COLLABORATIVE LAST MILE DELIVERY

Arun Nagarathinam, Minhui Zhang
Advised by Dr. Maria Jesus Saenz, Dr. Marina Mattos

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AGENDA

- **Background**

- Methodology

- Sensitivity Analysis

- Conclusion & Recommendation

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WALMART'S CHALLENGE

SETUP THE DELIVERY AREA FOR ITS ONLINE GROCERY BUSINESS...

- Set desired delivery area (5-7 Miles)

- Customer orders are scattered around the store

- More drivers are needed to deliver these orders
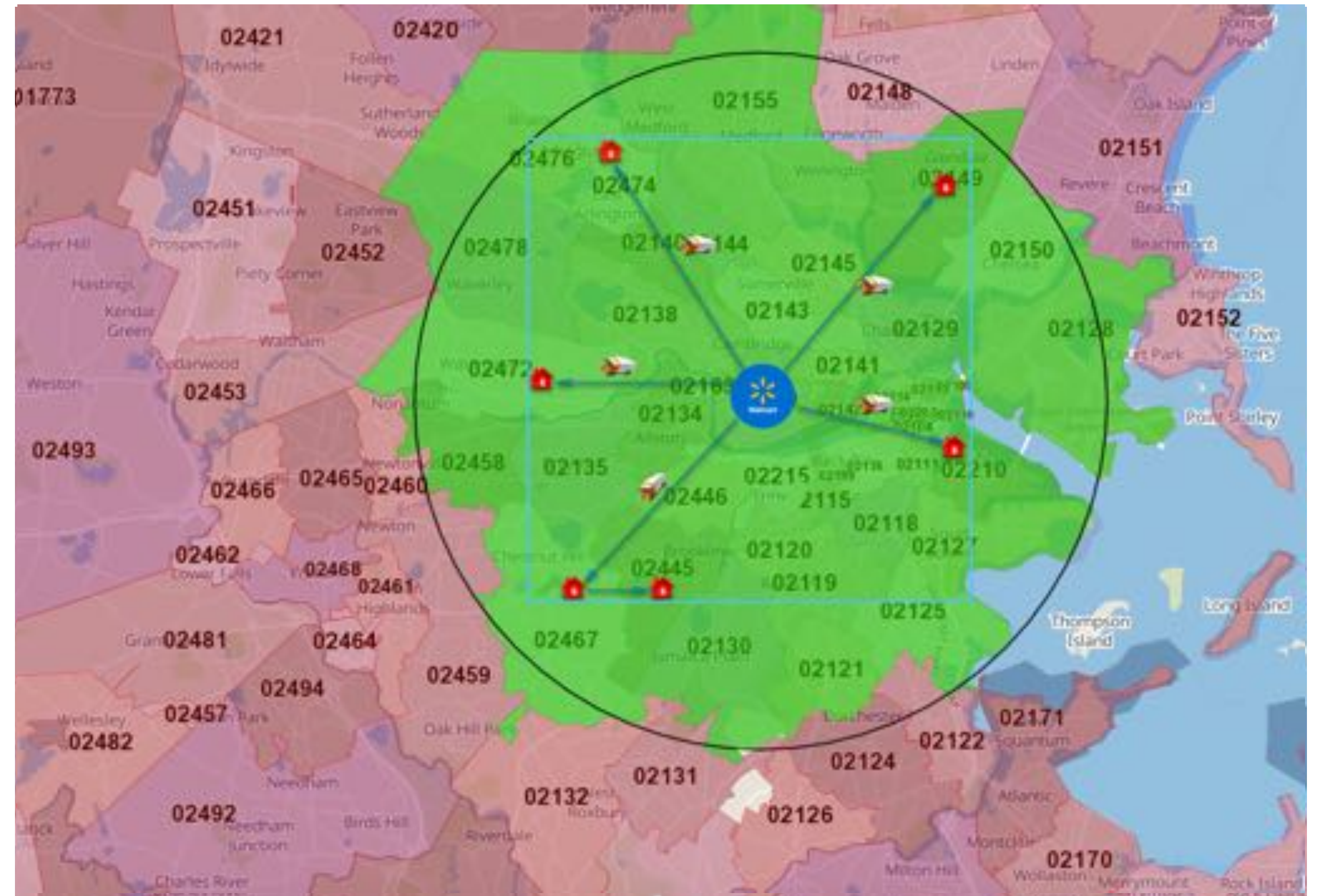
WALMART'S CHALLENGE

REDUCE CUSTOMER DELIVERY FEE TO DRIVE SALES

- Last Mile Delivery of Groceries from store to customer's home is challenging and expensive.

- The following factors are the biggest last mile challenges related to grocery

  - Delivery Density
  - Delivery Flexibility
  - Driver Engagement

May 9th 2019, Chris Sultemeier (Former EVP of Logistics at Walmart) in MIT CTL
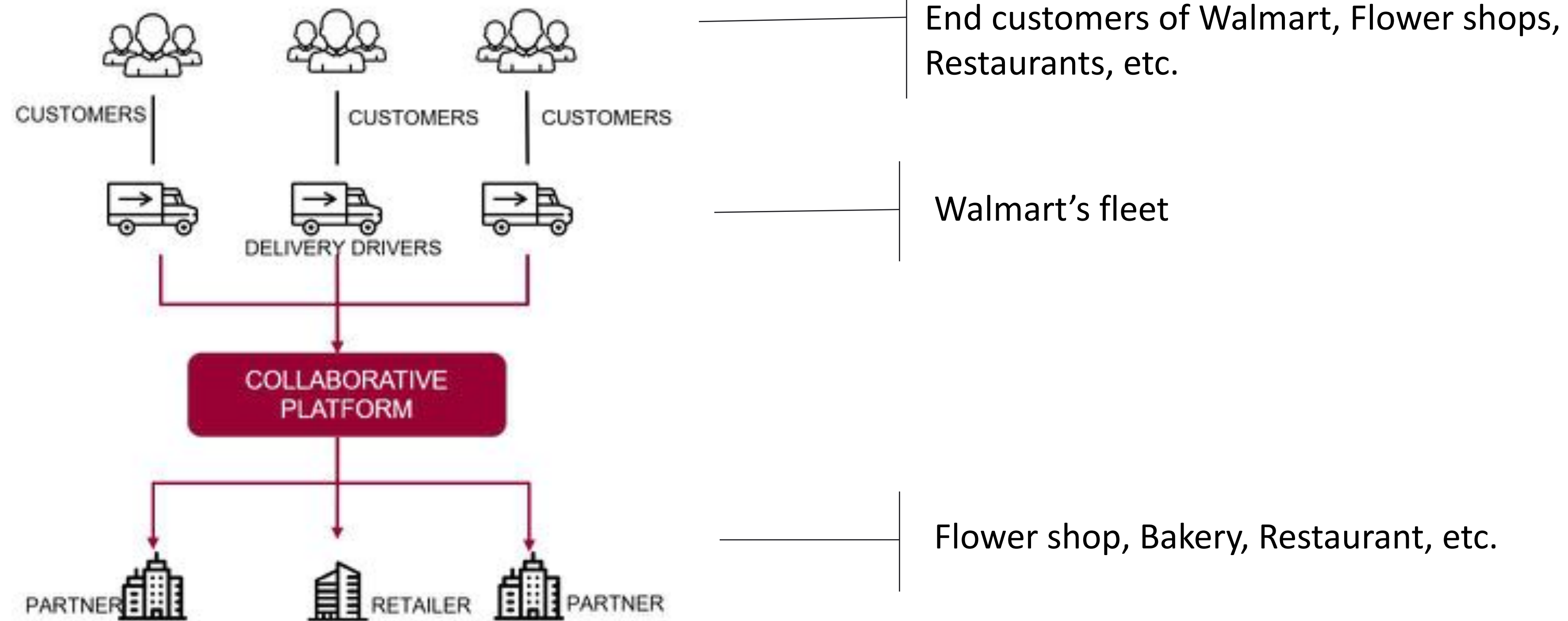
RESEARCH QUESTIONS

- How can Walmart identify the right delivery areas to extend its delivery services?

