“The Green Button”: Green Last Mile Home Delivery

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Co-Advisor: Dr. Karla M. Gámez-Pérez
“Green Button” with Coppel

CHECKOUT

CART > SHIPPING OPTIONS

Choose a shipping method:

- Overnight
- Expedited
- GREEN DELIVERY (standard)

Green option saves 45 tree seedlings grown for 10 years
~ 1300 Retail Stores in Mexico
~ 19 Regional DC’s
~ 200 Warehouses
~ 1200 last mile delivery vehicles
~ 600 primary fleet trucks

Products: clothing, accessories, furniture, and other home goods

Customer profile: Low - Median household income.
Research Questions

1. Does environmental impact information incentivize consumers to choose Green Button?

2. How to communicate environmental impact matters?

3. Any difference in the level of preference in different age, education, occupation and socioeconomic status?
Survey Design for Home Delivery @ Coppel

Field Study Questions:

1. How long did your delivery take?
2. Did you find this delivery fast/normal/slow?
3. Are you willing to wait a little longer for this delivery?
4. With an economical incentive, would you wait a little longer?
5. The longer delivery time would have positive impact to the environment. Knowing this, will you wait a little longer?

- For environmental impact we used 4 scenarios (CO2 emissions, Trash, Electricity and Trees)
Scope of Field Study

10 different regions of Mexico
961 Customer Surveys
Demographic Information (961 responses)

**Gender**
- Female: 65%
- Male: 29%
- No Answer: 6%

**Occupation**
- Housewife: 15%
- Employee: 38%
- Student: 30%
- Own business: 9%
- Other: 4%
- No Answer: 4%

**Socioeconomic level**
- No Answer: 13%
- A: 10%
- B: 6%
- C: 16%
- C+: 11%
- D: 18%
- D+: 17%
- E: 11%

**Age**
- 18-24: 4%
- 25-34: 7%
- 35-44: 11%
- 45-54: 23%
- 55-64: 25%
- 65-74: 19%
- 75+: 11%
- Prefer not to answer: 23%
- No Answer: 7%

**Education**
- Primary - Secondary: 31%
- High school: 19%
- University: 25%
- Posgraduate: 19%
- No Answer: 7%
- I do not want to answer: 11%
Customer's Feedback

NORMAL: 44.2%
- Delivery days (Average): 2.5 days
- Willingness to Wait (Days) – Economical Incentive: 3.7 days
- Willingness to Wait (Days) – Environmental Information: 2.4 days
- Willingness to Wait (Days) – No Incentive: 2.0 days

FAST: 46.8%
- Delivery days (Average): 1.7 days
- Willingness to Wait (Days) – Economic Incentive: 4.6 days
- Willingness to Wait (Days) – Environmental Information: 2.8 days
- Willingness to Wait (Days) – No Incentive: 2.9 days
Customer's Feedback

Consumers are willing to wait:

- **5.5 days** with economic incentives
- **4.7 days** with environmental incentives
Comparison of Incentives (Difference of Means)

Willingness to wait increases with incentives
Environmental Incentives (Willingness to Wait)

People are most willing to wait with information on **trees**.

The pooled standard deviation is used to calculate the intervals.
Comparison of Demographic Groups (Mean Analysis)

- **Region** to be the only variables found to be statistically significant in the test of Willingness to Wait (Chi Square and one-way ANOVA)
- **Age** requires further analysis

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<tr>
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Carbon Emissions Reduction
Environmental impact of Four-days delivery

Sample calculation of CO2 emission reduction in one region

Region: Culiacan, Mexico
Duration: 7 months

AZCP = Azcapotzalco
CUL = Culiacan
IZTP = Iztapalapa
LEON = León
MTRY = Monterrey
Why Choose Four Days?

Industry Benchmarks[1]

Delivery Time for Various Companies
(Days)

Company
Amazon
Apple
Lenovo
Hewlett Packard
Dell

0 2 4 6 8 10 12 14 16

Delivery Time (Business Days)

4 days is within range of other free shipping

Dell
Hewlett Packard
Lenovo
Apple
Amazon


Customer Tolerance (questionnaire)

90% of deliveries within 3 days are considered fast/normal

[Slow] [Normal] [Fast]

90%
80%
70%
60%
50%
40%
30%
20%
10%
0%

1 day
2 days
3 days
Several days
Do not remember

0% 5% 10% 15% 20% 25% 30% 35% 40%
Three Constraint Assumptions

1. Maximum Load per truck
   – 1,182kg per truck (85% utilization of physical truck capacity in weight)

2. Number of stops per truck per day
   – 75% of trucks make ≤ 16 stops
   – 89% of trucks make ≤ 18 stops
   – 99% of trucks make ≤ 29 stops

3. Distance per truck per day
   – 210km per trip
**Carbon Calculation**

1. The limiting constraint is the number of stops
2. Limiting at maximum of 16 stops per truck, truck utilization increases by 8%
3. It reduces 1.5 tons of CO\textsubscript{2} emission, 766 liters of diesel per month

### To Be Scenarios

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<th>Assumptions</th>
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<tr>
<td>Average additional distance per stop</td>
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<td>2km</td>
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</table>

