Optimizing Supply Chain Efficiency for McTrump's Fast-Food Distribution Network in New York

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Summary

McTrump’s Co., a renowned fast-food giant headquartered in New York City, is strategically planning to enhance its supply chain operations by establishing a centralized distribution center (DC) to serve seven outlets across New York State. The primary objective is to minimize shipping distances, thereby improving operational efficiency and cost-effectiveness.

McTrump’s value proposition is to provide customers with fresh food, at any point and at an affordable price. This is why it becomes important to find an apt place to open the distribution center which caters to seven outlets in NewYork in an optimized way, both cost and time-wise.

The team focused on minimizing shipping distances and leveraged advanced optimization techniques and mathematical modeling. We successfully developed an optimized model that meets all constraints while minimizing total shipping distances by employing Microsoft Excel's Solver and SolverTable add-in. Sensitivity analysis provided valuable insights into the impact of various factors on the model's performance, allowing for informed decision-making.

While the optimized solution demonstrates promising results, its practical implementation at scale may require additional resources and infrastructure. Nonetheless, the project highlights McTrump's potential strategic advantages in the competitive fast-food industry landscape. With a streamlined supply chain and optimized distribution network, McTrump is poised to enhance customer satisfaction by providing fresh food, reduce operational costs by planning to build a distribution center at the optimal location, and maintain its competitive edge in the market.

Introduction

Company

McTrump's, the renowned fast-food giant headquartered in the bustling metropolis of New York City, has garnered global acclaim for its diverse menu offerings, serving millions of customers daily across its expansive network of restaurants worldwide. At the core of McTrump's operational efficiency lies its meticulously designed distribution network, which facilitates the seamless transportation of raw materials, ingredients, and finished products from suppliers to restaurants. By prioritizing cost-effective shipping solutions, McTrump's not only ensures timely deliveries but also minimizes overhead costs, thus maintaining its profitability and competitive edge in the fast-food industry.

Problem

The company is strategizing the establishment of a distribution center (DC) to streamline the transportation of fresh products to seven designated fast-food outlets in the vicinity. The primary aim is to minimize the total shipping distances from the distribution center (DC) to the seven specified locations within New York State. By minimizing these distances, McTrump's Co. can enhance the efficiency of its supply chain operations.

In this scenario, the latitude (x_{dc}) and longitude (y_{dc}) coordinates of the distribution center (DC) within New York State are crucial parameters for optimizing the minimum total shipping distances.

The geographic limitations mandate that the distribution center (DC) must be strategically positioned within the defined boundaries set by the East River and the Hudson River. These limitations are expressed as inequalities for both latitude and longitude coordinates, ensuring the distribution center's placement within the specified geographical area. Determining the coordinates of these rivers and the intersection points become crucial to effectively decide the ideal location for the distribution center.

Table 1 displays the Longitude and Latitude coordinates of the seven outlets alongside the estimated annual shipments for each store.

	Longitute(x-coordinate)	Latitude(y-coordinate)	No. of annual shipments
Store 1	40.7505058	-73.990583	400
Store 2	40.7291264	-73.9932643	365
Store 3	40.7093746	-74.0099791	425
Store 4	40.7188385	-73.9882797	475
Store 5	40.7185138	-74.0011677	365
Store 6	40.7525294	-73.9928762	400
Store 7	40.750831	-73.9890961	400

From the table, we can gather that Stores 1, 3, 4, 6 and 7 have more than 365 shipments annually, which might mean that these locations have more than one shipment delivery in a day.

Proposed Solution

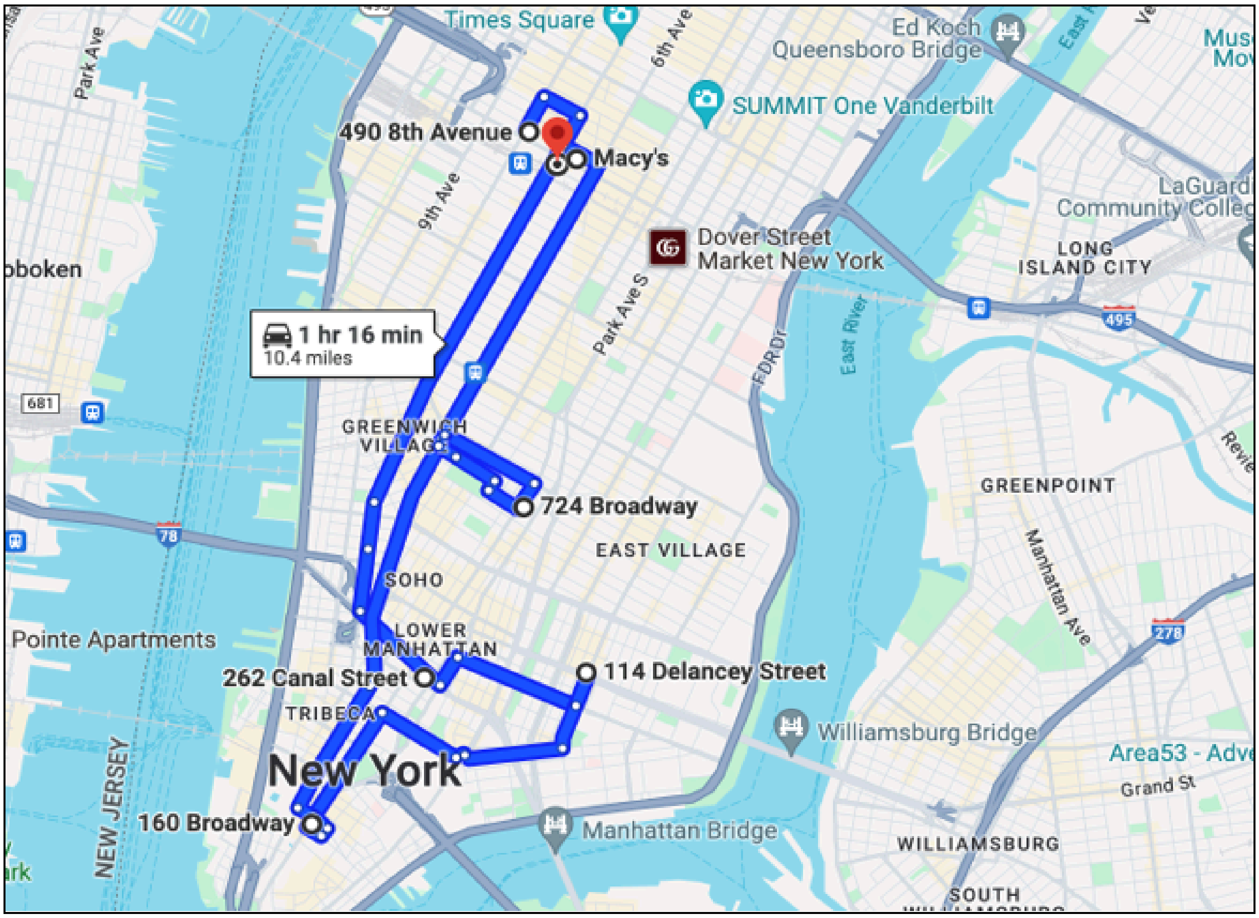
Employing advanced non-linear optimization algorithms and comprehensive geographic analysis, we will determine the optimal latitude (x_{dc}) and longitude (y_{dc}) coordinates for the distribution center within New York State. The proposed solution is optimizing McTrump's supply chain network, strategically minimizing the distance traveled to deliver goods from the distribution center to the designated fast-food outlets. This approach enhances operational efficiency, generates significant cost savings, and elevates service standards.