- **H**ow can Walmart implement a low-cost grocery delivery solution while maintaining its current service level?

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PROPOSAL

Data-driven platform where Walmart collaborates with local business partners to increase order density and driver engagement while driving down delivery cost.


End customers of Walmart, Flower shops, Restaurants, etc.

Walmart's fleet

Flower shop, Bakery, Restaurant, etc.
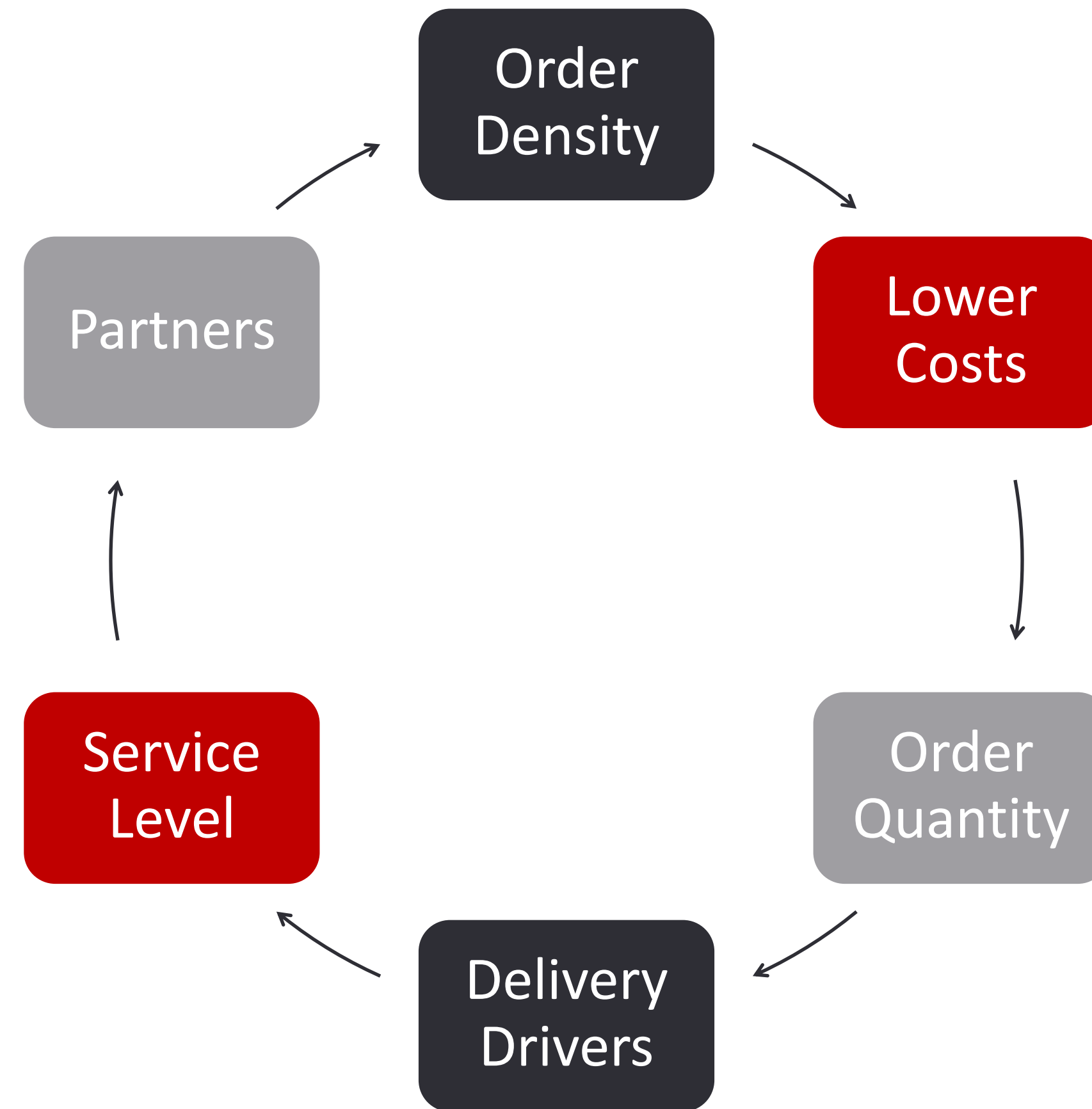
PROPOSAL

What are the advantages for the stakeholders ?

Stakeholder	Benefits
Walmart	• Higher delivery density • Lower delivery cost
Business Partners	• Provide home delivery to its customers • Low delivery fee for its customers
Delivery Drivers	• Opportunity to earn higher due to more delivery orders • Opportunity to receive more tips from customers

