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# Executive Summary:

This project focuses on reducing mileage costs through supply chain distribution network optimization. The goal is to establish a new distribution point that significantly decreases the expenses associated with delivering to high-volume areas. The current distribution point is located in Little Rock, AR, USA, and two potential secondary distribution centers, Fayetteville, NC, and Greenville, SC, have been evaluated as alternatives. The project utilizes a dataset containing information on 53 customers, including customer IDs, annual sales in pounds (LBs), and locations across different states in the USA. By analyzing this data, the annual mileage costs for each customer from the current distribution point and potential secondary distribution centers were calculated. The calculation of annual mileage costs involved determining the mileage load per pound for each customer and multiplying it by the total annual miles traveled from each distribution center to the customer. By applying the company's estimated mileage rate, the mileage costs for each distribution center were derived.

The geographic analysis was conducted to accurately assess customer locations and calculate distances between the distribution centers and customers. The analysis employed techniques such as obtaining latitude and longitude coordinates and utilizing distance calculation formulas to determine the total annual miles for each distribution center.

Considering the cost-effectiveness and potential for mileage cost reduction, it is recommended to establish a new distribution center in Greenville, SC. This decision is based on the lower annual mileage cost compared to the other options. By implementing the recommended distribution center in Greenville, the company can achieve significant cost savings, improve supply chain efficiency, and enhance customer service.

It is important to note that this analysis focused solely on mileage costs and did not consider other factors such as road conditions and fuel prices. Therefore, further evaluations incorporating these factors are recommended.

By acting upon the recommendations provided in this project, the company can optimize its supply chain distribution network, reduce mileage costs, and ultimately improve profitability and competitiveness.

# 2. Data Overview:

The data for this project consists of information related to 53 customers, including their unique customer IDs, annual sales in pounds (LBs), and respective locations across different states in the USA. This dataset serves as the foundation for the analysis and optimization of the supply chain distribution network.

The customer data provides essential insights into the distribution patterns and sales volumes across various regions. By understanding the distribution characteristics of the customer base, it becomes possible to identify opportunities for optimizing the network and reducing mileage costs.

Each customer's annual sales in pounds (LBs) serves as a key parameter in the analysis. This data allows for the determination of the annual mileage load per pound, which is crucial in calculating the mileage costs associated with serving each customer. The variation in sales volumes among customers contributes to the diversity of mileage costs, emphasizing the need for efficient distribution strategies.

Furthermore, the dataset includes customer locations, which are vital for accurately assessing the distances between the current distribution point in Little Rock, AR, and the potential secondary distribution centers in Fayetteville, NC, and Greenville, SC. The geographic information, including latitude and longitude coordinates, enables the calculation of precise distances using appropriate formulas and techniques.

The customer data, along with the associated annual sales and locations, forms the basis for evaluating the existing distribution point and determining the potential benefits of establishing a new distribution center in terms of reducing mileage costs. This data-centric approach ensures a comprehensive analysis of the supply chain distribution network and facilitates informed decision-making.

In the subsequent sections of this report, the data will be utilized to calculate the annual mileage costs, evaluate the distribution centers, perform geographic analysis, and ultimately present recommendations for optimizing the supply chain distribution network.

# 3. Calculation of Annual Mileage Costs:

The calculation of annual mileage costs is a crucial step in evaluating the efficiency and cost-effectiveness of different distribution centers. It involves determining the mileage load per pound for each customer and calculating the associated mileage cost based on the total annual miles traveled.

The following steps were followed to calculate the annual mileage costs:

## 3.1 Calculation of Mileage Load per Pound:

For each customer, the annual mileage load per pound was calculated. This was achieved by dividing the customer's annual sales in pounds by the full truck load (FTL) capacity, which is assumed to be 45,000 pounds. Dividing the annual sales by the FTL capacity provides the proportion of a full truck load that each customer represents.

By obtaining the mileage load per pound, it becomes possible to assess the relative contribution of each customer to the overall mileage costs. Customers with higher sales volumes will have a greater impact on the total mileage costs.

## 3.2 Calculation of Mileage Cost per Customer:

Once the mileage load per pound for each customer is determined, the next step is to calculate the mileage cost per customer. This is accomplished by multiplying the mileage load per pound by the total annual miles traveled from the current distribution point to the customer.

To calculate the total annual miles, the geographic coordinates (latitude and longitude) of the current distribution point and each customer's location are utilized. The Haversine formula or other distance calculation methods are employed to determine the distance in miles between two latitude and longitude points.

After obtaining the total annual miles, the mileage load per pound is multiplied by the total annual miles to calculate the mileage cost for each customer. Additionally, the company's estimated mileage rate, such as $2.00 per mile, is applied to determine the final cost.

By performing these calculations for each customer, the annual mileage costs for delivering to all customers from the current distribution point can be obtained.

These calculations provide a quantitative assessment of the impact of mileage costs associated with serving each customer from different distribution centers. The resulting figures enable a comparison of the costs associated with the current distribution point in Little Rock and the potential secondary distribution centers in Fayetteville and Greenville.

# 4. Evaluation of Distribution Centers:

The evaluation of distribution centers involves comparing the annual mileage costs associated with each distribution center option. In this project, the current distribution point in Little Rock, AR, USA, is assessed against two potential secondary distribution centers: Fayetteville, NC (Zip Code: 28306), and Greenville, SC (Zip Code: 29611).

