 961 | 861 | 361 | 161 | 161 | 161 | 161 | 161 | 161 | 111 |
| 11 | 970 | 870 | 370 | 170 | 170 | 170 | 170 | 170 | 170 | 101 |
| 15 | 971 | 871 | 371 | 171 | 171 | 171 | 171 | 171 | 171 | 611 |
| 16 | 980 | 880 | 380 | 180 | 180 | 180 | 180 | 180 | 180 | 701 |
| 17 | 981 | 881 | 381 | 181 | 181 | 181 | 181 | 181 | 181 | 801 |

In Table 1, six levels of product identification - 10 members, six levels of transport identification - 10 members, six levels of inventory - 10 members above or above six levels - 10 members missing in each of six levels - 10 members are members of the supply chain. Negative values mean a six-level deficit: 10 members 'stocks and positive values mean a six-level surplus: 10 members' stocks. The Transport ID in the table for six levels: 10 members serves as an index for separating deadlines for six levels: 10 members stocks and six levels: 10 members. Table 2 shows a sample of transport IDs for six levels - 10 members and deadlines for six levels - 10 members for six levels - 10 member populations. 6-member supply chain with six levels: 10 members, six levels can be obtained in 17 delivery times: 10 members.

Table 2. Database data examples with stock delivery times

| DI | R.W. I.D-1 | R.W. I.D-2 | R.W. I.D-3 | R.W. I.D-4 | R.W. I.D-5 | R.W. I.D-6 | R.W. I.D-7 | R.W. I.D-8 | R.W. I.D-9 | R.W. I.D-10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1440 | 2424 | 3434 | 8231 | 8213 | 8231 | 1783 | 7832 | 7834 | 4237 |
| 2 | 1424 | 2274 | 3484 | 8284 | 8281 | 8282 | 1788 | 7882 | 7884 | 4287 |
| 3 | 1434 | 2284 | 3474 | 8275 | 8217 | 8273 | 1787 | 7872 | 7874 | 4277 |
| 4 | 1427 | 2624 | 3464 | 8268 | 8261 | 8264 | 1786 | 7864 | 7864 | 4267 |
| 5 | 1487 | 2384 | 3474 | 8277 | 8217 | 8275 | 1787 | 7875 | 7874 | 4277 |
| 6 | 1437 | 2364 | 3484 | 8289 | 8218 | 8286 | 1788 | 7884 | 7884 | 4287 |
| 7 | 1476 | 2394 | 3494 | 8292 | 8219 | 8297 | 1789 | 7897 | 7894 | 4297 |
| 8 | 1486 | 2874 | 3205 | 8304 | 8310 | 8308 | 1780 | 7808 | 7804 | 2207 |
| 9 | 1467 | 2804 | 3245 | 8345 | 8341 | 8341 | 1784 | 7849 | 7844 | 2247 |
| 10 | 1470 | 2894 | 3225 | 8326 | 8312 | 8324 | 1782 | 7824 | 7824 | 2227 |
| 11 | 1487 | 2744 | 3235 | 8335 | 8343 | 8335 | 1783 | 7835 | 7834 | 2237 |
| 12 | 1487 | 2724 | 3285 | 8385 | 8383 | 8386 | 1788 | 7886 | 7884 | 2287 |
| 13 | 1423 | 2734 | 3275 | 8378 | 8374 | 8378 | 1787 | 7875 | 7874 | 2277 |
| 14 | 1426 | 2784 | 3265 | 8367 | 8364 | 8367 | 1786 | 7867 | 7864 | 2267 |
| 15 | 1427 | 2774 | 3285 | 8388 | 8385 | 8386 | 1788 | 7888 | 7884 | 2287 |
| 16 | 1478 | 2784 | 3295 | 8399 | 8399 | 8394 | 1789 | 7899 | 7894 | 2297 |
| 17 | 1487 | 2794 | 3305 | 8310 | 8307 | 8302 | 1780 | 7805 | 7804 | 3207 |

Table 2 shows sample data with shipping ID and stock delivery times. Seven actors in the rose wine sector can reach six deadlines in the supply chain.