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PROPOSAL - EXAMPLE
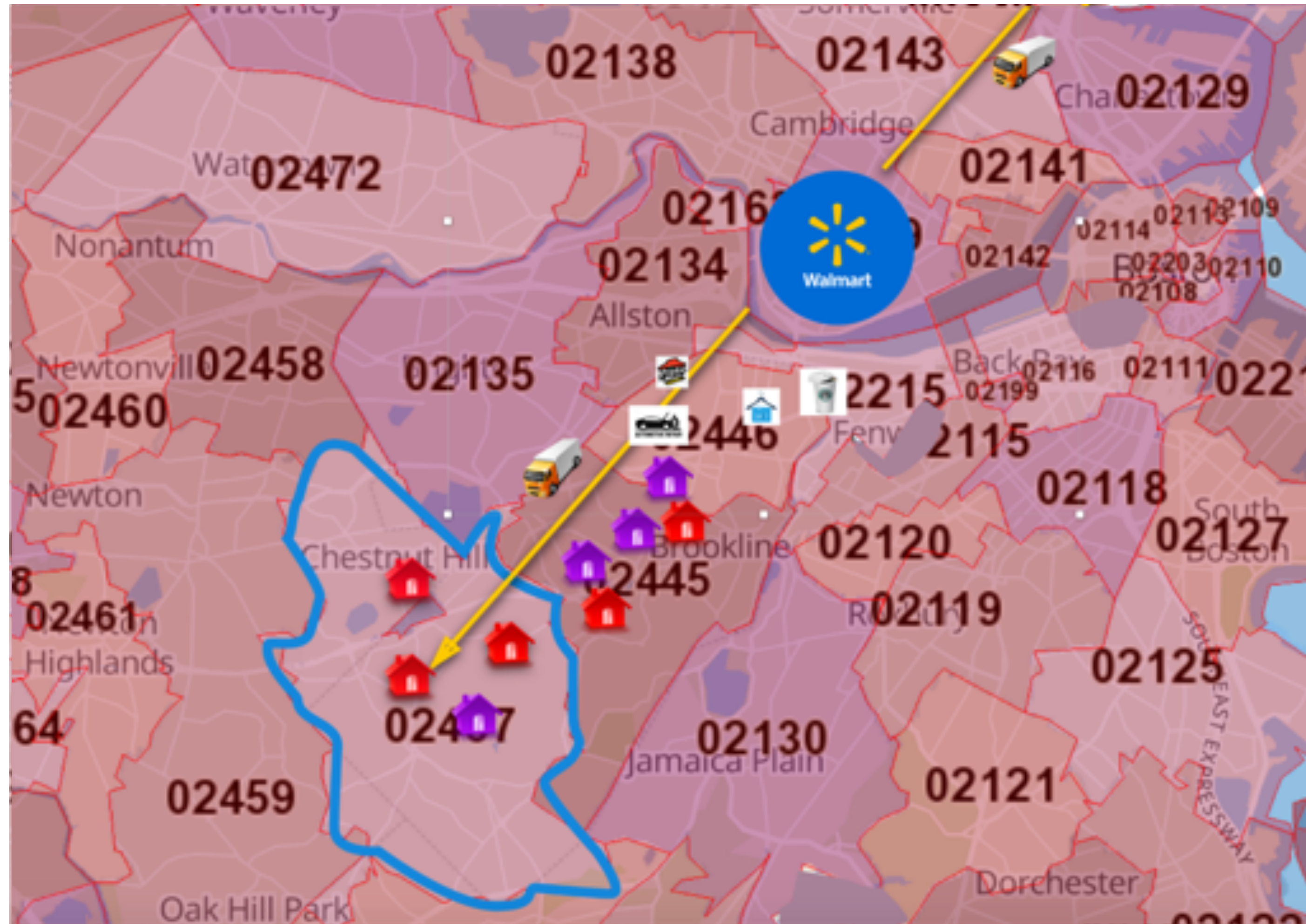
REINFORCING LOOP
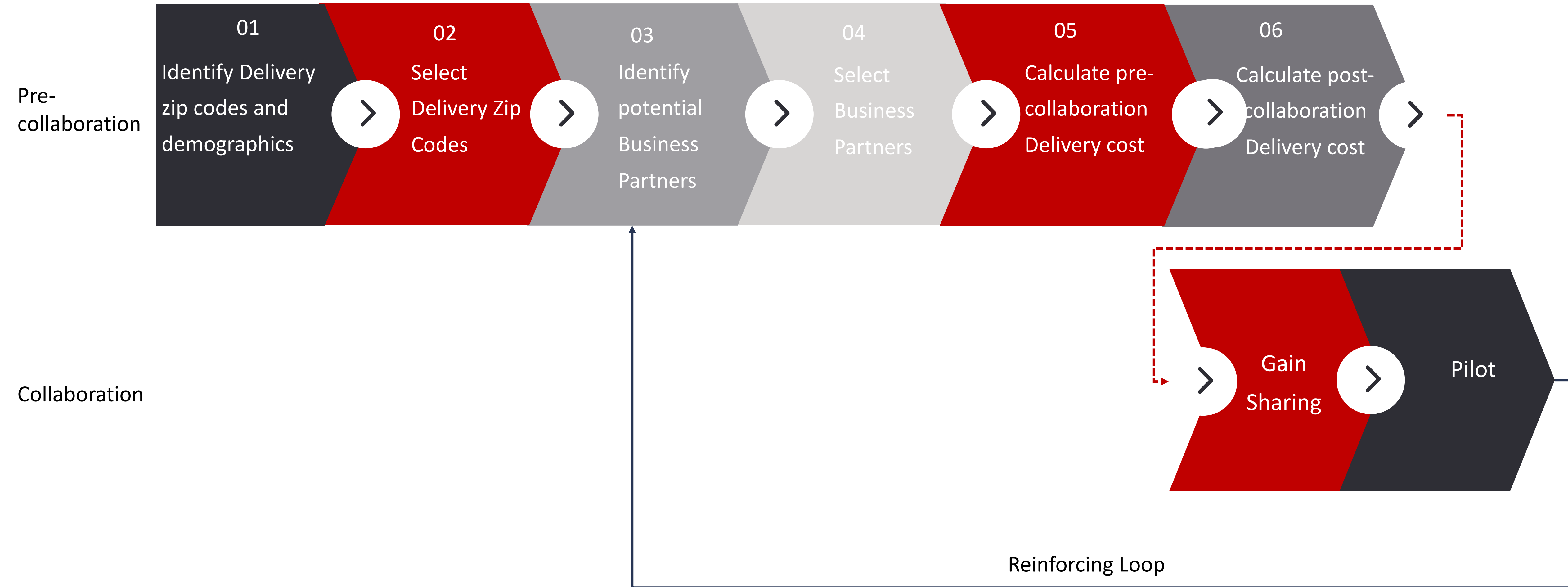
THE COLLABORATION WILL CREATE NETWORK EFFECTS

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METHODOLOGY

Pre-collaboration

01	02	03	04	05	06
Identify Delivery zip codes and demographics	Select Delivery Zip Codes	Identify potential Business Partners	Select Business Partners	Calculate pre-collaboration Delivery cost	Calculate post-collaboration Delivery cost

Collaboration

Gain Sharing → Pilot

Reinforcing Loop

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STEP 1 : IDENTIFY ZIP CODES & DEMOGRAPHICS

- Retrieve zip codes from www.zipcodeapi.com with store location and radius as inputs

- Parse demographics from www.city-data.com for all zip codes

- Features include: population age, home value, household income.

- Example output:

  Percentage of home value above 750k for Zip code 02472 : 45%
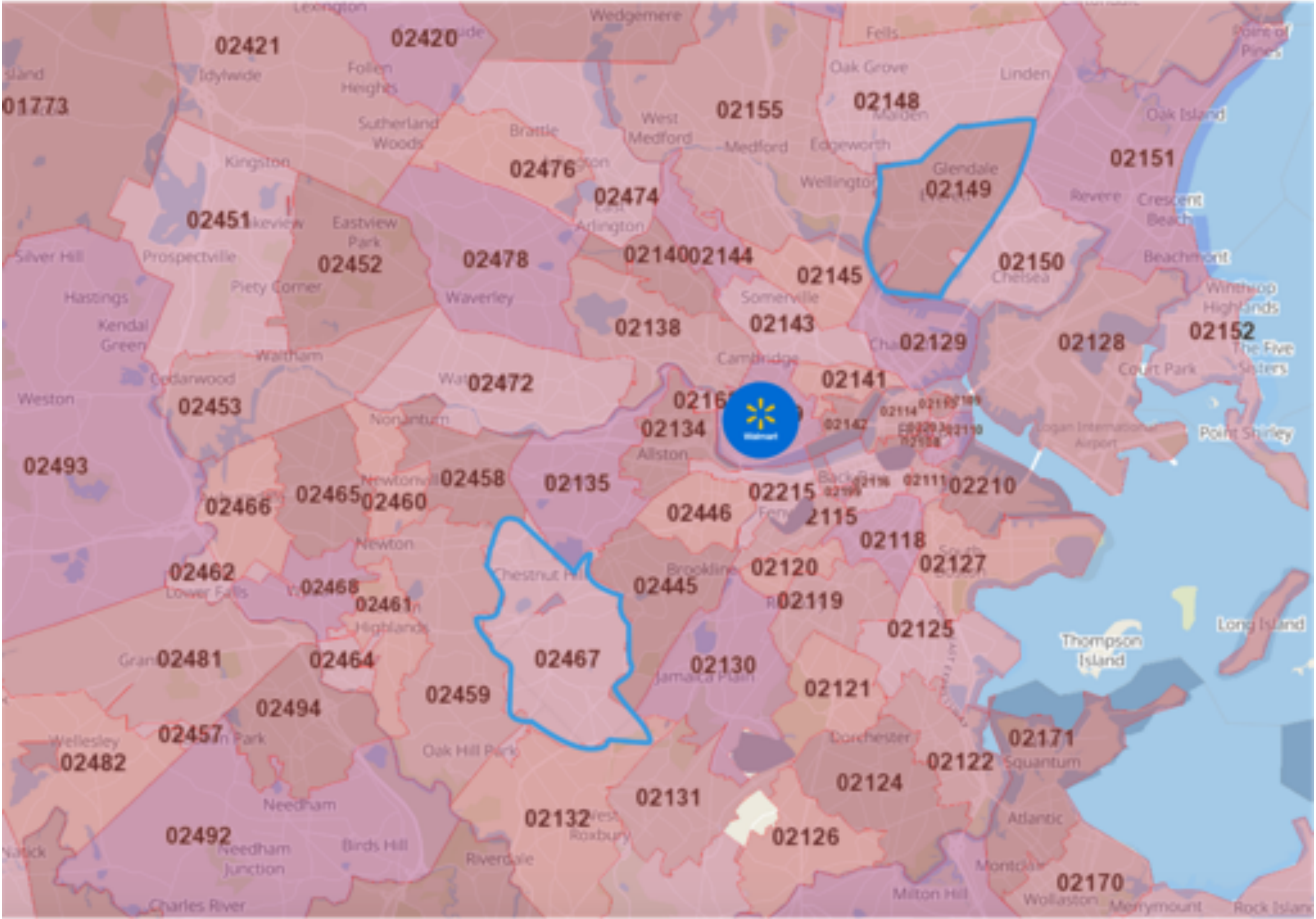 Percentage of home value above 750k for Zip code 02474 : 58%
  Percentage of home value above 750k for Zip code 02476 : 62%
  Percentage of home value above 750k for Zip code 02180 : 31%

