



Image. Pavel Morillo in Pexels, 2022.

# Total Costs Optimizations for the Distribution Network

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This problem situation was written by Genaro Espinosa López (genaro\_espinosa@tec.mx), and translated with artificial intelligence program (TecGPT), with the purpose of serving as discussion material in the classroom; it does not intend to illustrate good or bad administrative practices. The story on this document is based on different people's experiences; some data has been modified at the request of the people and institutions involved.

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### **The Company**

Don Miguel Álvarez, a farmer, ventured into the rustic furniture business in January 1979 in his hometown of Ocotlán, Jalisco. Understanding the preferences and needs of Guadalajara's consumers, his products quickly gained market acceptance.

Within four years, he transitioned from agriculture to artisan furniture production. Today, his business has 32 furniture stores supplied by eight central Mexico-based manufacturers.

### **The Furniture Industry of the State of Jalisco**

Ocotlán, located 80 kilometers east of Guadalajara, Jalisco, has a population of 89,340 inhabitants, 48.5% of whom are men and 51.5% are women. 59.9% in the 15-64 age range; 35.4% between 0-14 years old, and 4.7% are more 65 years. Regarding population density in Jalisco, the most densely populated municipality is Ocotlán (238.98 inhabitants/km<sup>2</sup>), followed by Jamay (96.56 inhabitants/km<sup>2</sup>) and Chapala (79.44 inhabitants/km<sup>2</sup>).

In the 1960s, the furniture industry in Ocotlán began with the mass production of wooden furniture and derivatives. This activity started to consolidate during the 1980s, but it wasn't until the 1990s that the number of companies dedicated to furniture manufacturing doubled. Since 2004, this has been the primary industrial activity in Ocotlán, which has become one of the most solid pillars of the economy in the municipality and the Ciénega region. This industry is composed of 250 companies, of which 122 are microenterprises, 96 small, 25 medium, and seven large, meaning that the majority (87%) are micro and small enterprises (AFAMO, 2004).

**Image.** The furniture industry in Ocotlán began with the mass production of wooden furniture.



**Source.** Maria Ilaria Piras in Pexels, 2016.

As is common in SMEs, they are very flexible in adapting to changing market conditions and provide job opportunities for many people who would otherwise be unemployed. They are generally artisanal workshops with little or no mechanization, where family members develop their activity based on a certain division of labor.

### **Current Situation**

Elena Linares, Supply Chain Director at Mueblerías DonMi, was analyzing the last quarter's financial results and identified significant distribution cost optimization opportunities, especially after the company's recent expansion to Aguascalientes.

Historically, transportation costs have been very high, and she believed that stopping the consolidated shipments to Aguascalientes would help reduce that expense without significantly increasing inventory.

Mueblerías DonMi operates 32 stores, 20 in Guadalajara area and the rest in Aguascalientes city; it handles products from eight suppliers located in the central zone of the country. These suppliers deliver products with similar volume and weight characteristics, so they can be considered as one.

The company began in Ocotlán, and its stores in the city of Guadalajara managed to grow during the first three years.

Each Guadalajara store sells an annual average of 360,000 units (45,000 units per supplier). The operation in Aguascalientes started about five years ago and still has a lot of growth potential. Each Aguascalientes store sells an annual average of 84,000 units (10,500 per supplier). One of Don Miguel's policies has been to maintain enough inventory to meet the product demand, the standard inventory level covers 15 days of sales at month's end.

Given the sales levels in the Guadalajara stores, Don Miguel followed a direct shipment model and used small trucks (10,000-units capacity) for direct shipments from each provider to each of the stores in the state capital.

Current distribution relies on small trucks delivering directly from suppliers to Guadalajara stores at a cost of \$450 USD per delivery. Aguascalientes uses consolidated shipments requiring a minimum of 500 units per store at \$0.50 per unit.

The average inventory holding cost for each store is \$ 1.00 USD per unit per year.

