

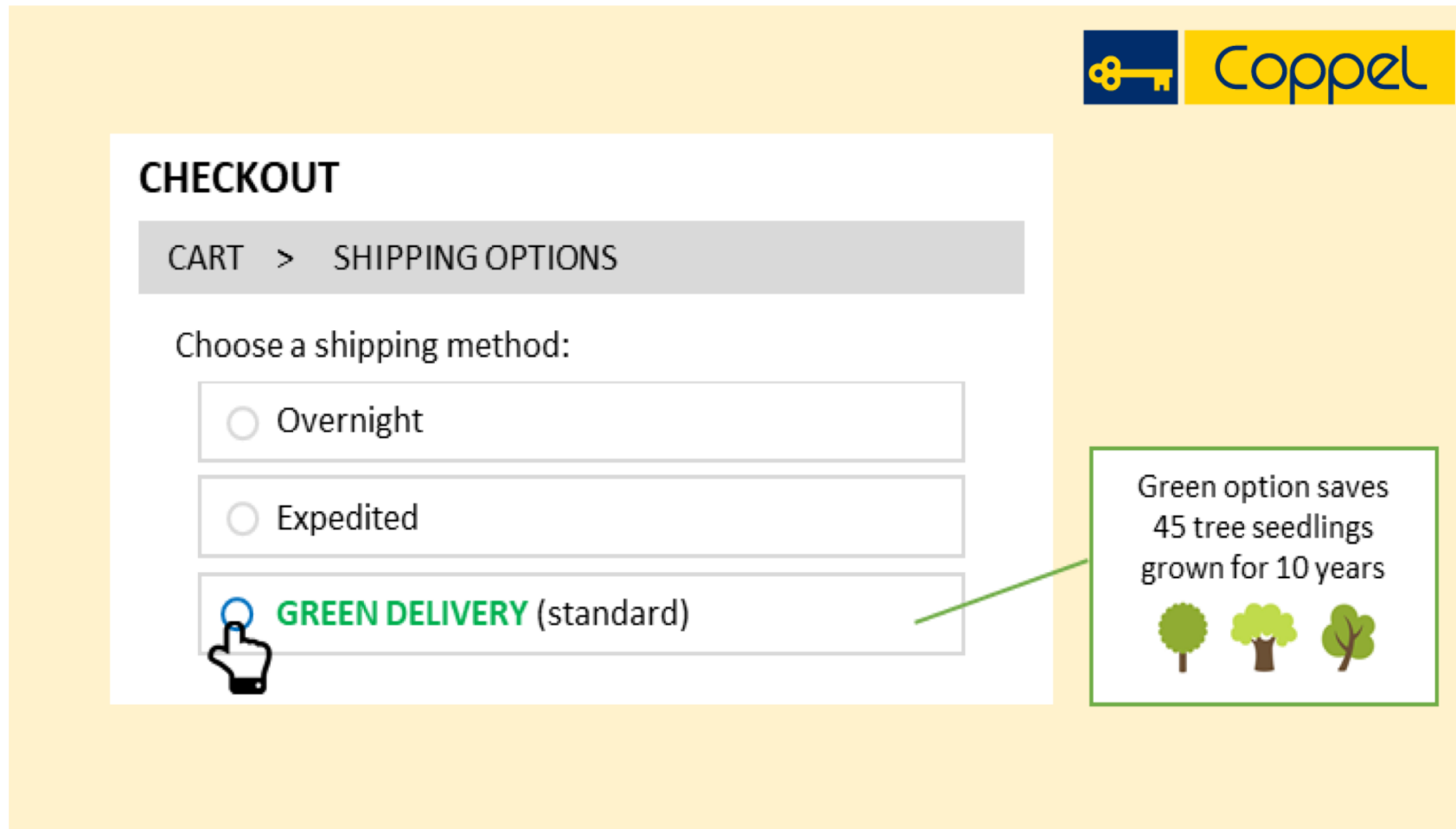
“The Green Button”: Green Last Mile Home Delivery

Capstone Project by *Mina Saito & Andrew Fu*

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Co-Advisor: Dr. Karla M. Gámez-Pérez

“Green Button” with Coppel



The image shows a checkout interface for Coppel. At the top right is the Coppel logo, which consists of a blue square with a yellow key icon and the word "Coppel" in a yellow sans-serif font. Below the logo is a white box with the heading "CHECKOUT" in bold black text. Underneath the heading is a grey bar with the text "CART > SHIPPING OPTIONS". Below this bar, the text "Choose a shipping method:" is displayed. There are three shipping options, each in a white box with a radio button on the left: "Overnight", "Expedited", and "GREEN DELIVERY (standard)". The "GREEN DELIVERY" option is highlighted with a blue hand cursor icon pointing to its radio button. A green callout box with a thin border is positioned to the right of the "GREEN DELIVERY" option, connected by a green line. The callout box contains the text "Green option saves 45 tree seedlings grown for 10 years" and three small green tree icons.

Coppel


CHECKOUT

CART > SHIPPING OPTIONS

Choose a shipping method:

- Overnight
- Expedited
- GREEN DELIVERY** (standard)