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01
Identify Delivery
zip codes and
demographics

STEP 2 : SELECT ZIP CODES FOR DELIVERY

- Target a specific demography for delivery and open up delivery for those zip codes

- Illustration : 60% of the home value >75K

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01
Identify Delivery zip codes and demographics
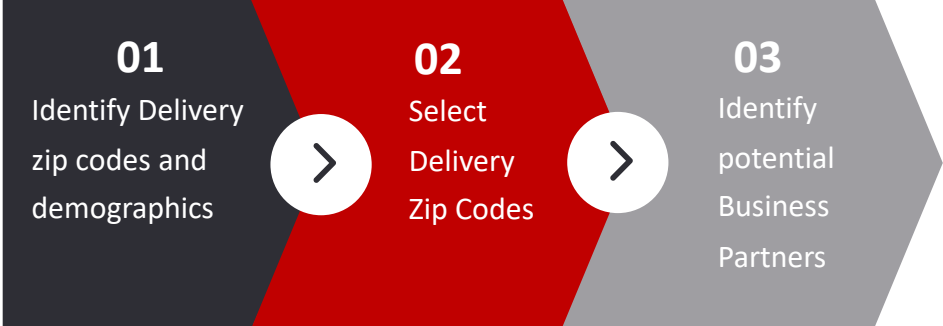
02
Select Delivery Zip Codes

STEP 3 : IDENTIFY BUSINESS PARTNERS

- Retrieve business names and ratings from api.yelp.com with delivery zip codes and business type as inputs
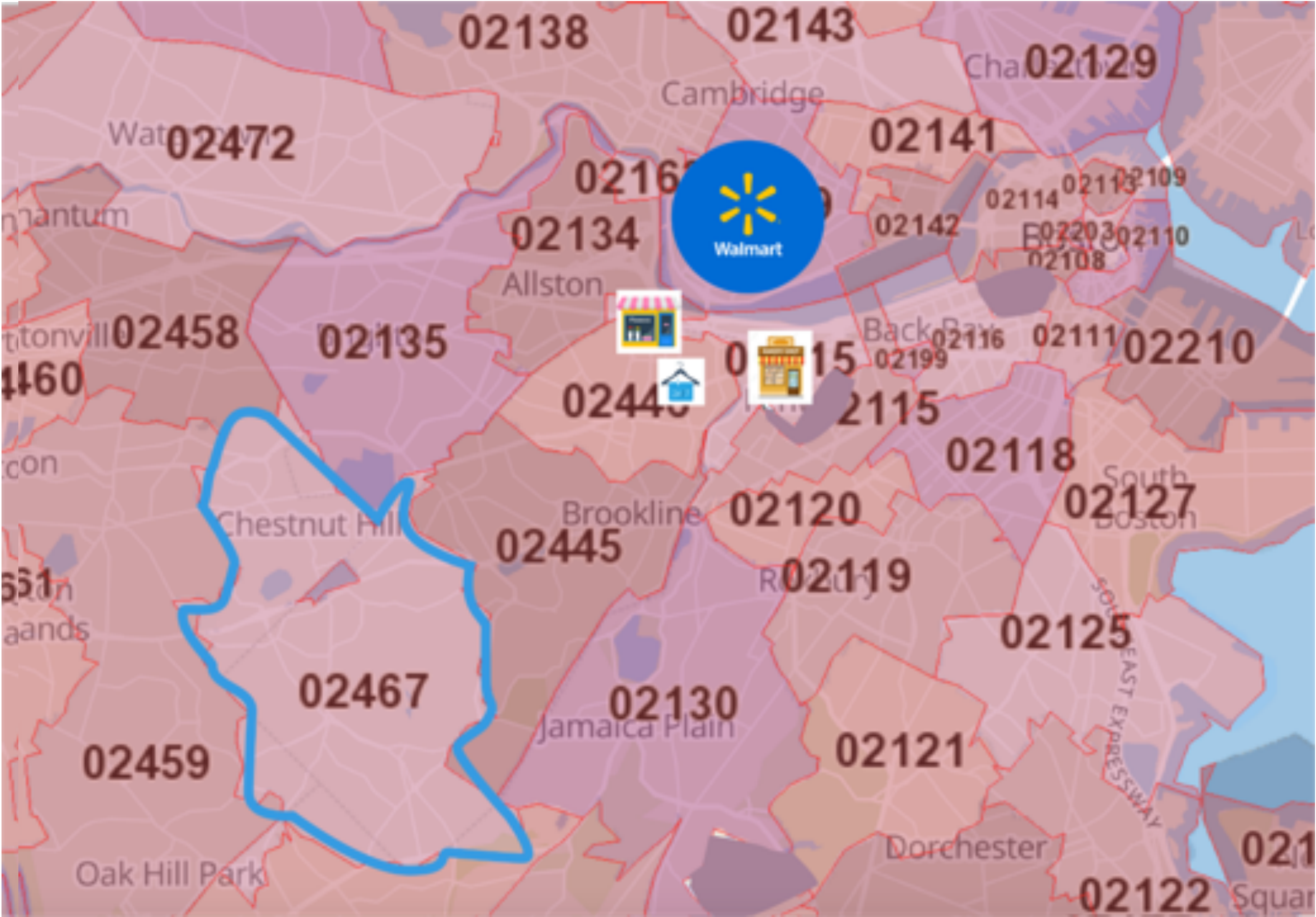
- Sample output: flower shop around zip code 01239