Main Chapter

Data collection

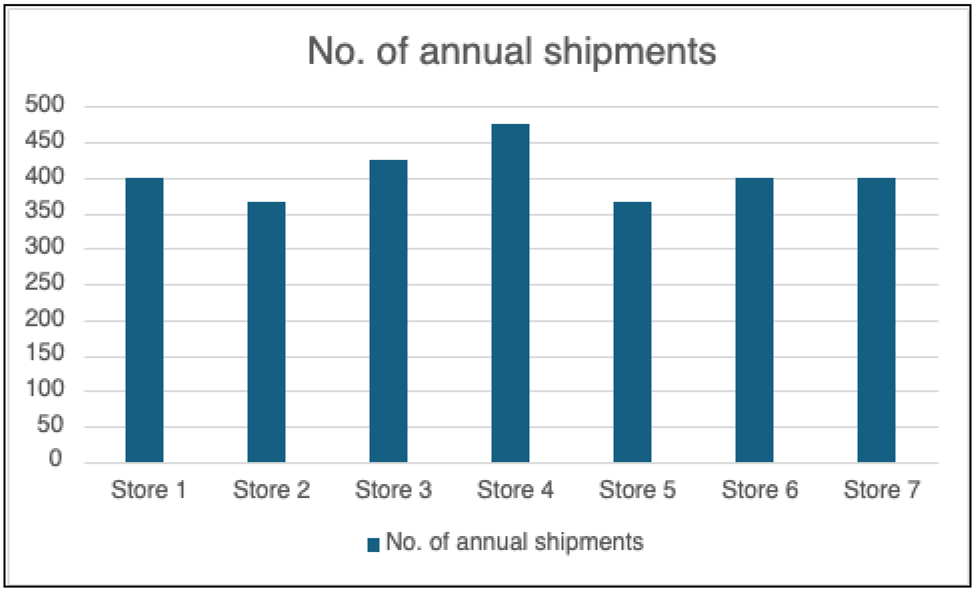
Our data collection process commenced by pinpointing the locations within New York City of the seven McTrump stores. This data will then be used for the model formulation on MS Excel.

Figure 1 illustrates the geographical locations of the seven outlets



Additionally, we gathered the total number of annual shipments for each store. The graph below illustrates this data, with Store 4 recording the highest number of shipments at 475, while Store 2 and Store 5 have the lowest, each with 365 shipments. It would be ideal if the distribution center is closer to the stores which have more than 365 shipments annually. This would help in minimizing the distance between the distribution center and the stores.

Figure 2 depicts a bar graph comparing the number of shipments across different stores.



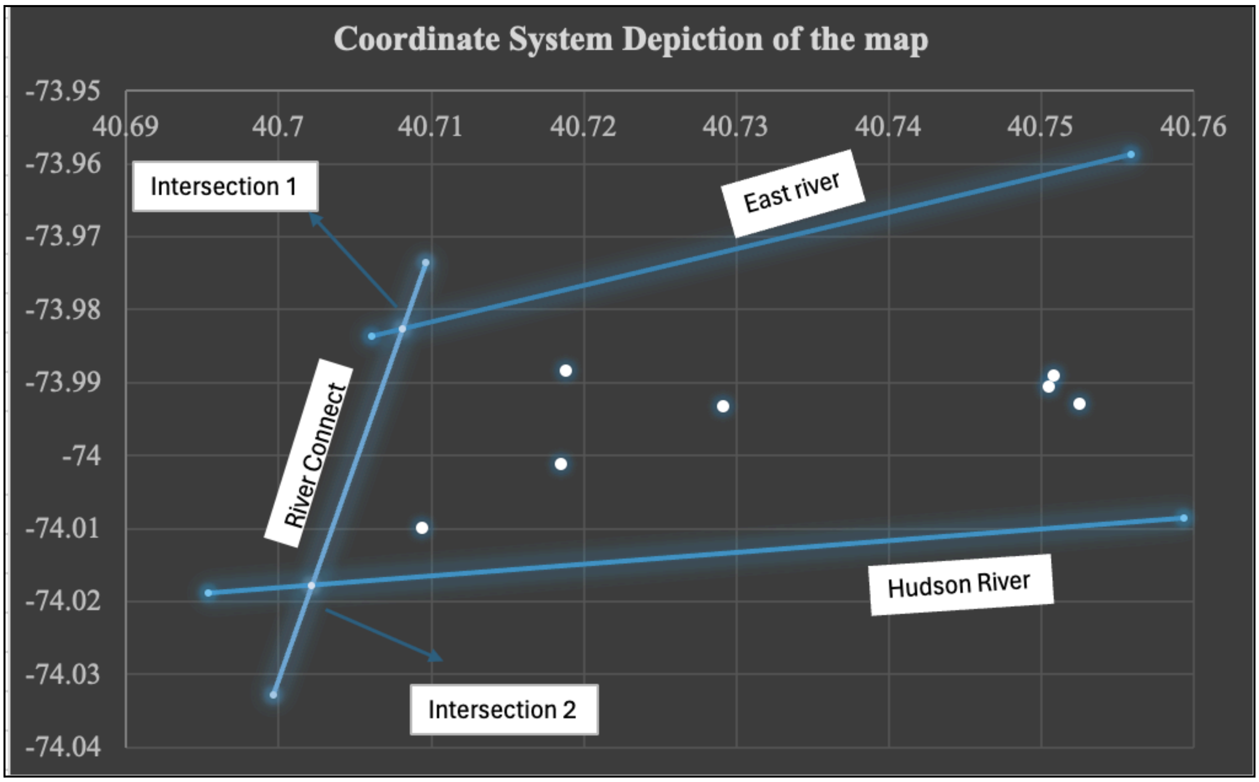
Furthermore, we gathered approximate coordinates for the East River and Hudson River. This also included identifying a specific area on the map where these two rivers merge. Hence, to accommodate this, we introduced an additional constraint line labeled "River Connect" which signifies the convergence point of these two rivers (Refer to Figure 3).