### **Total Costs Optimizations**

To reduce transportation and inventory holding costs, Elena's team proposed new distribution strategies for Guadalajara and Aguascalientes. The alternatives consider two types of trucks: small one, with a 10,000-unit capacity; and large with a 40,000-unit capacity.

## **Distribution Alternatives for Guadalajara**

The staff proposed two distribution strategies for Guadalajara stores:

1. Direct Delivery Using 40,000-unit Trucks
  1. The trucks charge \$1,150 USD per delivery per store. Using large trucks would reduce transportation costs but increase inventory holding costs due to the larger order sizes.
2. Delivery Routes Serving Multiple Stores:
  1. Establish delivery routes to be sent from each provider to several stores in Guadalajara to reduce inventory holding costs, even if transportation costs increase. Large trucks would charge \$1,000 USD per shipment plus a fee of \$150 USD per store drop-off, meaning that if the truck delivers to four stores in Guadalajara in the same shipment, the total cost of that shipment plus drop-offs would be \$1,600 USD. Small trucks would charge \$400 USD per shipment plus a fee of \$50 USD per store delivery.

## **Distribution Alternatives for Aguascalientes**

The staff proposed three alternatives for Aguascalientes stores:

1. Direct Delivery Using 10,000-unit Trucks:
  - a) Each truck charges \$2,050 USD per delivery per store. This is a significantly lower transportation cost than what is currently charged by the consolidated shipments. However, this alternative would increase inventory holding costs in Aguascalientes due to the larger lot sizes.
2. Delivery routes Serving Multiple Stores:
  - a) The small truck carrier charges \$2,000 USD per delivery plus \$50 per store drop-off. Therefore, a product shipment from a provider to four stores would cost \$2,200. Delivery route shipments would generate higher transportation costs than direct shipment but would keep inventory holding costs lower.
3. Third-Party Cross-Docking Facility:
  - a) Use a third-party cross-docking facility in Aguascalientes that charges \$0.10 USD per unit at the cross-docking facility. This would allow all providers to send product (destined for the 12 stores in Aguascalientes) using a large truck to the cross-docking facility where the items would be sorted and sent to the stores in smaller trucks (each smaller truck would now contain products from the eight providers). Large trucks charge \$4,150 USD from each provider to the cross-docking facility. Small trucks charge \$250 USD per store per delivery from the cross-docking facility to each store.

## **Evaluating the Best Alternative**

Elena questions the best way to structure the distribution network and whether the savings will justify the effort. She wants to present Don Miguel with a proposal in which the new distribution network generates lower total costs for the organization. She does not have all the information at hand, so she will have to make some assumptions to perform the calculations. For example, she needs to estimate monthly sales, so she will have to use the total annual sales divided by twelve months, even though she is aware of seasonal variations. She must also include the inventory at the end of each month in the variables because it is used to fulfill the orders for the following month, and at the end of each month, she must have a minimum of 15 days in inventory.

On the other hand, to calculate the total inventory holding cost, Elena thinks it is better to base it on the average annual total inventory. Regarding the total transportation cost, she will have to calculate it based on the total number of shipments sent to each store throughout the year. If she uses distribution routes in any of the regions, she will also have to decide how many stores to include. Another important point is to ensure that the contracted freight services pick up and deliver the products on the same day; the freight company should not store furniture in their facilities.

She still has several questions she wants to answer, such as what the total annual cost of the current distribution is, including transportation and inventory holding costs, or how that cost would change if the two alternatives for Guadalajara were implemented. She also wonders what the cost would be to implement the three alternatives for Aguascalientes, and what the total amount would be if the most efficient alternatives for each city were carried out.

### **Recommendations for the Board of Directors**

Elena plans to present to Don Miguel a comprehensive proposal to optimize the distribution network. He is very enthusiastic about Elena's initiative and has invited her to present her findings at the next Board meeting. Her analysis will guide strategic decisions to improve the supply chain's efficiency and reduce operational costs.