Business Name	Rating	Store Latitude	Store Longitude	Business Type	City Name	Zip Code
Five Star Flower Shop	5	42.386	-71.184	Flowers	Belmont	2478
Royal Flower Shop	2	42.376	-71.248	Flowers	Waltham	2451
Bright Town Flower Shop	2	42.349	-71.152	Flowers	Brighton	2135
Star Dry Flower Shop	5	42.349	-71.140	Flowers	Boston	2134
Best Flower Shop	5	42.421	-71.138	Flowers	Medford	2155
Dependable Flower Shop	2	42.360	-71.185	Flowers	Watertown	2472
J & D Flower Shop	2	42.404	-71.141	Flowers	Arlington	2474
Porter Square Flower Shop	1	42.389	-71.117	Flowers	Somerville	2144
Sunshine Flower Shop	3	42.336	-71.148	Flowers	Brighton	2445
Hemmingway Flower Shop	2	42.378	-71.164	Flowers	Belmont	2478

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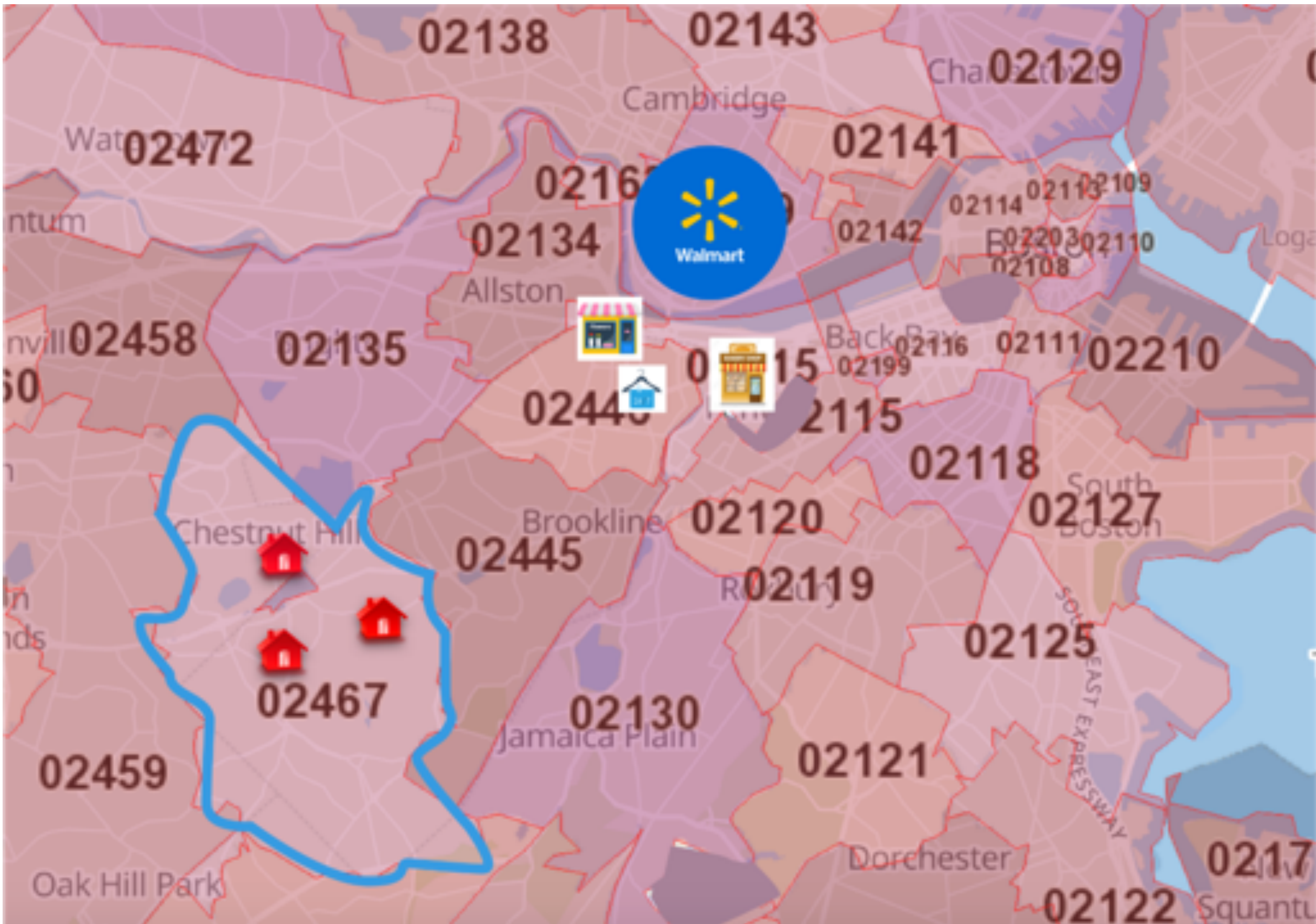| 01 Identify Delivery zip codes and demographics | 02 Select Delivery Zip Codes | 03 Identify potential Business Partners |

STEP 4 : SELECT BUSINESS PARTNERS

- Finalize business partners based on selection criteria

- Sample Criteria:

  - High customer rating – Ratings: 4+
  - Long time window– 4 hour delivery window
  - Short pick up time – Avoid Malls
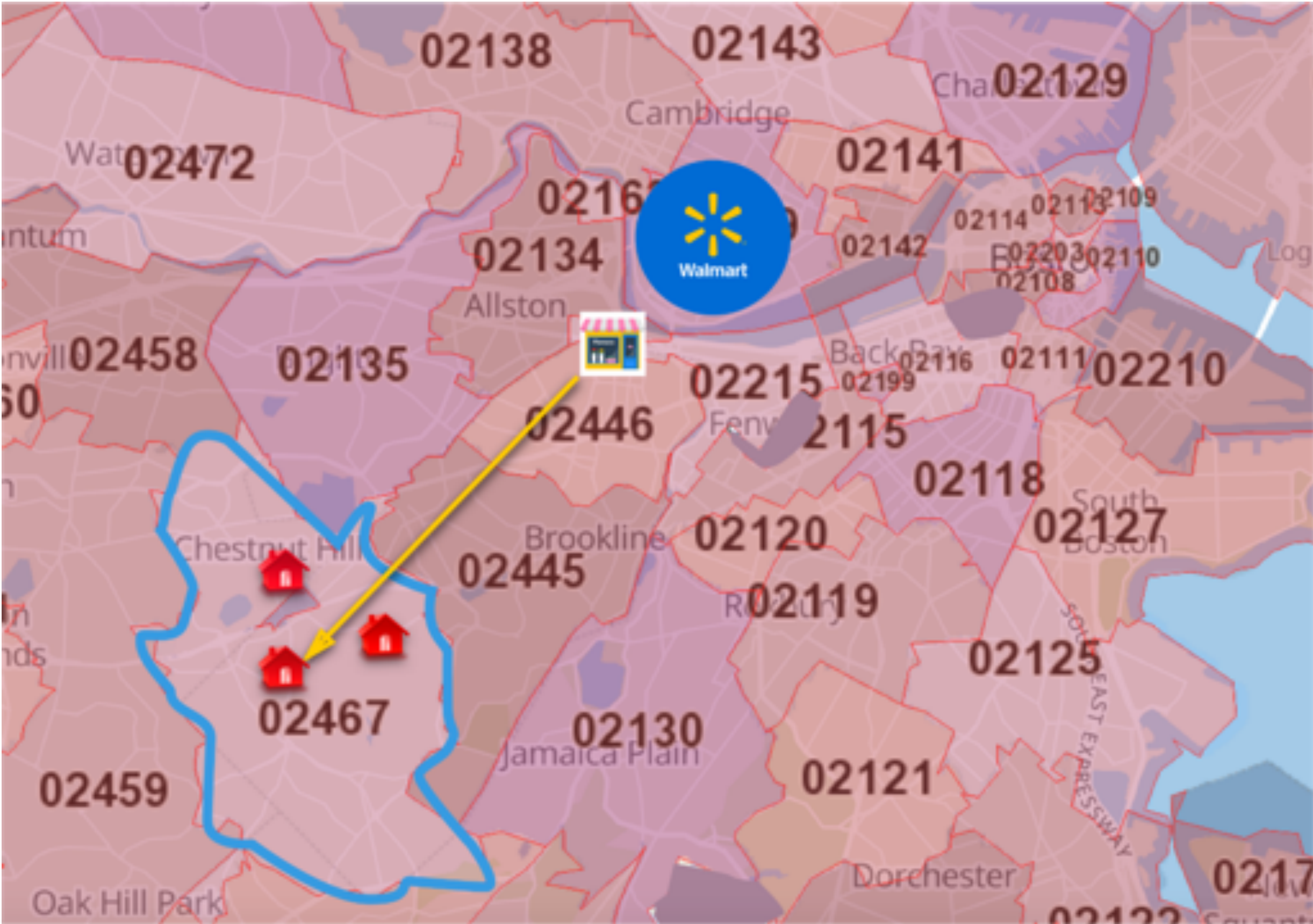 - Non peak time deliveries - 10 am to 3 pm

