Estimating Logistics Cost for Sushi Delivery

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Introduction

Sushi is an increasingly popular choice of food, with strong demand in New York. One of the challenges is ensuring a constant supply of fresh produce to restaurants in New York. I am exploring the potential business opportunity of supplying all sushi restaurants in New York with fresh fish on a daily basis. One of the key components of the business case is estimating the logistics requirements within New York. This project will aim to estimate the logistics costs involved.

Methodology

A basic costing model will be developed, given a set of target restaurants. Target sushi restaurants will be all of those within a 5km radius of Battery Park in New York, with an initial cap on 50 restaurants. A basic "nearest neighbour" algorithm will be used for estimating travel distances. This algorithm works by always visiting the nearest location, and progressively working through the list of unvisited location.

Data Requirements

The following data is required:

1. List of sushi restaurants in New York
2. Geo-coordinates of restaurants
3. Assumptions on vehicles fixed and operating costs, travel time between locations, working hours and time at each stop

To achieve (1) and (2) above, the Foursquare API will be used to obtain the geo-coordinates for Battery Park in New York, and subsequently to search for "sushi" within a 50km radius of this location.

For (3) above, approximate assumptions will be provided

Assumptions for estimating costs:

- Average travel speed of 20km/h
- 30 min delivery time
- Vehicles fixed cost of $50,000
- Driver cost of $40,000 / annum
- Vehicle variable costs (fuel, tires, maintenance, etc.) of $0.3 / km
- 8 hour working day

Results

The following list of 50 sushi restaurants were identified (list in Table 1 and locations on Figure 1).

Table 1: List of 50 restaurants within 5km of Battery Park

	name	address	lat	lng
0	Bento Sushi	173 Broadway	40.70996314	-74.01028184
1	Sabi Sushi	One New York Plaza	40.70255007	-74.012356
2	Blue Ribbon Sushi Bar	200 Vesey St	40.71274171	-74.01606482
3	Sabi Sushi		40.702495	-74.010993
4	Shinju Sushi	164 Pearl Street	40.70607041	-74.00743262
5	JR Sushi	86A West Broadway	40.71519478	-74.00947899
6	Blue Ribbon Sushi	119 Sullivan St	40.72616668	-74.00260712
7	Whole Foods Sushi Bar	Whole Foods Market	40.7239999	-73.99227662
8	Sushi of Gari Tribeca	130 W Broadway	40.71668439	-74.00834343
9	Sushi By Bou	218 Newark Ave	40.722346	-74.047052
10	Sushi Azabu	428 Greenwich St	40.72235543	-74.00974955
11	Koodo Sushi	55 Liberty St	40.70866739	-74.00936592
12	Genji Sushi	250 Vesey St	40.71491086	-74.01317412
13	Kuki Sushi	165 Church St	40.71506057	-74.00791782
14	Okami Fusion Sushi	63 Reade St	40.71495206	-74.00667765
15	Sushi & Co	65 Nassau St	40.709385	-74.008708
16	New Koto Sushi	552 Henry St	40.68219952	-74.00033652
17	Sushi Katsuei	210 7th Ave	40.67061519	-73.97850389
18	Sushi! by Bento Nouveau	32 Broadway	40.7060316	-74.0131842
19	Kikoo Sushi - East Village	141 1st Ave	40.72801318	-73.98502344
20	Sushi By Bou	49 W 20th St	40.74088312	-73.99352459
21	Blue Ribbon Sushi Bar	30 Rockefeller Plz	40.75940331	-73.97935485
22	Taro Sushi	244 Flatbush Ave	40.67979357	-73.97437685
23	Miyabi Sushi & Asian Cuisine	118 W 3rd St	40.73055476	-74.0003235
24	Sushi Tokyo	121 W 19th St	40.74091396	-73.99573208
25	Sushi Dojo NYC	110 1st Ave	40.72676075	-73.98590196
26	Sakura Sushi & Thai Cusine	273 Mott St	40.72386032	-73.99460727
27	Kyoto Sushi	115 Smith St	40.68790826	-73.98964583
28	Mira Sushi	46 W 22nd St	40.74196087	-73.99245065
29	SUGARFISH by sushi nozawa	202 Spring St	40.7252998	-74.00350734
30	Sushi Lounge	200 Hudson St	40.73851232	-74.02955608
31	Blue Ribbon Sushi Bar & Grill	308 W 58th St	40.76760995	-73.98290953
32	A1 Sushi Cafe	164 Pearl St	40.704218	-74.01163627
33	Sushi Seki Times Square	365 W 46th St	40.76084144	-73.99022221
34	Ko Sushi	1329 2nd Ave	40.76766956	-73.95927739
35	Niko Niko Sushi & Bowl	133 John St	40.70714273	-74.00505692
36	Genji Sushi Kano	1095 Avenue Of The Americas	40.754956	-73.984696
37	Wasabi Sushi & Bento	185 Greenwich St Unit LL3115	40.7126	-74.012737
38	Sushi Seki Chelsea	208 W 23rd St	40.74426	-73.99628
39	Kumo Sushi II	512 Court St	40.6763149	-73.99884567