### Scenarios

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Total #of trips</th>
<th>Average Utilization</th>
<th>Results per truck (average)</th>
<th>CO2 emission</th>
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<td>Weight</td>
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<td>1,182</td>
<td>85%</td>
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<td>To Be 3 (distance)</td>
<td>537</td>
<td>187%</td>
<td>2,328.05 kg</td>
<td>52.21 Enforced at 210.95km</td>
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</table>

**Total Saving:** 10,631
Conclusion
Conclusion: Consumers Care about Green Delivery

1. Providing environmental impact information incentivizes consumers to choose extended delivery option
   - Increases consumer willingness by 20%
   - Increases consumer tolerance by 0.5 days
Conclusion: Communication Matters

2. How to communicate environmental impact matters

- Trees saved influenced the most compared to trash, electricity, or CO$_2$ emission
Conclusion: Demographic Differences?

3. Education, Occupation, and Socioeconomic status have no differences, but Region and Age may have differences
4. Extended delivery time reduces fuel consumption and cuts carbon emission

- Reduces fuel consumption by 766 liters per month*
- Reduces 1.5 tons of carbon emissions per month*

*Case study of Coppel Home delivery in Culiacan, Mexico
Next Steps: “The Green Button”

CHECKOUT

CART > SHIPPING OPTIONS

Choose a shipping method:

- Overnight
- Expedited
- GREEN DELIVERY (standard)

Green option saves 45 tree seedlings grown for 10 years
QUESTIONS?
THANK YOU
Back-up
Comparison of Demographic Groups (Mean Analysis)

Willingness to Wait: Chi Square and one-way ANOVA demonstrate whether the means of different groups are the same. Values in blue are statistically significant.

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<th>Group</th>
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<th>Economic Incentive</th>
<th>Environmental Impact</th>
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<th>Category</th>
<th>Group</th>
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Willingness to Wait (Y/N, Binary Logistic Regression)

Locality is a statistically significant predictor of willingness to wait (Yes=1, No = 0)

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<tr>
<th>Source</th>
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<th>Adj Mean</th>
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<td>764.44</td>
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</table>
Profiles more willing to wait

Profile more willing to wait with Economic incentives

- **Generation:** Millennials, Generation X
- **Education level:** University degree
- **Occupation:** Student, Employee
- **Social status:** Indistinct
- **Region:** Monterrey, Toluca

Profile more willing to wait with Environmental info

- **Generation:** Millennials
- **Education level:** University degree
- **Occupation:** Employee
- **Social status:** Upper middle class (C+)
- **Region:** Leon, Toluca
Customer willingness to wait

Both economic incentive and **environmental information** increase customer willingness to wait longer by approximately 20%.

- **50%** willing to wait with no incentive/information
- **70%** willing to wait with economic incentive
- **71%** willing to wait with environmental information
Can you wait for your delivery?

50% of customers said they can wait for their delivery a little longer.

- Yes: 50%
- No/Depends/I don’t know: 5%
- 45%
## Customer's Feedback

### Delivery Perception:

<table>
<thead>
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<th></th>
<th>Fast</th>
<th>Normal</th>
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<tbody>
<tr>
<td>Delivery days (Average)</td>
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<td>2.5 days</td>
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<tr>
<td>Willingness to Wait</td>
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<tr>
<td>- Economical Incentive</td>
<td>4.9 days</td>
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<tr>
<td>- Environmental Information</td>
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</tr>
<tr>
<td>- No Incentive</td>
<td>3.0 days</td>
<td>2.0 days</td>
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### Willingness to Wait (Days)

- **Economical Incentive:**
  - No Incentive: 3.0 days
  - Environmental: 2.6 days
  - Economic: 3.8 days

- **Environmental Information:**
  - Economic: 6.245 days
  - Environmental: 6.046 days

### Slow Delivery Perception:

- 45.6% of customers prefer slow delivery with a 4.499-day willingness to wait.

### Graph

- Slow Delivery (45.6%)
  - No Incentive: 4.499 days
  - Economic: 6.245 days
  - Environmental: 6.046 days

---

**MIT Center for Transportation & Logistics**

---

**Sustainable Logistics Initiative**
Comparison of Incentives (Difference of Means)

Willingness to wait increases with incentives

Confidence Intervals

<table>
<thead>
<tr>
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<th>Comparison</th>
<th>Difference of Means</th>
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<td>0.60</td>
<td>1.04</td>
</tr>
<tr>
<td></td>
<td>environ vs. no info</td>
<td>0.47</td>
<td>0.28</td>
<td>0.66</td>
</tr>
<tr>
<td></td>
<td>econ vs no info</td>
<td>1.30</td>
<td>1.04</td>
<td>1.5</td>
</tr>
</tbody>
</table>
Conclusion

• Providing environmental impact information increases consumer preference towards green delivery option
  – Different environmental impact information results in different consumer preferences – Tree and Trash resulted in stronger willingness to wait than Electricity

• No statistical significance in willingness to wait was found in the following demographic groups:
  – Education level
  – Socio-economic level

• However, locality is statistically significant and age should be studied further