Table 2 represents the start and end points of East and Hudson rivers and their intersection points

	x-coordinate	y-coordinate
East River		
Start	40.755862	-73.958723
End	40.706086	-73.983676
Hudson River		
Start	40.759334	-74.008615
End	40.695411	-74.018892
River Connect		
Start	40.69963	-74.032743
End	40.709652	-73.973634
Intersection 1	40.70812246	-73.98265511
Intersection 2	40.70216249	-74.01780655

The additional points labeled as Intersection 1 and Intersection 2 serve a vital purpose in our model formulation process. These points denote the meeting points of the East River with the River Connect and the Hudson River with the River Connect, respectively. Accurately pinpointing these intersections allows us to establish constraints that align our model with the geographic features of the area.

Figure 3 illustrates the coordinate system depiction of the map



Data Analysis

The data analysis process comprised several steps. Initially, the input coordinates for the seven stores and the rivers were provided in longitude and latitude format. Given the inherent complexities associated with working directly with geographic coordinates, including variations in scale and units, we employed normalization techniques. These techniques enabled us to standardize the data, making it more conducive for analysis.

Table 3 gives an overview of the standardization:

Retail Stores	X-coord.	Y-coord.	Number of Annual Shipments	Normalizing X	Normalizing Y	Distance from Warehouse to Stores, miles
Store 1	40.7505058	-73.990583	400	0.971496862	0.567365604	1.101315063
Store 2	40.7291264	-73.993264	365	-0.202698328	0.225708287	0.12945751
Store 3	40.7093746	-74.009979	425	-1.287502793	-1.90439319	2.446316672
Store 4	40.7188385	-73.98828	475	-0.767728343	0.860851916	0.945296359
Store 5	40.7185138	-74.001168	365	-0.785561453	-0.78154999	1.228429628
Store 6	40.7525294	-73.992876	400	1.082636623	0.275153658	1.157376927
Store 7	40.750831	-73.989096	400	0.989357433	0.756863713	1.190938157
Average	40.73281707	-73.995035	404.2857143			
Standard Deviation	0.018207705	0.00784704	37.7964473			

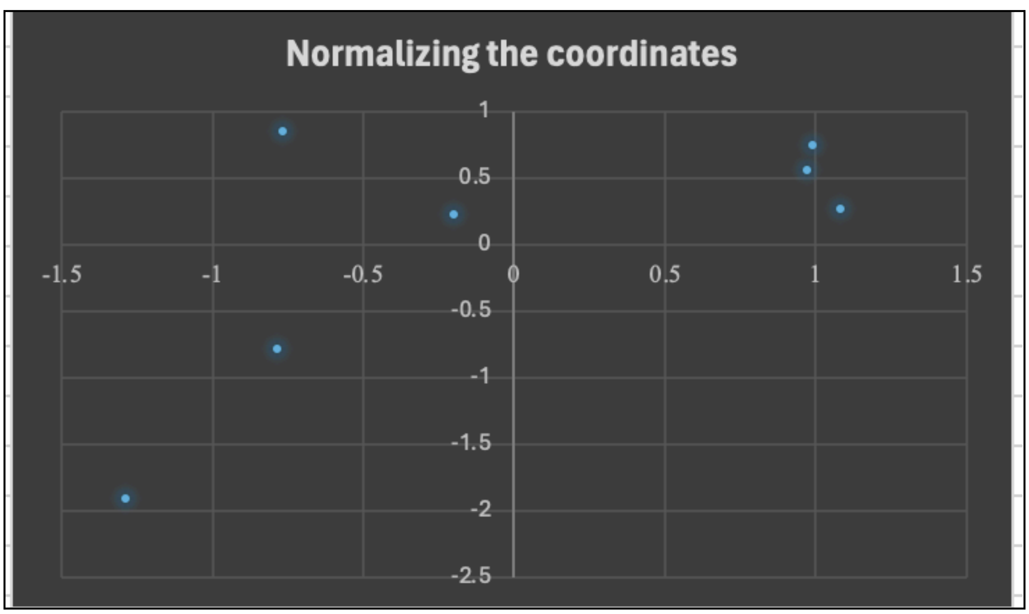
Mathematical formula used: (coordinate - mean) / std dev

Where, coordinate would be X or Y coordinate values

Excel formula/function: STANDARDIZE(coordinate value, mean, sd)

Where, coordinate is X-coord or Y-coord values

Figure 4 illustrates the coordinate system depiction of the map (Refer Figure 1) after normalization



Furthermore, we leveraged Python programming to compute the intersection points, streamlining the evaluation process for enhanced efficiency and accuracy.