40	Sushi Ginza Onodera	461 5th Ave	40.75247185	-73.98179167
41	Beyond Sushi	70 Pine Street	40.70644716	-74.00724659
42	Sushi Sen-Nin	30 E 33rd St	40.74693678	-73.98298723
43	Yummy sushi	198-A orchard street	40.722377	-73.987823
44	Hane Sushi	346 1st Ave	40.73490193	-73.9798466
45	Sushi Noodles	274 Troutman St	40.7034636	-73.92594603
46	Nizzi Sushi Bar		40.72130788	-73.98973935
47	Beyond Sushi - The Green Roll	75 9th Ave	40.742578	-74.006598
48	Wasabi Sushi & Bento	200 Broadway	40.71061748	-74.00912583
49	Lobster Place Sushi Bar		40.742619	-74.006143

Figure 1: Locations of 50 restaurants within 5km of Battery Park

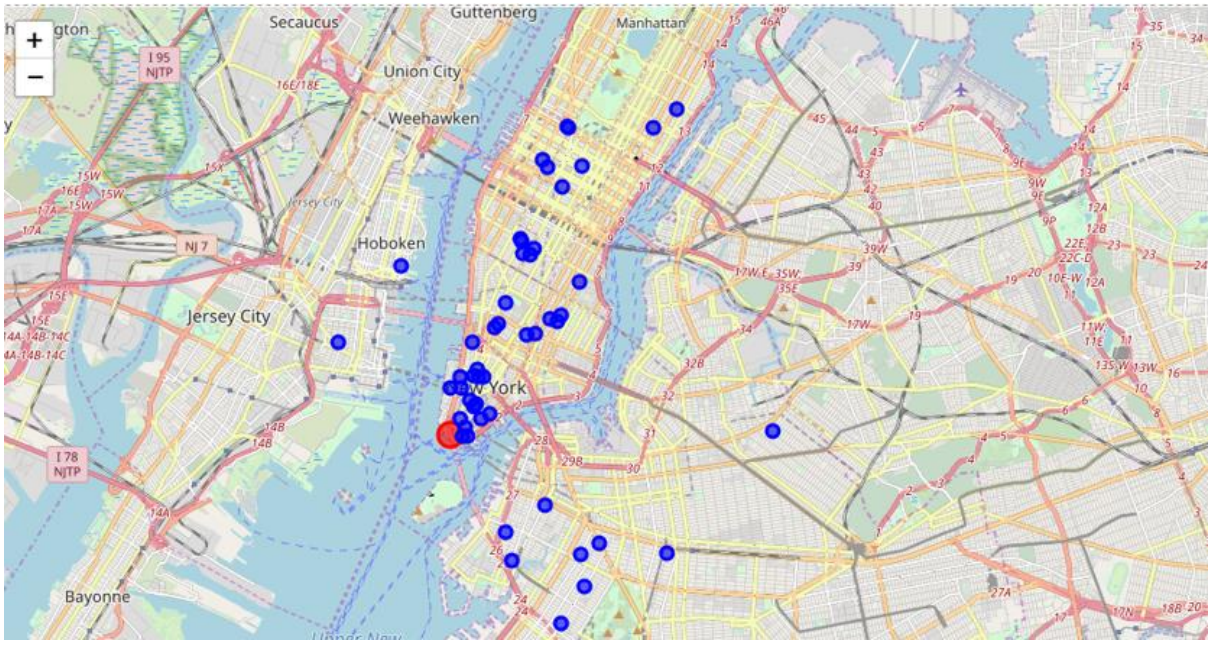
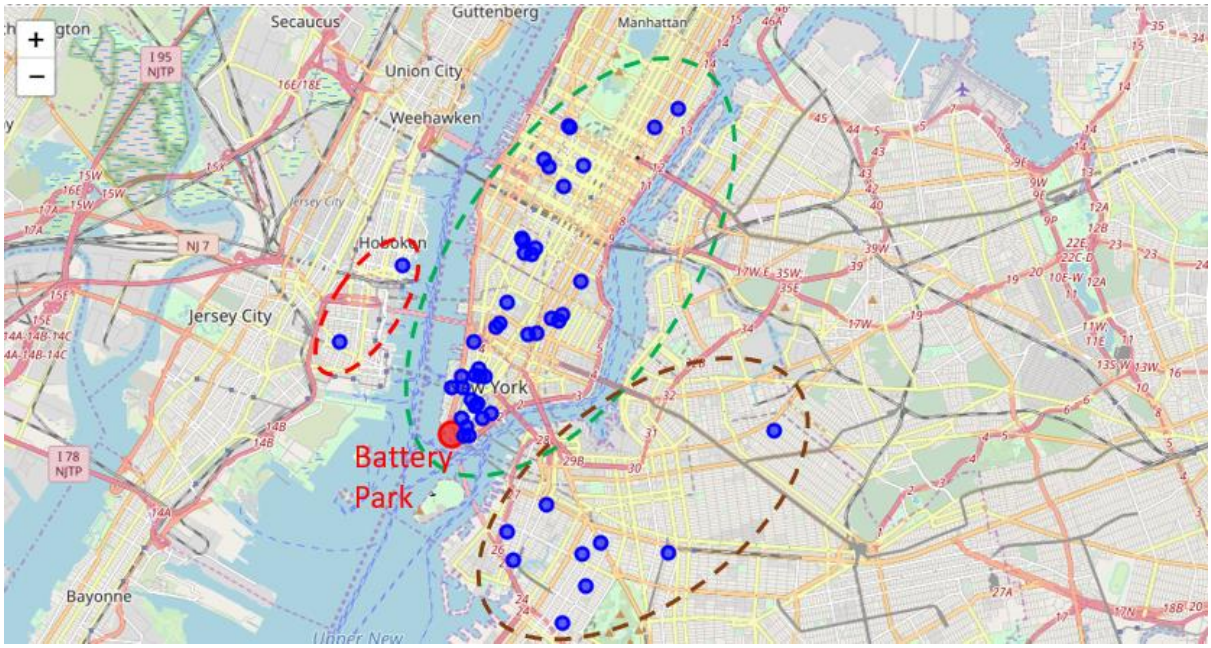


Figure 1 has 3 clear areas, depicted in Figure 2:

1. Green circle, showing the bulk of restaurants on Manhattan island
2. Red circle, which contains 2 separate restaurants to the North-West of Manhattan island
3. Brown circle, which contains 9 separate restaurants to the South-East of Manhattan island

Figure 2: List of 50 restaurants, separated by 3 distinct areas:



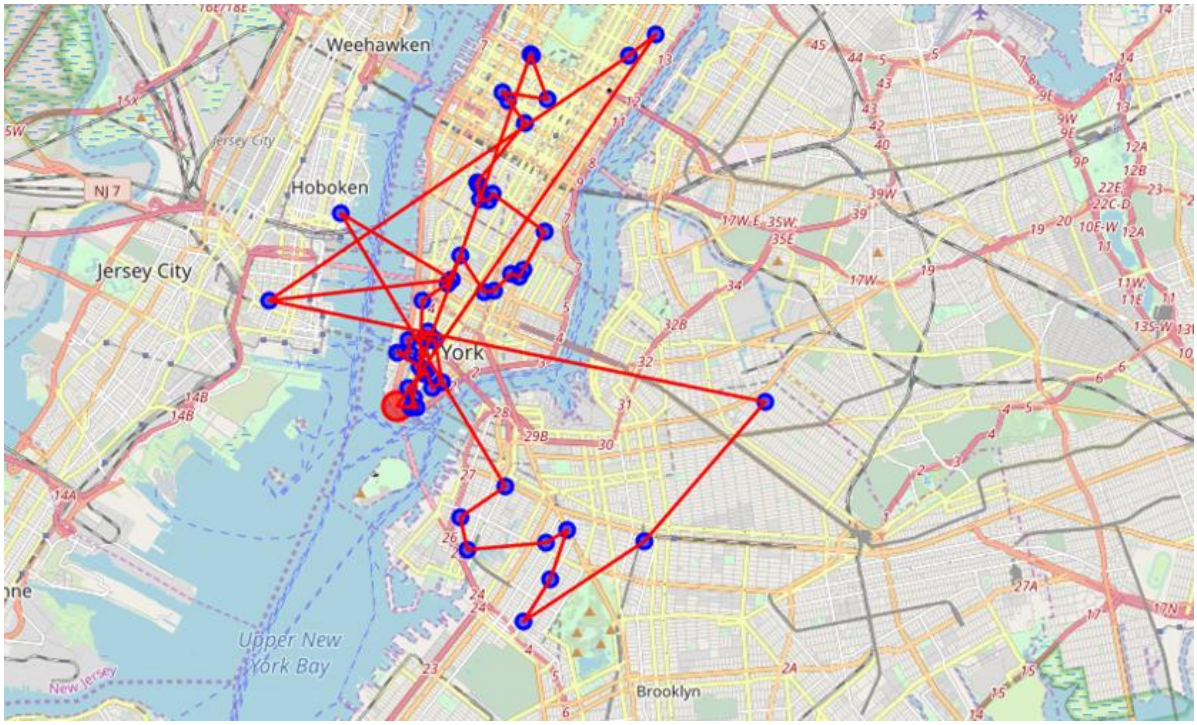
A theoretical exercise was first carried out to see whether all restaurants could be serviced by 1 vehicle. The results can be seen in Figure 3. Theoretically, 30 hours would be needed for 1 vehicle. This would be broken into the following:

- 27 hours delivery time at restaurants
- 3 hours travel time

It is clear that delivery time is driving the bulk of the time required.