Green option saves 45 tree seedlings grown for 10 years

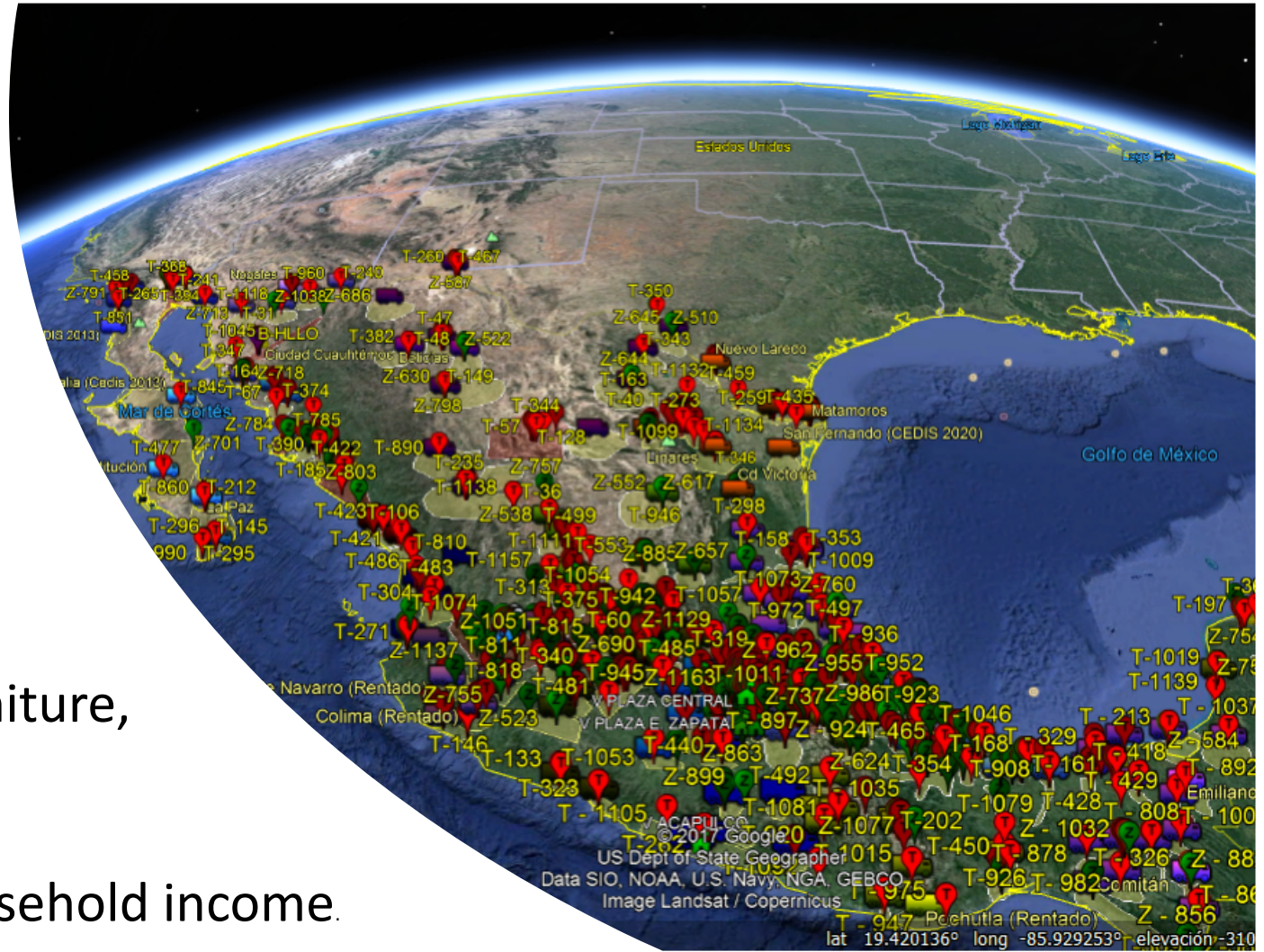




- ~ 1300 Retail Stores in Mexico
- ~ 19 Regional DC's
- ~ 200 Warehouses
- ~ 1200 last mile delivery vehicles
- ~ 600 primary fleet trucks

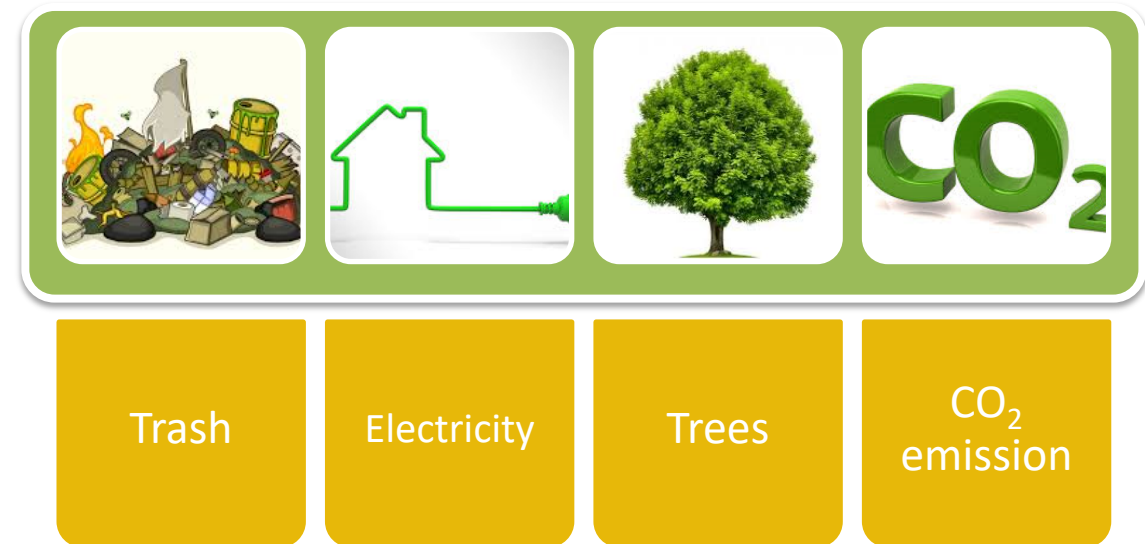
Products: clothing, accessories, furniture, and other home goods

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 @

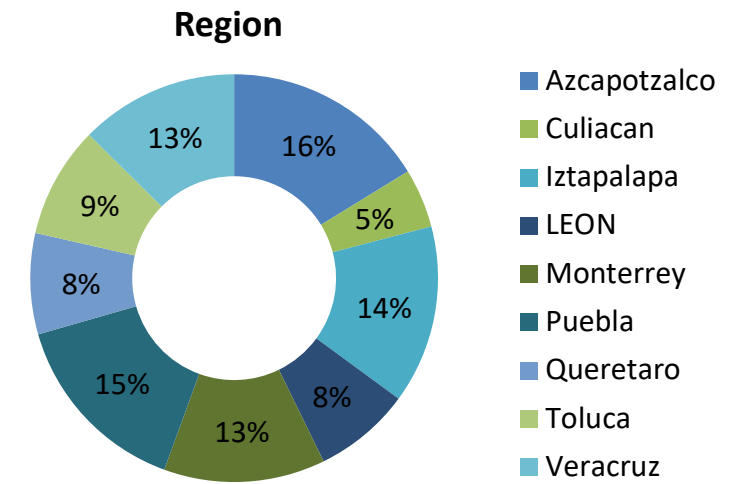
Field Study Questions:

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

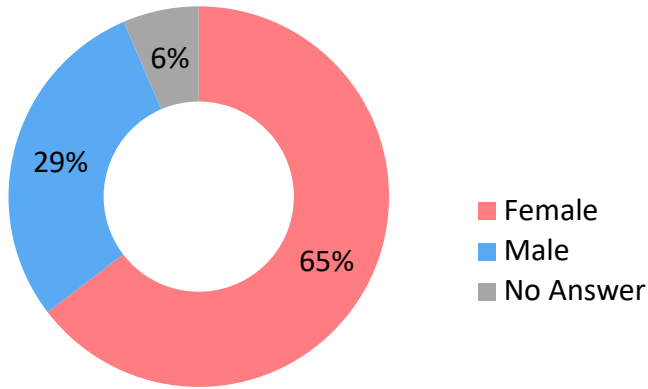


10 different regions of Mexico
961 Customer Surveys

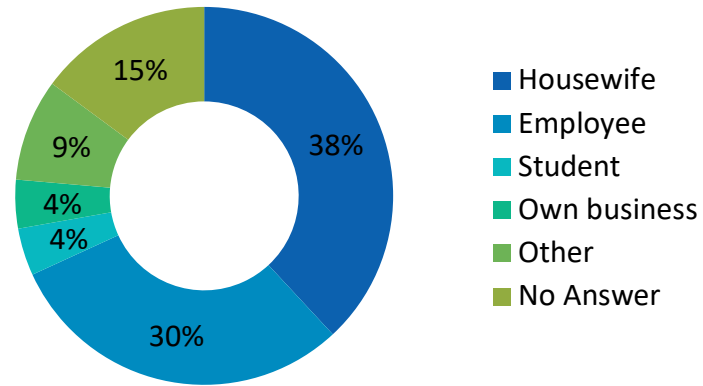


Demographic Information (961 responses)