Figure 5 presents a snippet of the Python program utilized to compute one of the intersection points.

```python
def find_intersection_point(x1, y1, x2, y2, x3, y3, x4, y4):

    m1 = (y2 - y1) / (x2 - x1)
    m2 = (y4 - y3) / (x4 - x3)

    b1 = y1 - m1 * x1
    b2 = y3 - m2 * x3

    x_intersect = (b2 - b1) / (m1 - m2)
    y_intersect = m1 * x_intersect + b1
    return x_intersect, y_intersect

x1, y1 = 40.759334, -74.008615
x2, y2 = 40.695411, -74.018892
x3, y3 = 40.69963, -74.032743
x4, y4 = 40.709652, -73.973634

intersection_point = find_intersection_point(x1, y1, x2, y2, x3, y3, x4, y4)
print("Intersection point coordinates:", intersection_point)
```

Requirements Gathering

The requirement-gathering process for our optimization project involved a detailed examination of the data and parameters necessary for formulating a tailored model to minimize the total shipping distances from the distribution center (DC) to the seven specified locations within New York State. We began by collecting comprehensive data, including coordinates for the seven stores, annual shipment volumes for each store, and approximate coordinates for the East River and Hudson River. This data formed the foundation for our optimization model. Additionally, we identified intersection points between rivers and introduced constraint lines to ensure the model aligns seamlessly with the area's geographic features. Normalization techniques were then applied to standardize input coordinates, ensuring consistency and accuracy in our analysis. To compute intersection points efficiently, we utilized Python programming. This approach streamlined our analysis process, allowing for faster iteration and optimization of the model.

Optimization Model

Having covered the problem and background, we'll now delve into the specifics of our optimization model. This will involve discussing the decision variables, inputs, and objectives in detail to understand how the model will be structured and how it will help us achieve our goals.

Decision Variables:

x_{dc} represents the x-coordinate of the distribution center (DC)

y_{dc} represents the y-coordinate of the distribution center (DC)

Inputs:

i denotes the store index, where $i = 1 \ldots 7$

x_i represents the x-coordinate of store i

y_i represents the y-coordinate of store i

s_i represents the projected number of annual shipments from the warehouse to store i

Calculated Value:

d_i represents the distance between the warehouse and store i, calculated using the Euclidean distance formula: $\boldsymbol{d_i = \sqrt{(x_{dc} - x_i)^2 + (y_{dc} - y_i)^2}}$

Objective function: The objective is to minimize the total annual shipping distances, which is expressed as the sumproduct of the estimated number of annual shipments (s_i) and the respective distances (d_i):

$$\text{Min} \sum_{i=1}^{7} s_i d_i$$

Constraints:

X-coordinate limits for distribution center (DC) location: $x_{dc} \leq X_{U,}$ $x_{dc} \geq X_L$

Y-coordinate limits for distribution center (DC) location: $y_{dc} \leq Y_{U,}$ $y_{dc} \geq Y_L$

Where X_U and Y_U are the upper limits of the optimal solution and X_L and Y_L are the lower limits of the optimal solution.

Table 4 represents the constraints considered in the formulation of optimization model

Constraints	LHS		RHS
X coordinate	-0.073395625	>=	-1.356272571
X coordinate	-0.073395625	<=	1.456357522
Y coordinate	0.219379172	>=	-1.730569772
Y coordinate	0.219379172	<=	1.57766826

- $X_{dc} \geq -1.356272571$ which means that the minimum allowable X-coordinate for the distribution center is set to -1.356272571, ensuring that the DC remains below the East River (Refer Figure 3)
- $X_{dc} \leq 1.456357522$ which means that the maximum allowable X-coordinate is limited to 1.456357522, ensuring that the DC is positioned above the Hudson River (Refer Figure 3)
- $Y_{dc} \geq -1.730569772$ which means that the minimum allowable Y-coordinate is set to -1.730569772, ensuring that the distribution center lies to the right of the merging point of the East River and the Hudson River (Refer Figure 3)
- $Y_{dc} \leq 1.57766826$ The maximum allowable Y-coordinate is limited to 1.57766826, ensuring that the distribution center remains to the right of the merging point of the East River and the Hudson River (Refer Figure 3)

These constraints guarantee that the distribution center remains within the defined boundaries set by the East River and the Hudson River while optimizing shipping distances to the target stores. With our model built, we proceeded to solve it using Excel Solver add-in. Employing the GRG Nonlinear function within Solver and using the minimum function, we aimed to obtain our optimized solution. We made sure to uncheck the non-negativity constraints as the coordinates of the distribution center could lie in the negative quadrant of the cartesian plane as well.

Solution Results and Analysis

Table 5 depicts the optimal model that adheres to all imposed constraints

Retail Stores	X-coord.	Y-coord.	Number of Annual Shipments	Normalizing X	Normalizing Y	Distance from Distribution center to Stores, miles
Store 1	40.7505058	-73.990583	400	0.971496862	0.567365604	1.101315063
Store 2	40.7291264	-73.993264	365	-0.202698328	0.225708287	0.12945751
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Average	40.73281707	-73.995035	404.2857143			
Standard Deviation	0.018207705	0.00784704	37.7964473			
Decision variable: Distribution center coordinates						
Distribution Center (DC) Coordinates	X-coord.	Y-coord.				
	-0.073395625	0.21937917				
Objective Function						
Minimize total distances from Distribution center to stores	3364.181219					

In the optimal solution, we have the normalized values of x = -0.073395625 and y = 0.219379172. The optimal solution for the distribution center coordinates, determined through the optimization model, is situated at longitude 40.73148071 and latitude -73.99331366. We denormalized it by using the same formula - (coordinate - mean) / std dev.