To evaluate the distribution centers, the following steps were taken:

## 4.1 Calculation of Annual Mileage Costs for Each Distribution Center:

Using the previously calculated mileage costs for each customer from the current distribution point, the same calculations were applied to determine the annual mileage costs associated with delivering to all customers from Fayetteville and Greenville.

By considering the geographic coordinates of the distribution centers and the customer locations, the distances between each distribution center and every customer were determined using appropriate distance calculation methods. The total annual miles for each distribution center were calculated by summing the distances to all customers.

Using the mileage load per pound and the total annual miles, the annual mileage costs were calculated for both Fayetteville and Greenville. This enabled a direct comparison of the costs associated with the three distribution centers.

## 4.2 Comparison of Annual Mileage Costs:

The calculated annual mileage costs for the current distribution point in Little Rock, Fayetteville, and Greenville were analyzed to determine the most cost-effective option.

By comparing the costs, it was found that Little Rock incurred an annual cost of $94,666.70, Fayetteville resulted in an annual cost of $48,247.83, and Greenville yielded an annual cost of $41,550.32. These figures represent the expenses associated with delivering to all customers from each respective distribution center.

The comparison clearly demonstrates that Greenville offers the lowest annual mileage cost among the three options. This suggests that establishing a new distribution center in Greenville would lead to significant cost savings in terms of mileage expenses.

Based on this evaluation, Greenville is recommended as the optimal distribution center choice for the supply chain distribution network. The lower annual mileage cost indicates a more efficient and cost-effective distribution strategy, which can positively impact the company's profitability and operational efficiency.

# 5. Geographic Analysis:

The geographic analysis in this project aimed to accurately determine customer locations and assess the distances between the distribution centers and each customer. This analysis is crucial for calculating the annual mileage costs and identifying the optimal distribution center.

To perform the geographic analysis, the following steps were undertaken:

## 5.1 Obtaining Latitude and Longitude Coordinates:

The customer data provided in the project included information on customer locations across different states in the USA. To accurately determine the latitude and longitude coordinates of each customer's location, the VLOOKUP Excel formula or a similar method was utilized. This allowed for the retrieval of the corresponding latitude and longitude values based on the provided customer IDs or other unique identifiers.

## 5.2 Calculation of Distances:

With the latitude and longitude coordinates of the distribution centers (Little Rock, Fayetteville, and Greenville) and the customer locations, the distances between each distribution center and every customer were calculated. The Haversine formula or other appropriate distance calculation methods were employed to determine the distances in miles.

The Haversine formula takes into account the curvature of the Earth and provides accurate distance calculations between two latitude and longitude points. By applying this formula or a similar method, the distances between the distribution centers and customers were accurately calculated, enabling a comprehensive assessment of the transportation distances.

## 5.3 Assessing Total Annual Miles:

By summing the distances between each distribution center and all customers, the total annual miles for each distribution center were calculated. This represented the cumulative distance that would be covered by the distribution center when serving all customers.

The total annual miles served as a key parameter in the calculation of the annual mileage costs for each distribution center. It reflected the overall transportation distance and helped determine the distribution center's efficiency and cost-effectiveness in terms of mileage expenses.

The geographic analysis ensured the accuracy and reliability of the project's calculations and findings. It provided valuable insights into the distances involved in serving different customers from various distribution centers, facilitating data-driven decision-making regarding the optimal distribution center selection.

# 6. Conclusion and Recommendation:

Based on the comprehensive analysis conducted in this project, focused on reducing mileage costs through supply chain distribution network optimization, the following conclusions and recommendation can be drawn:

## 6.1 Conclusion:

* The evaluation of distribution centers revealed that the current distribution point in Little Rock, AR, incurred an annual mileage cost of $94,666.70.
* Among the two potential secondary distribution centers, Fayetteville, NC, resulted in an annual cost of $48,247.83, while Greenville, SC, yielded the lowest annual cost of $41,550.32.
* The geographic analysis accurately determined customer locations and assessed the distances between the distribution centers and each customer, providing valuable insights into the transportation distances involved.
* The data-driven analysis clearly demonstrated that establishing a new distribution center in Greenville would lead to significant cost savings in terms of annual mileage expenses.

## 6.2 Recommendation:

Based on the findings and analysis, it is recommended to establish a new distribution center in Greenville, SC (Zip Code: 29611), to optimize the supply chain distribution network and reduce mileage costs. By choosing Greenville as the new distribution center, the company can achieve substantial cost savings and enhance operational efficiency. The lower annual mileage cost of $41,550.32 compared to Little Rock and Fayetteville makes Greenville the most cost-effective option.

The establishment of the distribution center in Greenville should be accompanied by a well-planned transition strategy to ensure a seamless transfer of operations from the current distribution point. Considerations such as logistics infrastructure, proximity to major transportation routes, and customer accessibility should be factored into the implementation plan.

It is important to note that while Greenville offers the best optimize cost solution in terms of mileage expenses, other factors such as road conditions, traffic patterns, and fuel prices were not considered in this analysis. Therefore, it is recommended to conduct a more comprehensive evaluation that takes these factors into account to validate and refine the findings.

By implementing the recommended distribution center in Greenville, the company can significantly reduce its annual mileage costs, improve supply chain efficiency, and enhance customer service. The optimization of the supply chain distribution network through this strategic decision will contribute to the company's overall profitability and competitiveness.