STEP 5: PRE-COLLABORATION DELIVERY COSTS

a. Simulate the customer's orders in zip code - 02467

01
Identify Delivery
zip codes and
demographics

02
Select
Delivery
Zip Codes

03
Identify
potential
Business
Partners

04
Select
Business
Partners

05
Calculate pre-
collaboration
Delivery cost

STEP 5 : PRE COLLABORATION DELIVERY COST

01	02	03	04	05
Identify Delivery zip codes and demographics	Select Delivery Zip Codes	Identify potential Business Partners	Select Business Partners	Calculate pre-collaboration Delivery cost

STEP 5 : PRE COLLABORATION DELIVERY COST

b. Calculate the on demand delivery cost from the business partner to customer's home using Uber api's

Sample Output : From Five Star Flower Shop to Zip Code - 02467

Days / Hour	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Sunday	$ 28	$ 24	$ 31	$ 24	$ 25	$ 23	$ 20	$ 24	$ 20	$ 25	$ 25	$ 25	$ 23	$ 24	$ 23	$ 28	$ 23	$ 23	$ 23	$ 22	$ 25	$ 24	$ 23	$ 25
Monday	$ 24	$ 25	$ 25	$ 25	$ 25	$ 30	$ 24	$ 26	$ 22	$ 23	$ 21	$ 22	$ 22	$ 21	$ 21	$ 24	$ 25	$ 30	$ 26	$ 25	$ 22	$ 24	$ 24	$ 24
Tuesday	$ 24	$ 24	$ 21	$ 24	$ 25	$ 24	$ 24	$ 25	$ 22	$ 24	$ 23	$ 22	$ 22	$ 23	$ 23	$ 23	$ 28	$ 24	$ 39	$ 24	$ 22	$ 23	$ 24	$ 21
Wednesday	$ 24	$ 24	$ 24	$ 25	$ 25	$ 24	$ 25	$ 25	$ 23	$ 42	$ 23	$ 25	$ 26	$ 24	$ 23	$ 26	$ 25	$ 25	$ 43	$ 25	$ 23	$ 29	$ 25	$ 25
Thursday	$ 23	$ 25	$ 24	$ 25	$ 25	$ 29	$ 25	$ 26	$ 28	$ 28	$ 24	$ 26	$ 24	$ 24	$ 24	$ 24	$ 33	$ 25	$ 46	$ 31	$ 24	$ 23	$ 27	$ 29
Friday	$ 25	$ 25	$ 25	$ 24	$ 25	$ 42	$ 25	$ 25	$ 23	$ 41	$ 23	$ 23	$ 23	$ 28	$ 32	$ 38	$ 29	$ 25	$ 43	$ 36	$ 23	$ 23	$ 25	$ 30
Saturday	$ 45	$ 36	$ 24	$ 24	$ 35	$ 24	$ 20	$ 28	$ 21	$ 21	$ 24	$ 22	$ 24	$ 24	$ 24	$ 31	$ 30	$ 27	$ 31	$ 34	$ 31	$ 23	$ 25	$ 33

Lowest Delivery Cost Pre-Collaboration: $20

01	02	03	04	05
Identify Delivery zip codes and demographics	Select Delivery Zip Codes	Identify potential Business Partners	Select Business Partners	Calculate pre-collaboration Delivery cost

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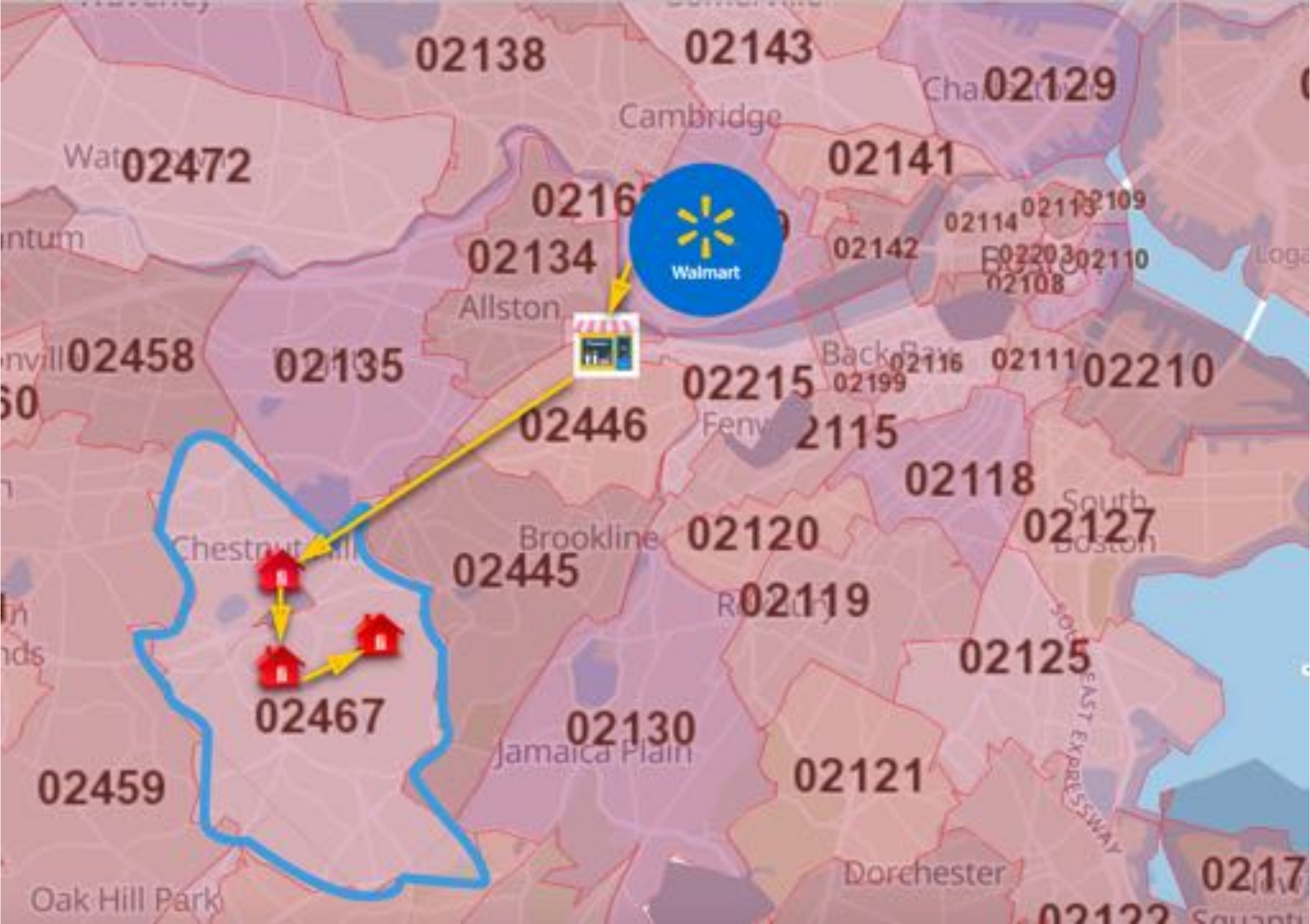DIGITAL SUPPLY CHAIN TRANSFORMATION