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| DI | R.W. I.F | R.W. I.P | R.W. I.P.P. | R.W. I.D1 | R.W. I.D2 | R.W. I.D3 | R.W. I.A1 | R.W. I.A2 | R.W. I.A3 | R.W. I.PPD |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 725 | -247 | 354 | 125 | 125 | 125 | 354 | 354 | 354 | -101 |
| 2 | 754 | 215 | 351 | -234 | -234 | -234 | 265 | 265 | 265 | 901 |

| |
|---|
| D1 is the deadline for product movements of the Red wine industry of product from R.W. I.F to R.W. I.P |
| D2 is the deadline for product movements R.W. I.P to R.W. I.P.P; |
| D3 is the deadline for product movements R.W. I.P.P. to R.W. I.D1; |
| D4 is the deadline for product movements R.W. I.P.P. to R.W. I.D2; |
| D5 is the deadline for product movements R.W. I.P.P. to R.W. I.D3; |
| D6 is the deadline for product movements R.W. I.D1 to R.W. I.A1; |
| D7is the deadline for product movements R.W. I.D1 to R.W. I.A2; |
| D8is the deadline for product movements R.W. I.D1 to R.W. I.A3; |
| D9 is the deadline for product movements R.W. I.D2 to R.W. I.A1; |
| D10 is the deadline for product movements R.W. I.D2 to R.W. I.A2; |
| D11 is the deadline for product movements R.W. I.D2 to R.W. I.A3; |
| D12 is the deadline for product movements R.W. I.D3 to R.W. I.A1; |
| D13 is the deadline for product movements R.W. I.D3 to R.W. I.A2; |
| D14 is the deadline for product movements R.W. I.D3 to R.W. I.A3; |
| D15 is the deadline for product movements R.W. I.A1 to R.W. I.PPD; |
| D16 is the deadline for product movements R.W. I.A2 to R.W. I.PPD; |
| D17 is the deadline for product movements R.W. I.A3 to R.W. I.PPD; |

As an initialization step in the neural network process, random individuals and their corresponding velocities are generated.

Table 3: Initially random people

For analysis based on neural networks, participants in the supply chain must be composed of random people with 17 particles representing product identification and seven red wine industries. Table 3 describes two people in the sample. Table 4 also shows the random velocities corresponding to each particle.

Table 4: Random initial velocities corresponding to each particle

| DI | R.W. I.F | R.W. I.P | R.W. I.P.P. | R.W. I.D1 | R.W. I.D2 | R.W. I.D3 | R.W. I.A1 | R.W. I.A2 | R.W. I.A3 | R.W. I.PPD |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 10.725 | 10.154 | 10.124 | 10.145 | 10.145 | 10.145 | 10.158 | 10.158 | 10.158 | 10.169 |
| 2 | 10.274 | 10.245 | 10.254 | 10.231 | 10.231 | 10.231 | 10.287 | 10.287 | 10.287 | 10.201 |

The final individual obtained after meeting the above convergence criteria is shown in Table 5.

Table 5: Formatting the last person's database.

| DI | R.W. I.F | R.W. I.P | R.W. I.P.P. | R.W. I.D1 | R.W. I.D2 | R.W. I.D3 | R.W. I.A1 | R.W. I.A2 | R.W. I.A3 | R.W. I.PPD |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1120 | -1180 | -1230 | 1235 | 1235 | 1235 | -1301 | -1301 | -1301 | -1501 |

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The last person thus received represents the product identifier and stock level for each of the seven players important to the rose wine industry in order to optimize the supply chain supply.

## 4. Conclusion

Today, the red wine industry is considered to be an important sector of red wine management. When effective and efficient management of the red wine sector in the red wine supply chain will finally improve customer service. In order to ensure the minimum costs of the red wine sector in the supply chain, it is necessary to establish independently the records of the red wine sector which must be maintained at different levels of the red wine sector in the supply chain. Reducing the overall cost of the red wine supply chain to a minimum refers to reducing the cost of ownership and the supply chain deficit in the red wine sector. Effective stock management The red wine sector is a complex process where stock management is managed throughout the red wine supply chain and the final solution is identified as the optimal solution. In other words, in the process of managing the red wine sector, the inventory of each actor in the red wine supply chain must correspond to the minimum total cost of the red wine supply chain. The dynamics of abundance and scarcity at all times are a serious problem when considering implementation. In addition, taking into account different product management capabilities creates a very complex inventory management process. The complexity of the problem increases with the division of the red wine and red wine industry.

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