Table 6 gives the actual coordinates of the optimal solution

Coordinates for ideal point	
-0.073395625	40.73148071
0.219379172	-73.99331366

This solution effectively minimizes the total shipping distance from the distribution center to the stores, resulting in a total distance of 3,364.18 miles.

Sensitivity Analysis

One-way Sensitivity Analysis

Using the SolverTable for the non-linear programming model (NLP), we explored the fluctuations in the optimal total distances from the Distribution Center (DC) to all the seven stores. We specifically analyze these variations concerning changes in the number of annual shipments for Store 4, ranging from 100 to 1,000, with an incremental increase of 50 units.

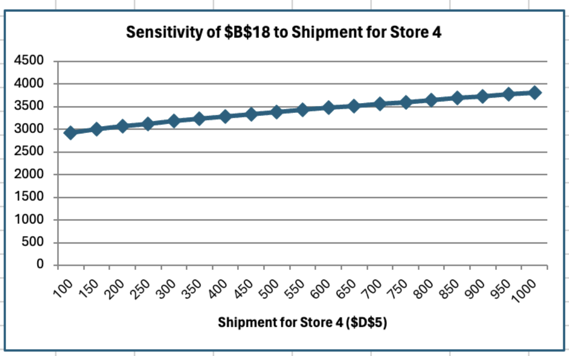
Figure 6 illustrates the one-way sensitivity analysis of the optimal total distances from the distribution center to store 4.

One-way analysis for Solver model in Formulation worksheet

Shipment for Store 4 (cell D5) values along side, output cell(s) along top

	B18	Data for chart: B18
100	2931.145	2931.145
150	2999.604	2999.604
200	3064.362	3064.362
250	3125.582	3125.582
300	3183.533	3183.533
350	3238.48	3238.48
400	3290.654	3290.654
450	3340.267	3340.267
500	3387.543	3387.543
550	3432.77	3432.77
600	3476.352	3476.352
650	3518.947	3518.947
700	3561.452	3561.452
750	3603.956	3603.956
800	3646.461	3646.461
850	3688.966	3688.966
900	3731.471	3731.471
950	3773.976	3773.976
1000	3816.481	3816.481

When you select an output from the dropdown list in cell K4, the chart will adapt to that output.



After conducting the one-way sensitivity analysis, focusing on the number of annual shipments for Store 4, we gained valuable insights into how the optimized total distances vary in response to changes in this parameter.

The sensitivity analysis results unveil a clear trend: as the number of annual shipments for Store 4 increases, the optimal total distances from the distribution center to the stores also exhibit an upward trajectory. This observation indicates that higher the shipment volumes for Store 4 higher is the distances traveled within the distribution network.

For instance, as we increment the annual shipment volume by 50 units from 100 to 1,000, we observe a consistent positive correlation with the objective function, indicating an increase in total distances as shipment volumes rise.

To illustrate further, when Store 4 has a relatively modest volume of 100 annual shipments, the optimized total distance amounts to 3,009.70 miles. However, with a substantial increase in the number of annual shipments for Store 4 to 1,000, the corresponding optimal total distance escalates to 3,860.46 miles. Notably, our optimal solution occurs at a shipment volume of 475, with the corresponding total distance being 3,364 miles.

This progressive rise in total distances underscores the significant impact of shipment volume on the overall efficiency of the distribution network. By delving into these relationships, we gain deeper insights into how the delivery system operates, particularly in terms of optimizing the total distances from the distribution center to the stores within McTrump's supply chain.

Two way sensitivity analysis

For our two-way sensitivity analysis, we varied the number of annual shipments for Store 2 (with the lowest number of shipments per year) and Store 4 (with the highest number of shipments per year) to see the effect of the change on our objective function, i.e., the minimum total distance from the distribution center to the stores. We have taken a range of 100 to 1,000 with an increment of 50 for both these stores.

Table 7 displays the two-way sensitivity analysis of the optimal total distances from the distribution center to the stores.

Two-way analysis for Solver model in Formulation worksheet

Shipment for Store 2 (cell D3) values along side, Shipment for Store 4 (cell D5) values along top, output cell in corner