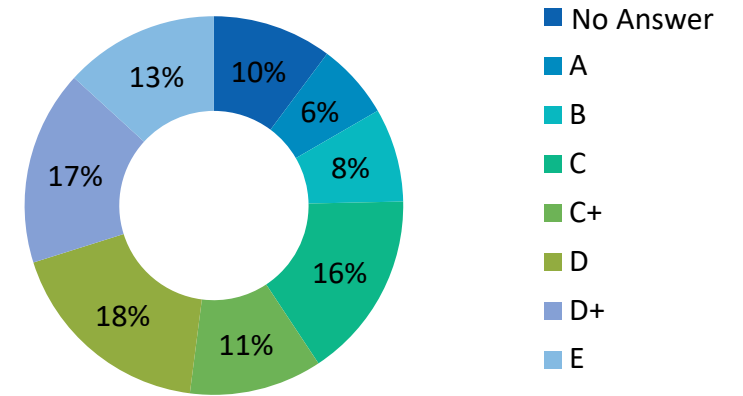
Gender



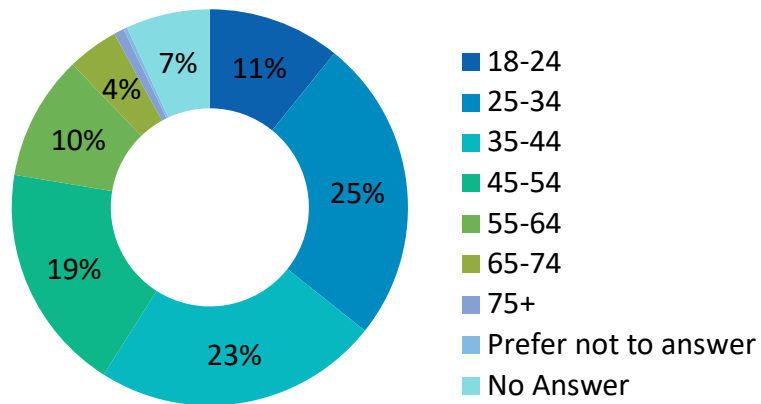
Occupation



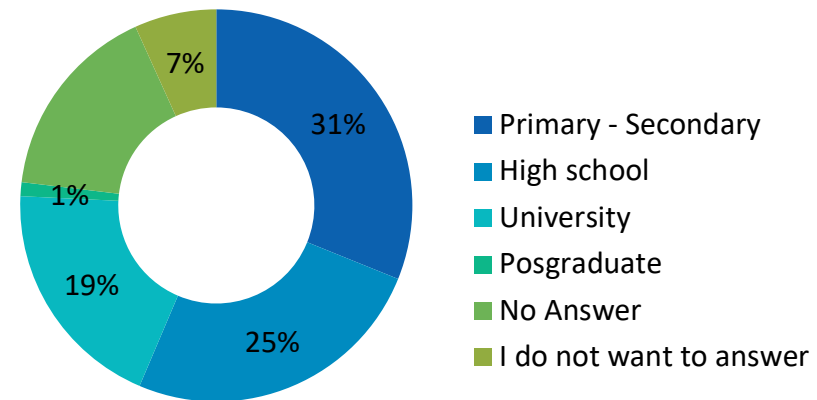
Socioeconomic level



Age



Education



Customer's Feedback

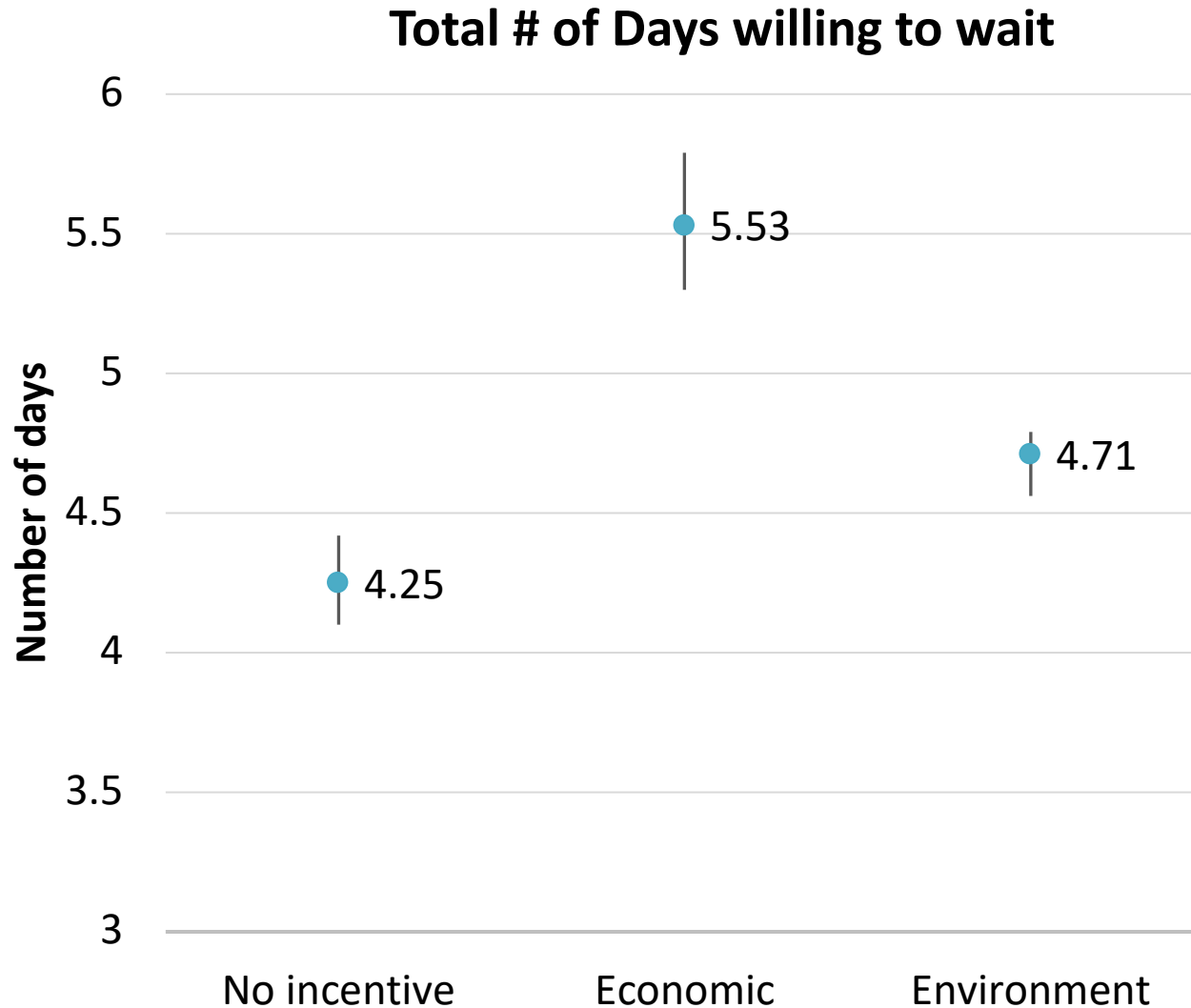
NORMAL: 44.2%

- Delivery days (Average): **2.5 days**
- Willingness to Wait (Days) –
Economic 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

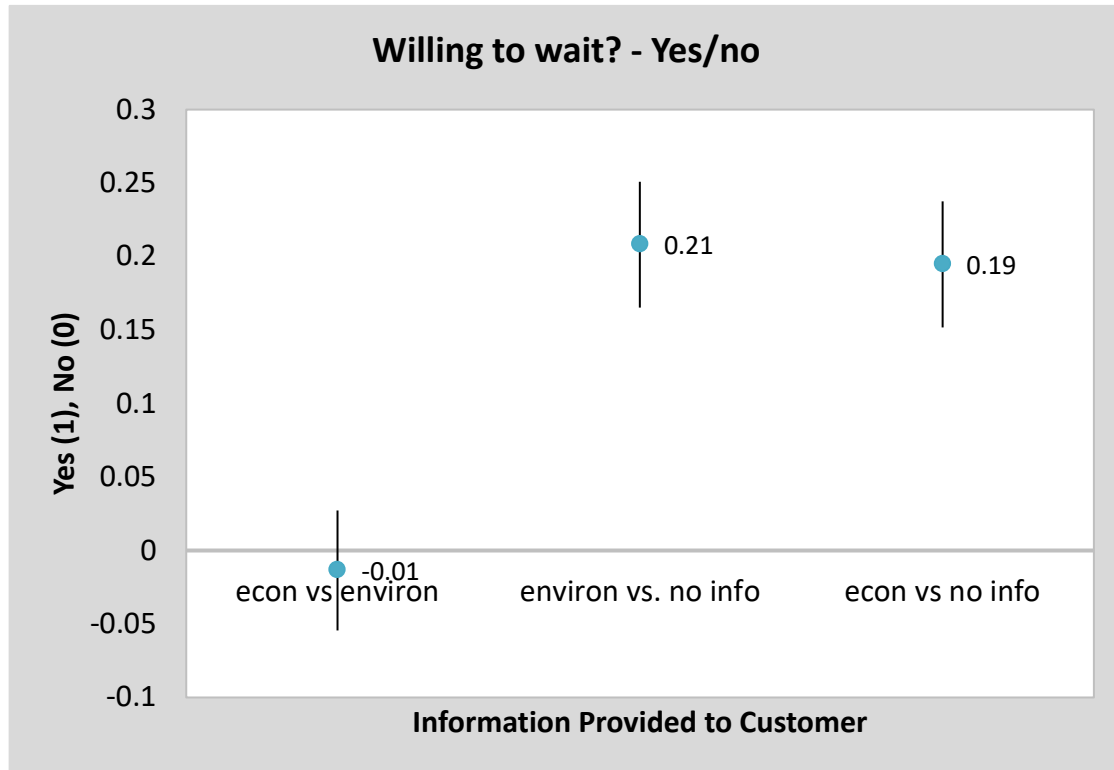


Consumers are willing to wait:

- **5.5 days** with economic incentives
- **4.7 days** with environmental incentives

