COLLABORATIVE
LAST MILE DELIVERY

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AGENDA

- Background
- Methodology
- Sensitivity Analysis
- Conclusion & Recommendation
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?

• How can Walmart implement a low-cost grocery delivery solution while maintaining its current service level?
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.
What are the advantages for the stakeholders?

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walmart</td>
<td>• Higher delivery density&lt;br&gt;• Lower delivery cost</td>
</tr>
<tr>
<td>Business Partners</td>
<td>• Provide home delivery to its customers&lt;br&gt;• Low delivery fee for its customers</td>
</tr>
<tr>
<td>Delivery Drivers</td>
<td>• Opportunity to earn higher due to more delivery orders&lt;br&gt;• Opportunity to receive more tips from customers</td>
</tr>
</tbody>
</table>
REINFORCING LOOP

THE COLLABORATION WILL CREATE NETWORK EFFECTS

Order Density

Lower Costs

Partners

Service Level

Order Quantity

Delivery Drivers

9
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People who work in marketing try to get the attention.

**METHODOLOGY**

1. **Pre-collaboration**
   - Identify Delivery zip codes and demographics

2. **Identify Delivery Zip Codes**

3. **Identify potential Business Partners**

4. **Select Business Partners**

5. **Calculate pre-collaboration Delivery cost**

6. **Calculate post-collaboration Delivery cost**

**Collaboration**

- Gain Sharing
- Pilot

**Reinforcing Loop**
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%
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
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

<table>
<thead>
<tr>
<th>Business Name</th>
<th>Rating</th>
<th>Store Latitude</th>
<th>Store Longitude</th>
<th>Business Type</th>
<th>City Name</th>
<th>Zip Code</th>
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</thead>
<tbody>
<tr>
<td>Five Star Flower Shop</td>
<td>5</td>
<td>42.386</td>
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<td>Flowers</td>
<td>Belmont</td>
<td>2478</td>
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<td>-71.248</td>
<td>Flowers</td>
<td>Waltham</td>
<td>2451</td>
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<tr>
<td>Bright Town Flower Shop</td>
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<td>-71.152</td>
<td>Flowers</td>
<td>Brighton</td>
<td>2135</td>
</tr>
<tr>
<td>Star Dry Flower Shop</td>
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<td>42.349</td>
<td>-71.140</td>
<td>Flowers</td>
<td>Boston</td>
<td>2134</td>
</tr>
<tr>
<td>Best Flower Shop</td>
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<td>42.421</td>
<td>-71.138</td>
<td>Flowers</td>
<td>Medford</td>
<td>2155</td>
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<tr>
<td>Dependable Flower Shop</td>
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<td>-71.185</td>
<td>Flowers</td>
<td>Watertown</td>
<td>2472</td>
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<tr>
<td>J &amp; D Flower Shop</td>
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<td>42.404</td>
<td>-71.141</td>
<td>Flowers</td>
<td>Arlington</td>
<td>2474</td>
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<tr>
<td>Porter Square Flower Shop</td>
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<td>42.389</td>
<td>-71.117</td>
<td>Flowers</td>
<td>Somerville</td>
<td>2144</td>
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<tr>
<td>Sunshine Flower Shop</td>
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<td>2445</td>
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<tr>
<td>Hemmingway Flower Shop</td>
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<td>42.378</td>
<td>-71.164</td>
<td>Flowers</td>
<td>Belmont</td>
<td>2478</td>
</tr>
</tbody>
</table>
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

Identify Delivery zip codes and demographics
Select Delivery Zip Codes
Select Business Partners
STEP 5: PRE-COLLABORATION DELIVERY COSTS

a. Simulate the customer’s orders in zip code - 02467
STEP 5 : PRE COLLABORATION DELIVERY COST

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

Lowest Delivery Cost Pre-Collaboration: $20
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
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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
SENSITIVITY ANALYSIS 2/3

Delivery Flexibility

Parameters below are held constant:

- Order Quantity = 25 orders
- Radius = 5 miles
- # of Vehicle Available = 5 vehicles
SENSITIVITY ANALYSIS 3/3

03  Driver Engagement

1 driver = 1 vehicle

Parameters below are held constant:

- Order Quantity = 25 orders
- Radius = 5 miles
- # of Vehicle Available = 5 vehicles
Derived from sensitivity analysis, the rate card below is used to reinforce the collaboration between Walmart and its business partners.

<table>
<thead>
<tr>
<th></th>
<th>Silver</th>
<th>Gold</th>
<th>Diamond</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Order per Day</td>
<td>&lt;25</td>
<td>25 ~ 50</td>
<td>&gt;50</td>
</tr>
<tr>
<td>Delivery Time Window</td>
<td>4 hours</td>
<td>2 hours</td>
<td>1 hour</td>
</tr>
<tr>
<td>Committed Minimum On-time Delivery %</td>
<td>90%</td>
<td>95%</td>
<td>98%</td>
</tr>
<tr>
<td>Maximum Orders % Delivered in Peak Hours</td>
<td>15%</td>
<td>25%</td>
<td>50%</td>
</tr>
<tr>
<td>Delivery Rate</td>
<td>$$$</td>
<td>$</td>
<td>$</td>
</tr>
</tbody>
</table>
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
Any Question?