B18	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
100	2688.22	2770.851	2852.293	2932.321	3010.634	3086.835	3160.431	3230.896	3297.806	3360.979	3420.479	3476.517	3529.358	3579.29	3626.629	3671.727	3714.927	3756.478	3796.465
150	2739.606	2820.897	2900.709	2978.718	3054.5	3127.542	3197.323	3263.48	3325.918	3384.778	3440.308	3492.797	3542.552	3589.919	3635.293	3679.079	3721.59	3762.987	3803.27
200	2789.217	2868.778	2946.434	3021.729	3094.128	3163.132	3228.456	3290.101	3348.269	3403.234	3455.288	3504.739	3551.94	3597.313	3641.309	3684.307	3726.526	3768.021	3808.724
250	2836.51	2913.753	2988.478	3060.136	3128.271	3192.696	3253.509	3310.956	3365.32	3416.881	3465.932	3512.815	3557.96	3601.86	3644.965	3687.568	3729.776	3771.554	3812.777
300	2880.637	2954.698	3025.51	3092.691	3156.176	3216.144	3272.868	3326.621	3377.659	3426.247	3472.701	3517.437	3560.972	3603.836	3646.425	3688.923	3731.331	3773.538	3815.374
350	2920.329	2990.192	3056.363	3118.899	3178.041	3234.065	3287.221	3337.735	3385.833	3431.793	3475.992	3518.946	3561.452	3603.957	3646.462	3688.966	3731.471	3773.976	3816.453
400	2954.142	3019.281	3080.897	3139.26	3194.629	3247.224	3297.234	3344.847	3390.293	3433.898	3476.442	3518.947	3561.452	3603.956	3646.462	3688.966	3731.471	3773.976	3816.481
450	2981.474	3042.231	3099.882	3154.656	3206.737	3256.28	3303.435	3348.385	3391.432	3433.937	3476.442	3518.947	3561.452	3603.956	3646.462	3688.966	3731.471	3773.976	3816.481
500	3002.981	3059.996	3114.239	3165.859	3214.98	3261.717	3306.209	3348.927	3391.432	3433.937	3476.442	3518.947	3561.452	3603.956	3646.462	3688.967	3731.471	3773.977	3816.481
550	3019.69	3073.464	3124.675	3173.418	3219.78	3263.863	3306.422	3348.927	3391.432	3433.937	3476.442	3518.947	3561.452	3603.957	3646.461	3688.966	3731.471	3773.976	3816.481
600	3032.401	3083.252	3131.66	3177.69	3221.41	3263.917	3306.422	3348.927	3391.432	3433.937	3476.442	3518.947	3561.452	3603.957	3646.461	3688.966	3731.471	3773.977	3816.481
650	3041.641	3089.754	3135.49	3178.908	3221.412	3263.917	3306.422	3348.927	3391.432	3433.937	3476.442	3518.947	3561.452	3603.957	3646.461	3688.967	3731.471	3773.976	3816.481
700	3047.735	3093.212	3136.403	3178.908	3221.412	3263.917	3306.422	3348.927	3391.432	3433.937	3476.442	3518.947	3561.452	3603.957	3646.461	3688.967	3731.471	3773.976	3816.481
750	3050.878	3093.898	3136.403	3178.908	3221.413	3263.917	3306.422	3348.927	3391.432	3433.937	3476.442	3518.947	3561.452	3603.957	3646.461	3688.966	3731.471	3773.976	3816.481
800	3051.393	3093.898	3136.403	3178.908	3221.413	3263.917	3306.422	3348.927	3391.432	3433.937	3476.442	3518.947	3561.452	3603.957	3646.462	3688.966	3731.471	3773.976	3816.481
850	3051.393	3093.898	3136.403	3178.908	3221.413	3263.918	3306.422	3348.927	3391.432	3433.937	3476.442	3518.947	3561.452	3603.957	3646.461	3688.966	3731.471	3773.976	3816.481
900	3051.393	3093.898	3136.403	3178.908	3221.413	3263.918	3306.423	3348.927	3391.432	3433.937	3476.442	3518.947	3561.452	3603.957	3646.461	3688.966	3731.471	3773.976	3816.481
950	3051.393	3093.898	3136.403	3178.908	3221.413	3263.917	3306.422	3348.927	3391.432	3433.937	3476.442	3518.947	3561.452	3603.957	3646.461	3688.966	3731.471	3773.976	3816.481
1000	3051.393	3093.898	3136.403	3178.908	3221.413	3263.917	3306.422	3348.927	3391.432	3433.937	3476.442	3518.947	3561.452	3603.957	3646.462	3688.966	3731.472	3773.976	3816.482

Output and Shipment for Store 2 value for chart		Output and Shipment for Store 4 value for chart	
Output	Shipment for Store 2 value	Output	Shipment for Store 4 value
B18	100	B18	100
2688.22		2688.22	
2770.851		2739.606	
2852.293		2789.217	
2932.321		2836.51	
3010.634		2880.637	
3086.835		2920.329	
3160.431		2954.142	
3230.896		2981.474	
3297.806		3002.981	
3360.979		3019.69	
3420.479		3032.401	
3476.517		3041.641	
3529.358		3047.735	
3579.29		3050.878	
3626.629		3051.393	
3671.727		3051.393	
3714.927		3051.393	
3756.478		3051.393	
3796.465		3051.393	

Figure 7a, 7b, 7c and 7d depicts the graph which are linear in nature emphasizing a positive correlation

Figure 7a (at 100 units)

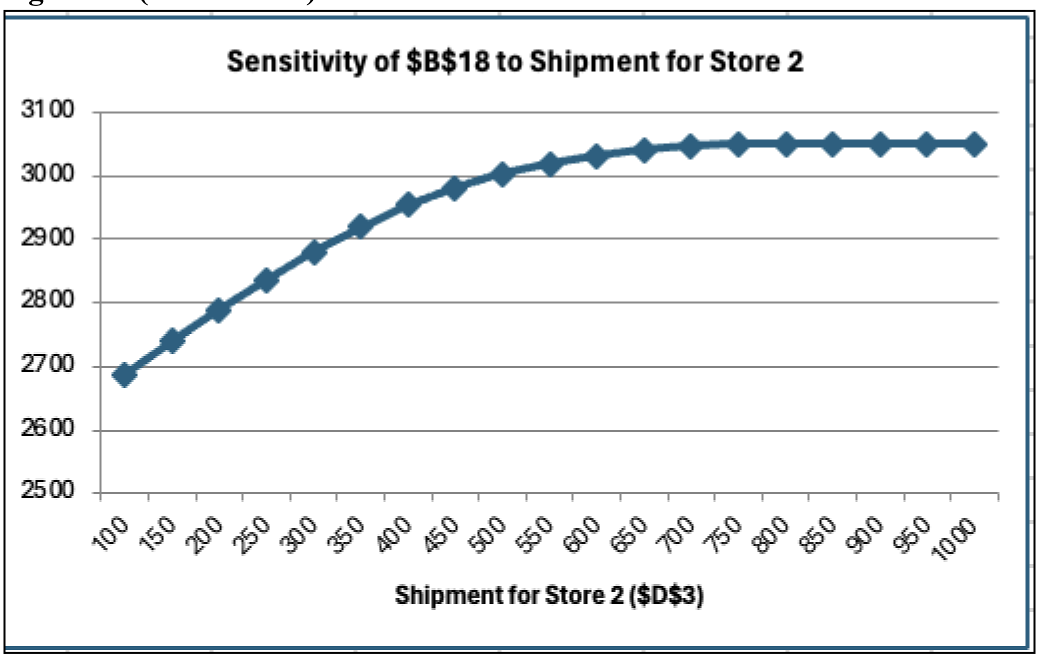
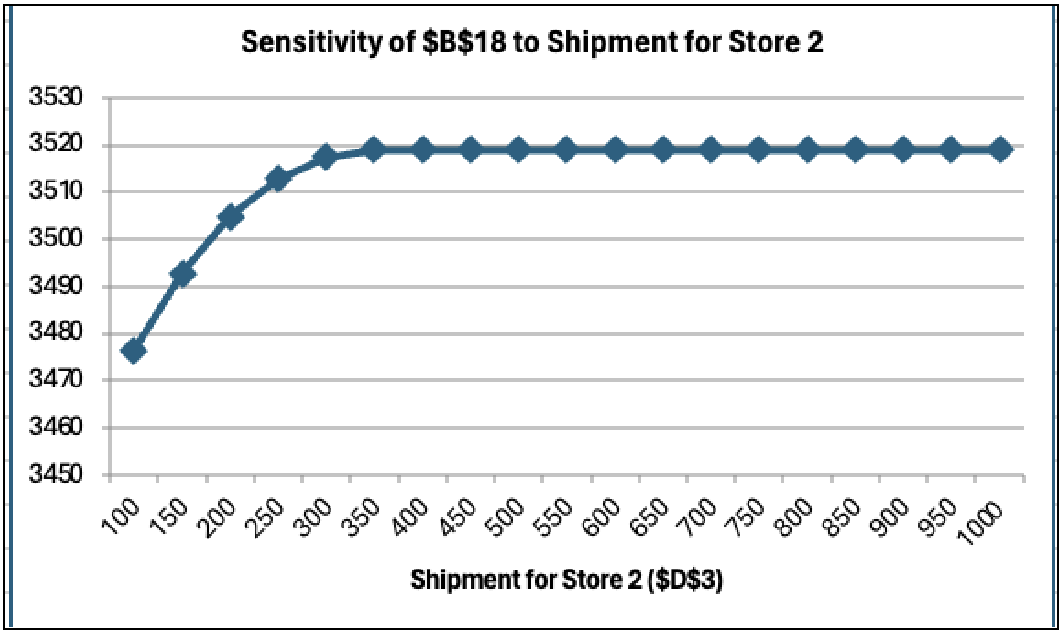