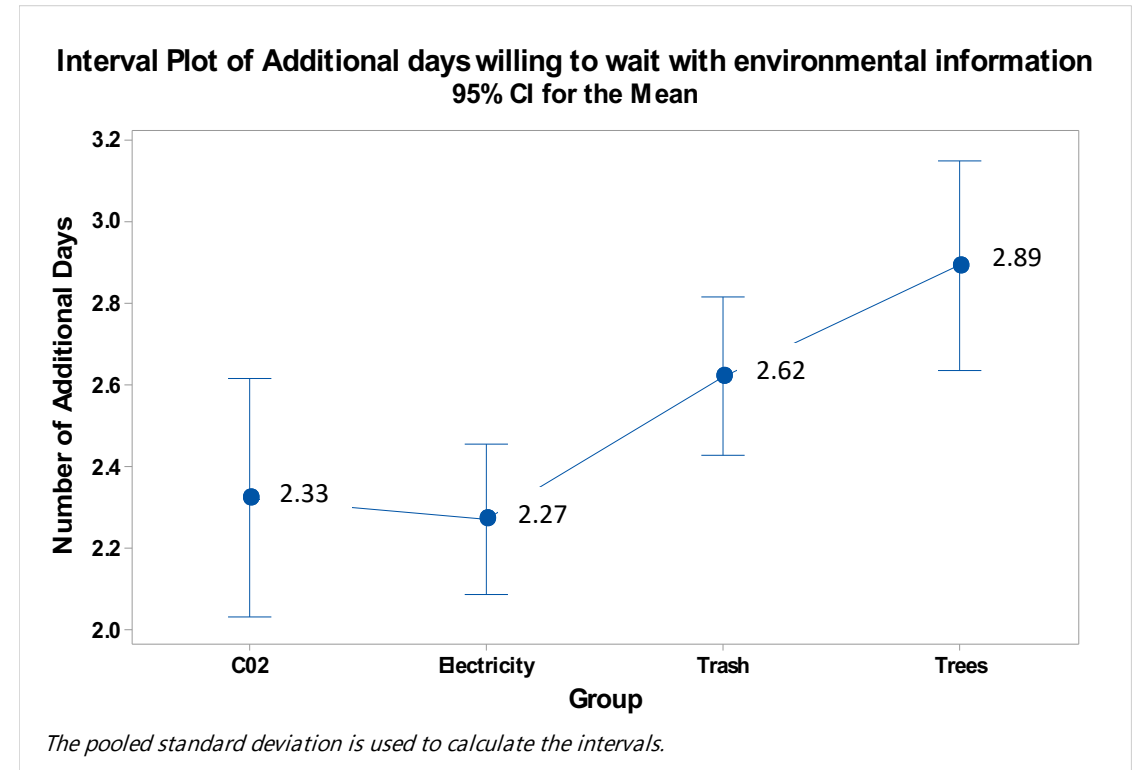
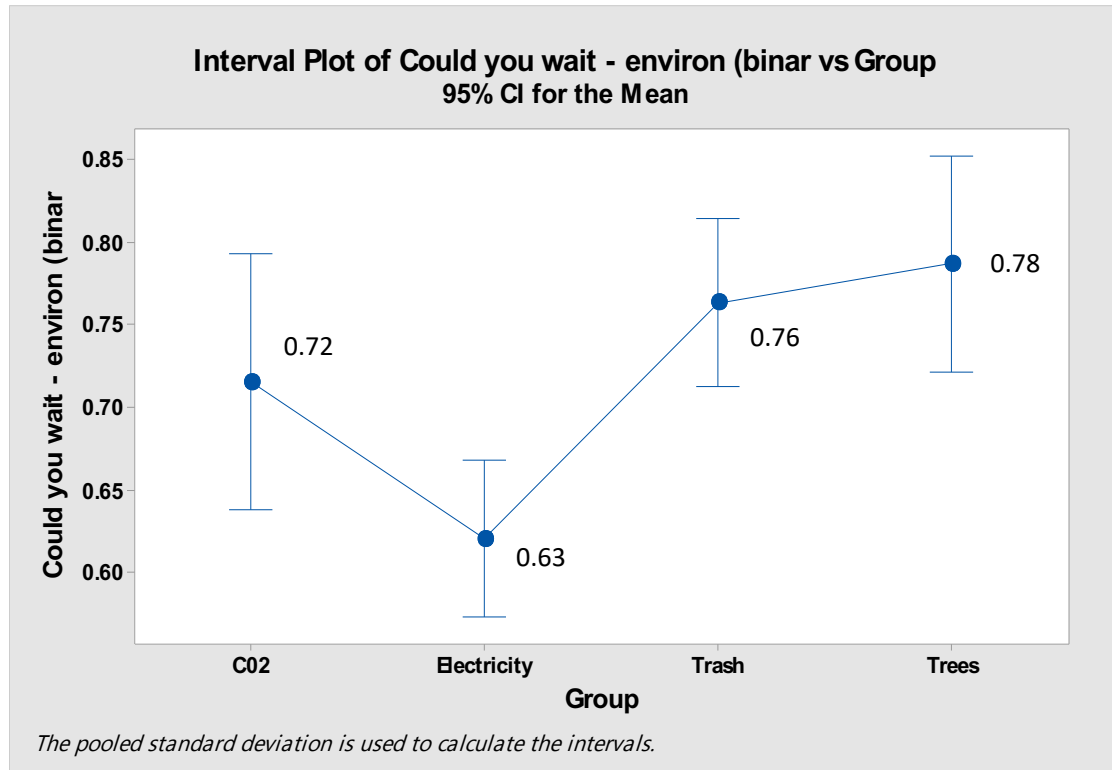
Comparison of Incentives (Difference of Means)

Willingness to wait **increases with incentives**



Environmental Incentives (Willingness to Wait)

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



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

Category	Statistically Significant	Possible Exception
Age	No	Millennials (25-34) Baby Boomers (55-64)
Education	No	
Occupation	No	Students, business owners
Socioeconomic Status	No	C+
Region	Yes	

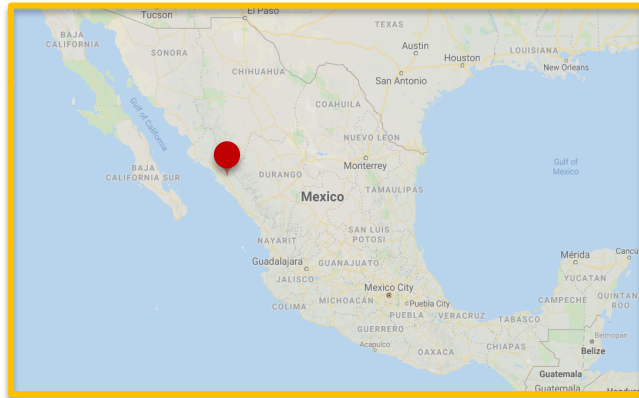
Carbon Emissions Reduction

Environmental impact of Four-days delivery

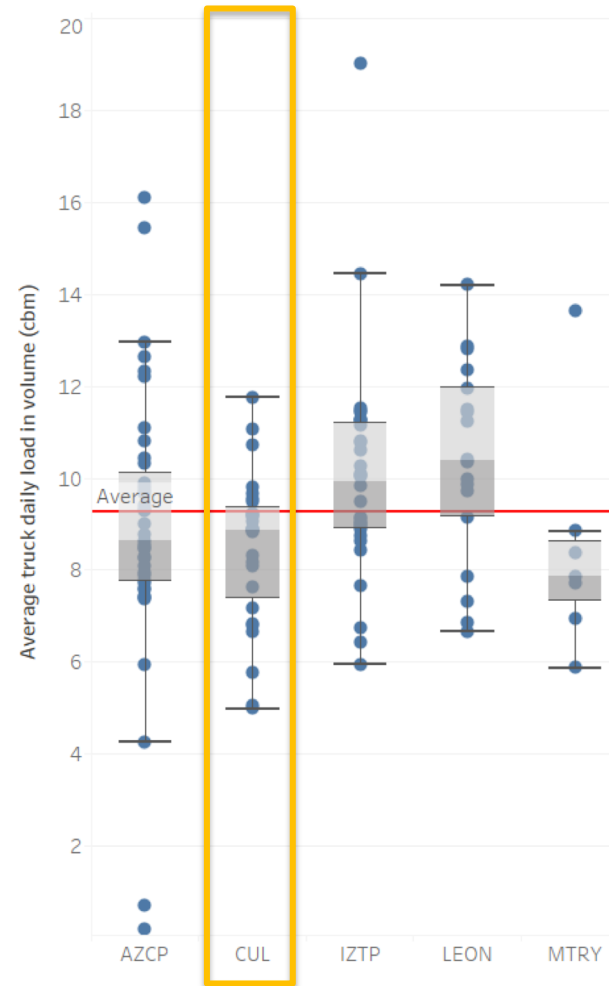
Sample calculation of CO2 emission reduction in one 1 region