STEP 6 : POST-COLLABORATION DELIVERY COST

- **Calculate delivery rates from Walmart & Business partner to the customer locations**

- **Use VRPTW to solve this as Pickup & Delivery problem with Time Windows**

- **Convert Delivery Time to Total cost and calculate cost per order**

Sample Delivery Cost Post Collaboration:

Total Delivery Time = 53 minutes
Total Operating Hours = 53/60 = 1 hour
Driver Pay per Hour = $12
Number of Orders = 3
*Total Delivery cost = 12 * 1 = $12*
Average Delivery Cost per Order = $12/3 = $4

01	02	03	04	05	06
Identify Delivery zip codes and demographics	Select Delivery Zip Codes	Identify potential Business Partners	Select Business Partners	Calculate pre-collaboration Delivery cost	Calculate post-collaboration Delivery cost

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- Methodology

- **Sensitivity Analysis**

- Conclusion & Recommendation

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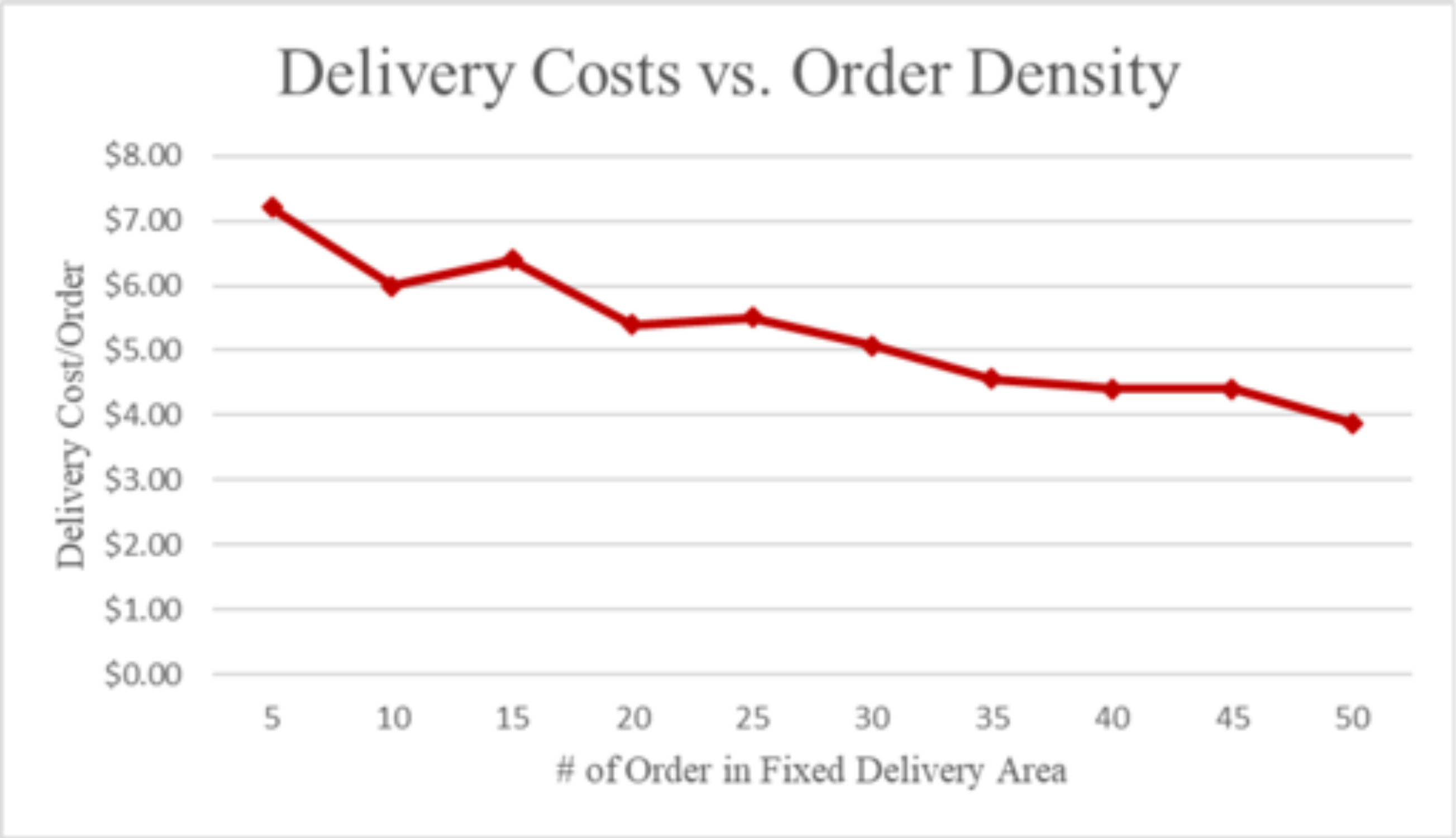DIGITAL SUPPLY CHAIN
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SENSITIVITY ANALYSIS 1/3

01 Order Density

Parameters below are held constant:

- Time Window = 2 *hours*

- Radius = 5 *miles*

- # of Vehicle Available = 5 *vehicles*
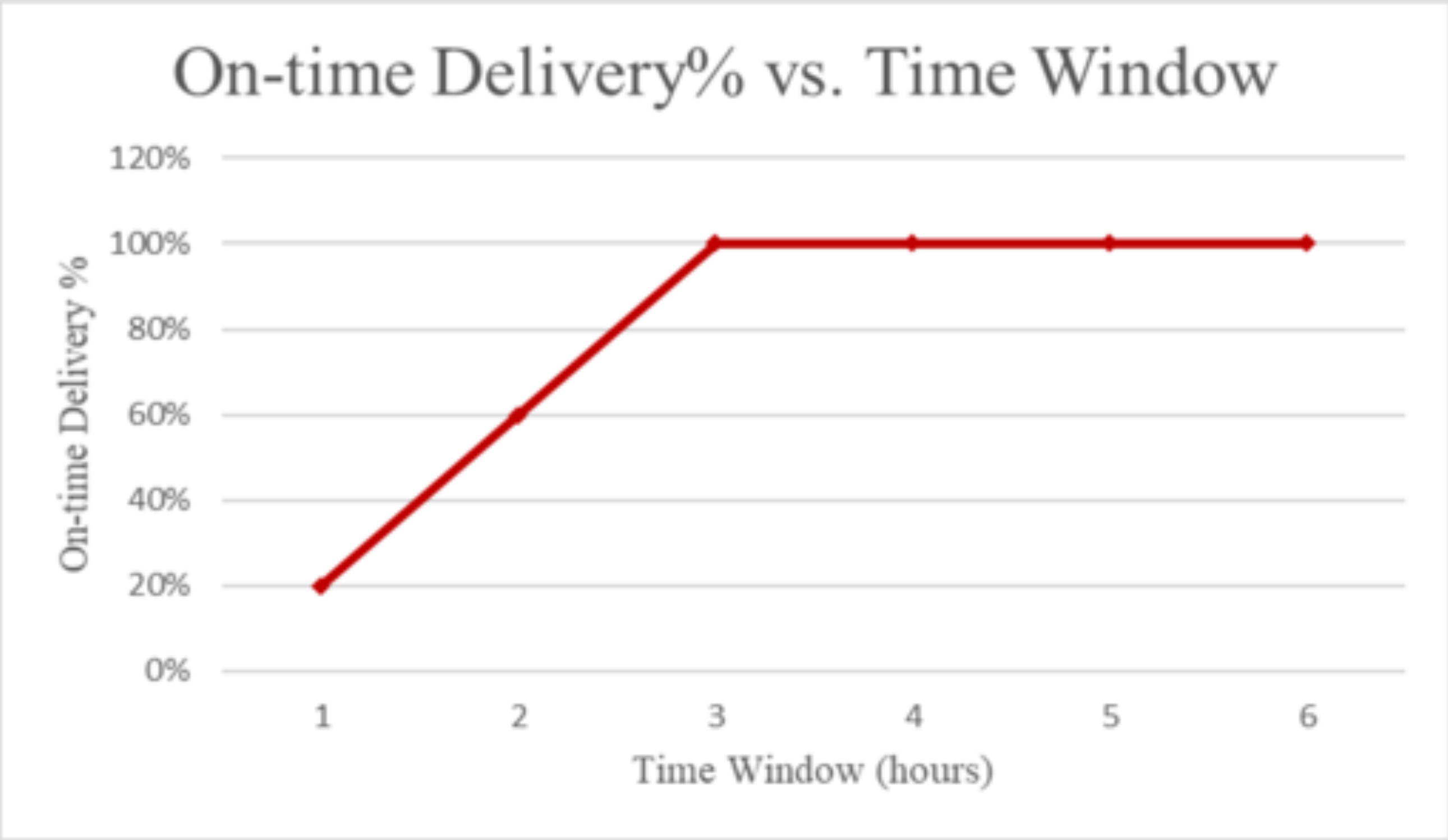
Delivery Costs vs. Order Density

SENSITIVITY ANALYSIS 2/3

02 Delivery Flexibility

Parameters below are held constant:

- Order Quantity = 25 *orders*

- Radius = 5 *miles*

- # of Vehicle Available = 5 *vehicles*

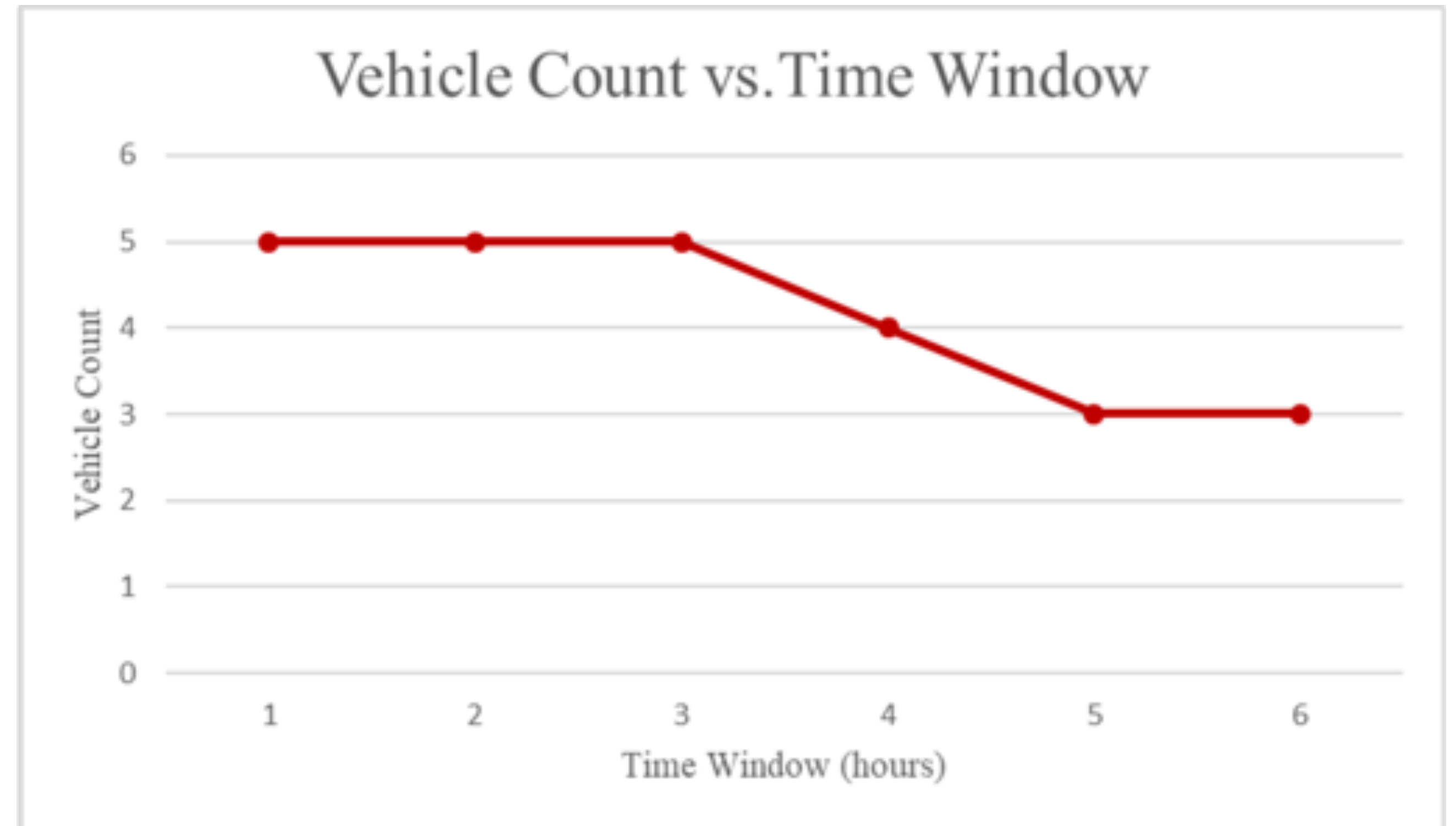On-time Delivery% vs. Time Window

SENSITIVITY ANALYSIS 3/3

Driver Engagement

1 driver = 1 vehicle

Parameters below are held constant:

- Order Quantity = 25 *orders*

- Radius = 5 *miles*

- # of Vehicle Available = 5 *vehicles*

Vehicle Count vs. Time Window

GAIN SHARING

Derived from sensitivity analysis, the rate card below is used reinforce the collaboration between Walmart and its business partners.

	Silver	Gold	Diamond
# of Order per Day	<25	25 ~ 50	>50
Delivery Time Window	4 hours	2 hours	1 hour
Committed Minimum On-time Delivery %	90%	95%	98%
Maximum Orders % Delivered in Peak Hours	15%	25%	50%
Delivery Rate	$$$	$$	$

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CONCLUSION & NEXT STEPS

- **Horizontal Collaboration drives down delivery costs**
- **Identified Order Density , Delivery Flexibility and Driver Engagement as key factors for collaboration**

- **Next Steps**
  - **Walmart to Pilot**

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Any Question?