Figure 7b (at 650 units)



Upon examining the graphs presented in Figure 7a, a clear relationship emerges between the volume of shipments directed towards Store 2 and the corresponding total distance covered in the distribution network.

Firstly, as the number of annual shipments directed towards Store 2 increases, the total distance traveled from the distribution center to all stores shows a noticeable upward trend. This observation indicates that a higher volume of shipments to Store 2 increases the overall distance covered in the distribution network. However, after a point (here at 750 units and above) the objective function is insensitive at about $3050.

From Figure 7b, we can see that the objective function does not change at all (is insensitive) after 350 units and stays at about $3520.

Figure 7c (at 100 units)

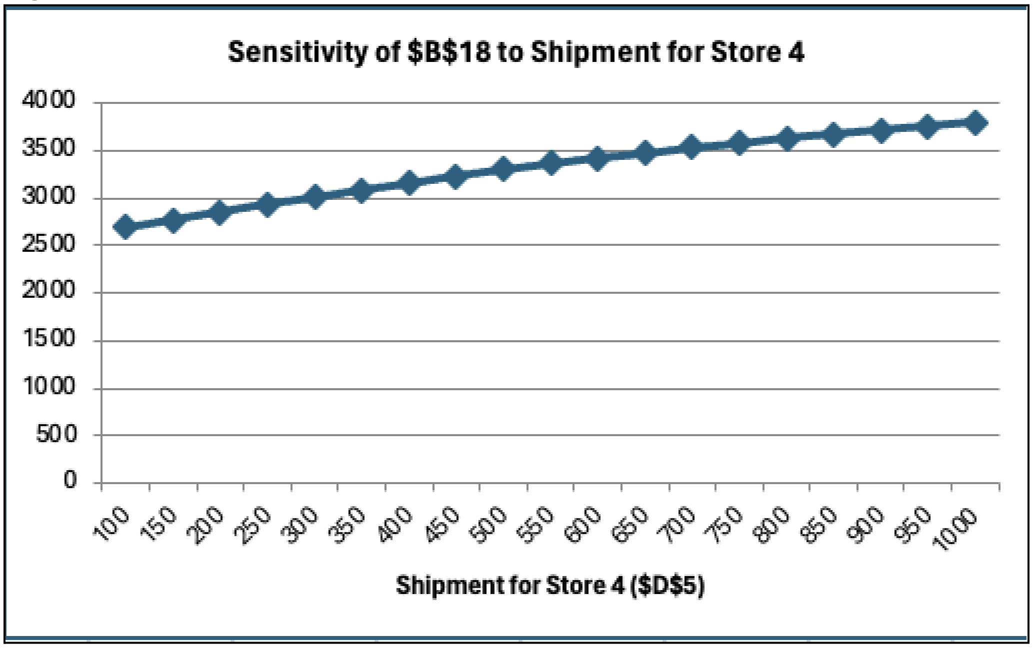
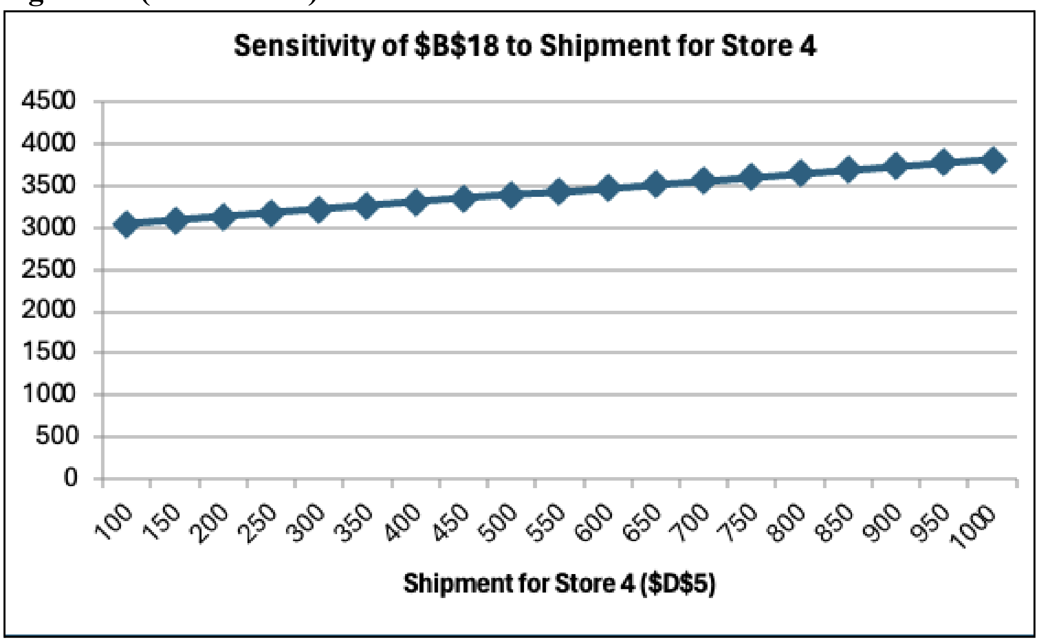