Region: Culiacan, Mexico

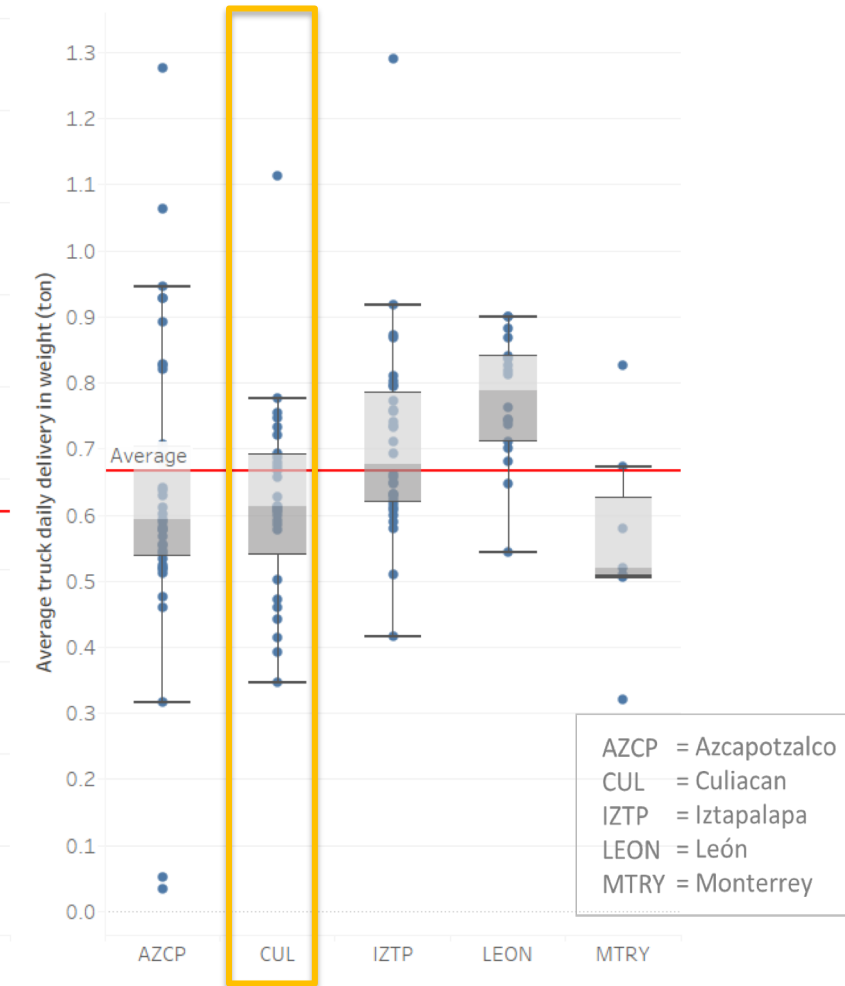
Duration: 7 months



Load Volume



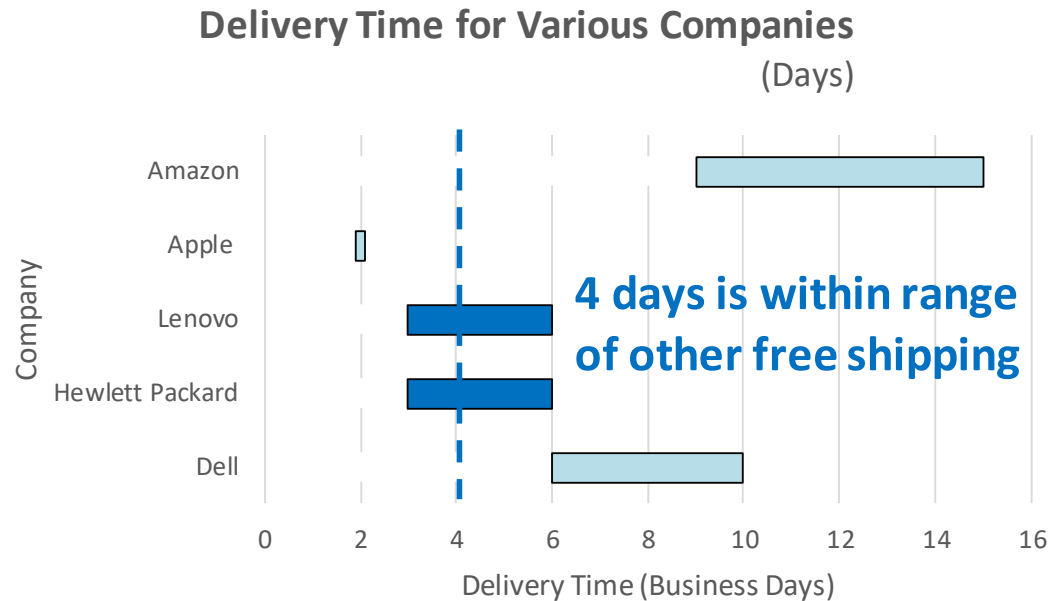
Load Weight



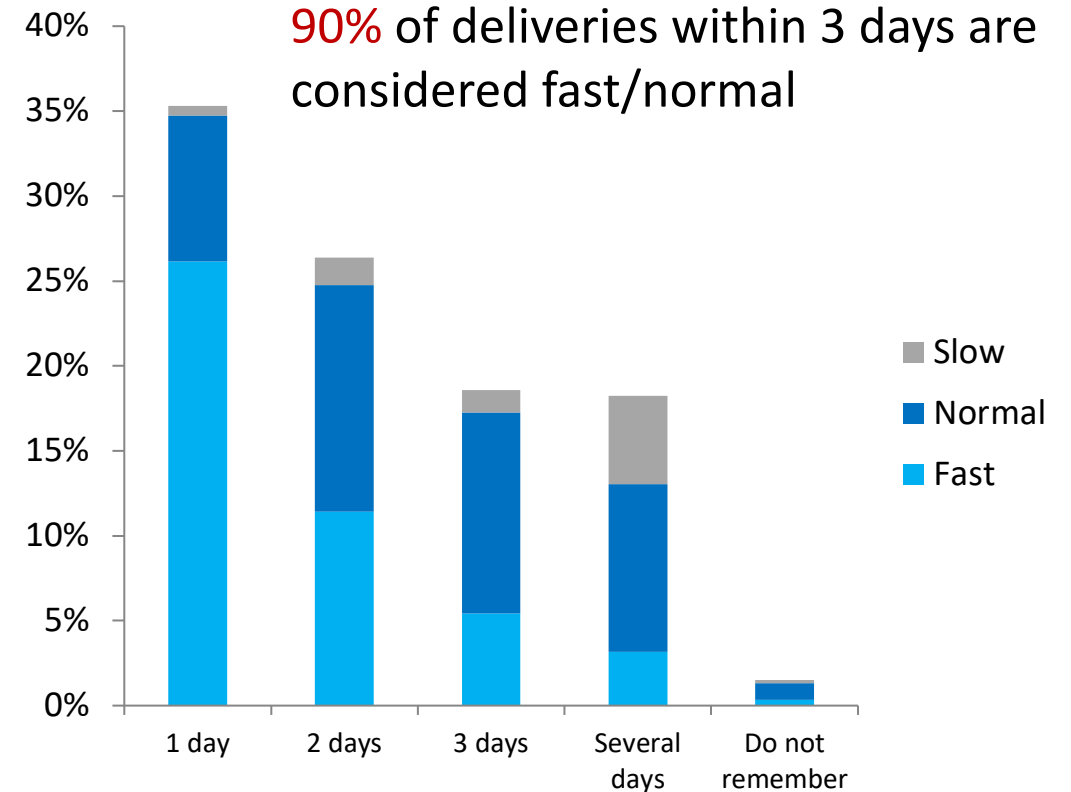
AZCP = Azcapotzalco
CUL = Culiacan
IZTP = Iztapalapa
LEON = León
MTRY = Monterrey

Why Choose Four Days?

Industry Benchmarks^[1]



Customer Tolerance (questionnaire)



[1] Source: Beyer, C. (2017). Optimizing Shipping Pricing on Dell.com on Build to Order Notebooks to US Consumers across Customer Experience, Profitability and Working Capital. Massachusetts Institute of Technology Masters Thesis.

Three Constraint Assumptions

1. Maximum Load per truck

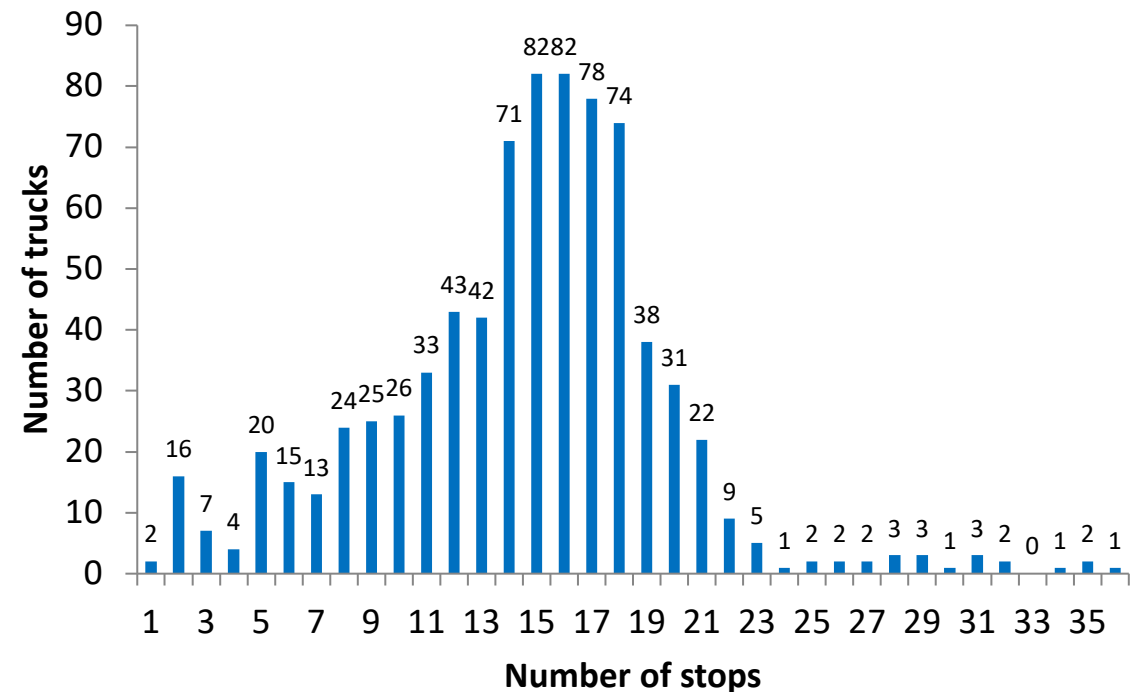
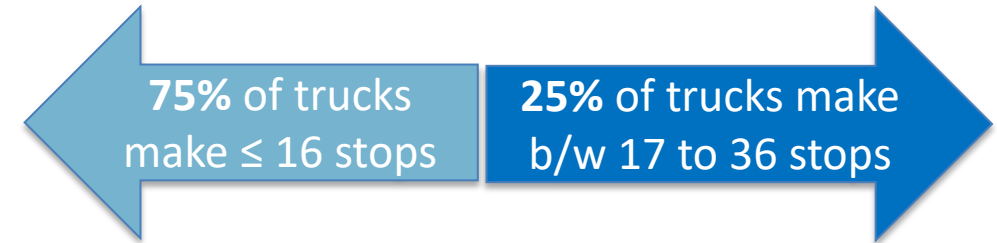
- 1,182kg per truck (85% utilization of physical truck capacity in weight)

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 CO₂ emission, 766 liters of diesel per month

To Be Scenarios		
Assumptions	Total cargo delivered (kg)	1,250,339
	Total Number of stops	27,928
	Average additional distance per stop	2km

Scenarios	Total #of trips	Average Utilization	Results per truck (average)		
			Weight	Number of stops	Distance
Baseline	2,043	49%	612.01 kg	13.67	133.86 km
To Be 1 (weight)	1,182	85%	Enforced at 1,182.00kg	23.63	153.78 km
To Be 2 (stops)	1,746	57%	716.12 kg	Enforced at 16	138.52 km
To Be 3 (distance)	537	187%	2,328.05 kg	52.21	Enforced at 210.95km



CO2 emission	
Per truck (kg)	Total (kg)
48.33	98,737

50.48	88,106
-------	--------

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 CO₂ emission



Conclusion: Demographic Differences?