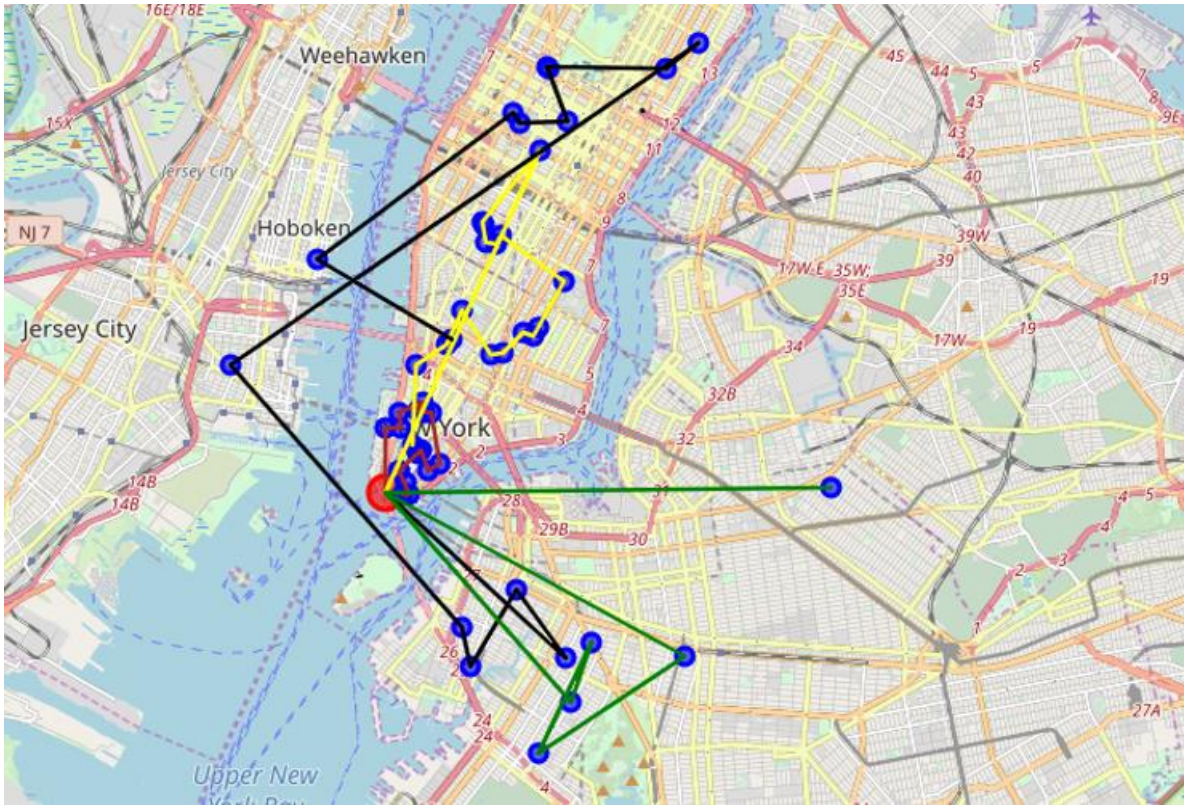
If delivery time could be reduced to 15 min, 1 vehicle could visit all stores in 17 hours. Assuming store operating hours are not a problem, this could be accomplished by 2 driver shifts every day on 1 vehicle.

Figure 3: Nearest-neighbour route for visiting all 50 restaurants



The next step in the methodology was to determine how may vehicles would be required when working within an 8 hour working day. The results of this can be observed in Figure 4 below.

Figure 4: Different routes required when operating on an 8 hour working day,



The final step was to determine the total logistics cost required. This can be broken down as follows:

- Up-front fixed costs ($40,000 per annum):
    - Vehicles: $50,000 x 4 = $200,000 ($150,000 if 3 vehicles possible)
    - Assume simple capitalization over 5 years, giving $40,000 per annum
- Annual fixed costs ($200,000 per annum)
    - Drivers: $40,000 x 5 = $200,000 (1 extra driver for leave, risk mitigation, etc.)
- Annual variable costs ($7,200):
    - $0.3 / km x 66km x 365 days = $7,200

This gives a total annual cost of $247,200, with asset costs amortized.

It should be noted that 80% of the cost is driven by driver salaries, which is a function of time required. Therefore, the main focus to reduce cost should be on reducing time required to deliver. In turn, it was also shown that time was predominantly a function of waiting times at restaurants.

Conclusion

Logistics costs would need to be compared to revenue and other business factors before making a final decision on whether this is a viable business opportunity.

Potential areas of Improvement:

- More optimal routing solutions would reduce distance and travel time. However, time at delivery point is contributing to the bulk of the cost, so would not invest a large amount of time

The following next steps are recommended:

- Investigate use of returnable storage boxes that can be dropped off in short time, with the old ones picked up. This could significantly reduce waiting time at restaurants, which is the primary overall cost driver.
- Other options potentially in the future:
    - Drone deliveries, potentially with multiple launch sites at central locations
    - Driverless cars, to reduce the need for driver salaries
    - Increased customer analysis, e.g. analysing break-even points on customer volume. This could then be used to target only certain profitable customer segments.