Figure 7d (at 650 units)



Similarly, from Figure 7c and 7d, we can see that when the volume of shipments directed towards Store 4 is increased, the minimum total distance traveled for deliveries from the distribution center to all stores correspondingly rises. This trend highlights the impact of shipment volume on the efficiency of the distribution network, with higher volumes necessitating longer distances traveled to fulfill deliveries to the designated stores.

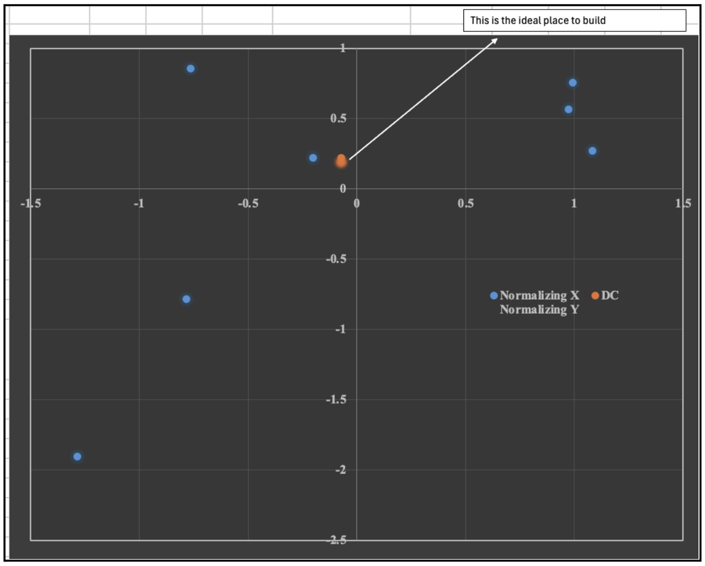
However, the strategic insight here lies in the optimal allocation of shipments, particularly towards Store 2. Given its proximity to the distribution center, a more efficient approach involves distributing multiple shipments to Store 2, rather than increasing shipments to Store 4 as it is farther from the distribution center compared to Store 2. This approach minimizes the total distance traveled for deliveries since Store 2 requires less transportation distance.

Conclusion

In this project, using Excel Solver and Excel SolverTable add-in, we, as a team, demonstrated the optimal solution for the establishment of a distribution center (DC) to serve McTrump's seven outlets across New York State. The optimization model that we built presents a strategic opportunity to enhance supply chain operations, improve operational efficiency, and drive cost-effectiveness.

Our optimization result shows that the distribution center coordinates, determined through the optimization model, are situated at longitude 40.73148071 and latitude -73.99331366.

Figure 8 depicts the store locations (blue points) and the suggested location for DC (orange point)



This solution effectively minimizes the total shipping distances from the distribution center to the designated stores, resulting in a total distance of 3,364.18 miles. Implementing this solution across McTrump's distribution network offers significant benefits. By minimizing shipping distances, the company can save on fuel, reduce vehicle maintenance costs, resulting in streamlined logistics operations as well as aids in providing fresh food which results in customer satisfaction.

Furthermore, we also learned additional results by running One-way and Two-way sensitivity analysis using the Excel SolverTable tool. Our prime objective of this study was to see

how the optimal total distance varies with changes in the number of annual shipment parameters of the stores. We observed a direct relationship between the number of annual shipments and the total distance traveled in our distribution network model. As shipment volumes increased, so did the total distances, underscoring the importance of strategic allocation.

Limitations

While the optimization model provides valuable insights into McTrump's distribution network, it's important to acknowledge its limitations. Firstly, the accuracy of input data, including store locations, annual shipments, and geographic coordinates, is crucial for the model's effectiveness. Any inaccuracies could compromise the model's effectiveness. Additionally, assumptions made during formulation may not always align perfectly with real-world scenarios, emphasizing the need for ongoing refinement to adapt to changing market conditions and customer demands. These considerations underscore the importance of careful implementation and continuous improvement to ensure the model's efficacy in practical settings.

Moreover, computational complexity may demand significant resources and time, particularly when dealing with large datasets.

Use cases

1. **Strategic Utilization of the New Distribution Center**

By strategically focusing on deliveries to stores closer to the new DC, we can achieve a multi-faceted benefit. Reduced transportation costs, faster order fulfillment, and maximized DC utilization all contribute to a more efficient and cost-effective distribution network. This approach ensures a strong return on investment for the new DC and strengthens the overall competitive advantage of the company.

2. **Focus on boosting sales for stores located closest to our distribution center (DC)**

By prioritizing sales for nearby stores, we can create a more competitive advantage by offering faster, potentially more affordable delivery, ultimately enhancing the customer experience and our overall profitability. Thanks to their proximity, we can leverage faster delivery times and potentially lower shipping costs.