3. Education, Occupation, and Socioeconomic status have no differences, but Region and Age may have differences

Age



Inconclusive



Socioeconomic status



No Difference



Education



No Difference



Region



Significant Difference



Occupation



No Difference



Conclusion: What is the impact for the Company

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



The image shows a checkout interface with three shipping options. The 'GREEN DELIVERY (standard)' option is selected, indicated by a hand icon and a blue dot. A callout box points to this option, stating that it saves 45 tree seedlings grown for 10 years, accompanied by three tree icons.

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.

Category	Group	Sample Size	Chi Sq test - P value			ANOVA		
			With no info	Economic Incentive	Environmental Impact	With no info	Economic Incentive	Environmental Impact
Age	18-24	104	0.1683	0.9572	0.4260	-	-	-
	25-34	239	0.5871	0.0125	0.0622	-	0.0290	-
	35-44	224	0.2086	0.7231	0.7617	-	-	-
	45-54	179	0.6153	0.3408	0.8722	-	-	-
	55-64	98	0.1997	0.0000	0.0278	-	0.0000	0.0400
	65-74	40	0.3325	0.4225	0.0842	-	-	-
	75+	8	0.1133	0.5052	0.3769	-	-	-
Education	Primary - Secondary	299	0.5039	0.5039	0.0429	-	-	0.6090
	High school	243	0.4701	0.4701	0.5943	-	-	-
	University	186	0.8962	0.8962	0.2191	-	-	-
	Posgraduate	11	0.5161	0.5161	0.5437	-	-	-
Occupation	Student	39	0.0324	0.0770	0.5850	0.0360	-	-
	Housewife	366	0.9605	0.7778	0.5264	-	-	-
	Employee	289	0.7182	0.3646	0.8973	-	-	-
	Own business	40	0.0846	0.0243	0.1048	-	0.0290	-
	Other	84	0.8962	0.6048	0.8933	-	-	-

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.

Category	Group	Sample Size	Chi Sq test - P value			ANOVA		
			With no info	Economic Incentive	Environmental Impact	With no info	Economic Incentive	Environmental Impact
Socioeconomic	A	62	0.2367	0.8396	0.9578	-	-	-
	B	77	0.6341	0.8267	0.2211	-	-	-
	C+	109	0.2663	0.4991	0.0330	-	-	0.0440
	C	154	0.3080	0.8972	0.4996	-	-	-
	D+	160	0.9743	0.1930	0.9840	-	-	-
	D	174	0.9860	0.7434	0.4025	-	-	-
	E	127	0.2244	0.1231	0.3866	-	-	-
Region	Azacapozalco	156	0.1381	0.4525	0.3184	-	-	-
	Culiacan	45	0.0073	0.0121	0.0005	0.0090	0.0150	0.0010
	Iztapalapa	136	0.0146	0.3072	0.0340	0.0240	-	0.0520
	LEON	74	0.0470	0.2215	0.0197	0.0560	-	0.0240
	Monterrey	123	0.0031	0.0060	0.3258	0.0060	0.0090	0.3620
	Puebla	144	0.1068	0.3632	0.4133	-	-	-
	Queretaro	77	0.0003	0.4819	0.5215	-	-	-
	Toluca	85	0.0000	0.0056	0.0000	0.0000	0.0070	0.0000
	Veracruz	121	0.3293	0.2338	0.5092	-	-	-

Willingness to Wait (Y/N, Binary Logistic Regression)

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

Source	DF	Adj Dev	Adj Mean	Chi-Square	P-Value
Regression	27	41.48	1.54	41.48	0.04
Age	5	6.86	1.37	6.86	0.23
Education	3	3.13	1.04	3.13	0.37
Occupation	5	5.22	1.05	5.22	0.39
Region	8	16.77	2.10	16.77	0.03
Socioeconomic Level (INEGI)	6	7.78	1.30	7.78	0.26
Error	624	722.96	1.16		
Total	651	764.44			

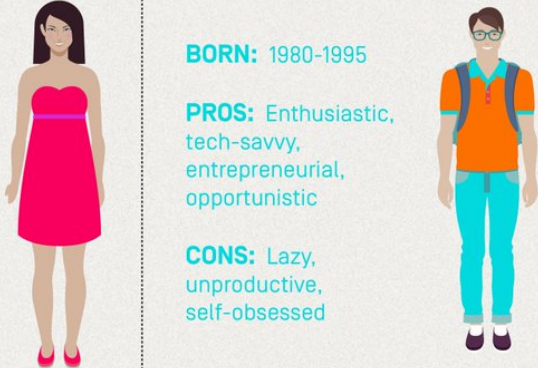
Profiles more willing to wait

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



GEN X	MILLENNIALS
BORN: 1963-1980	BORN: 1980-1995
PROS: Managerial skills, revenue generation, problem solving	PROS: Enthusiastic, tech-savvy, entrepreneurial, opportunistic
CONS: Less cost-effective, less executive presence	CONS: Lazy, unproductive, self-obsessed



Profile more willing to wait with Environmental info

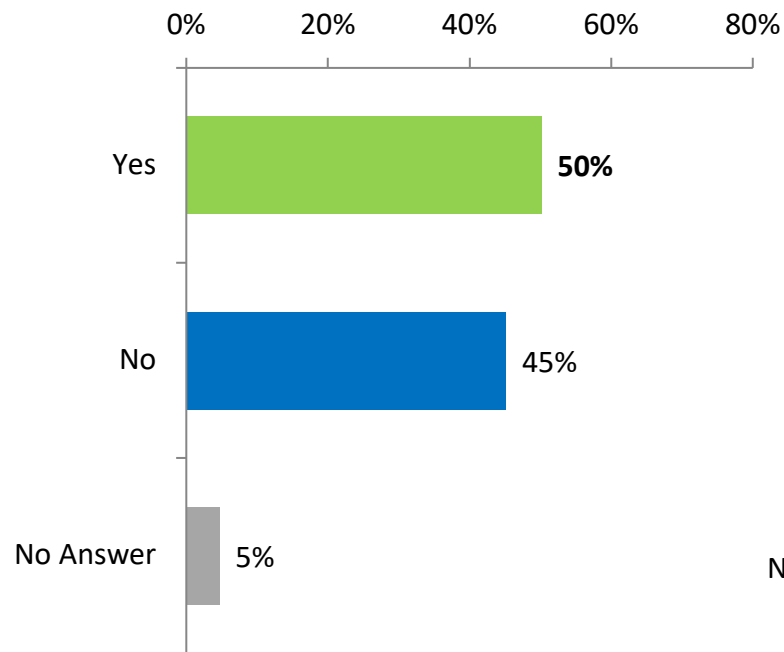
- Generation: Millennials
- Education level: University degree
- Occupation: Employee
- Social status: Upper middle class (C+)
- Region: Leon, Toluca



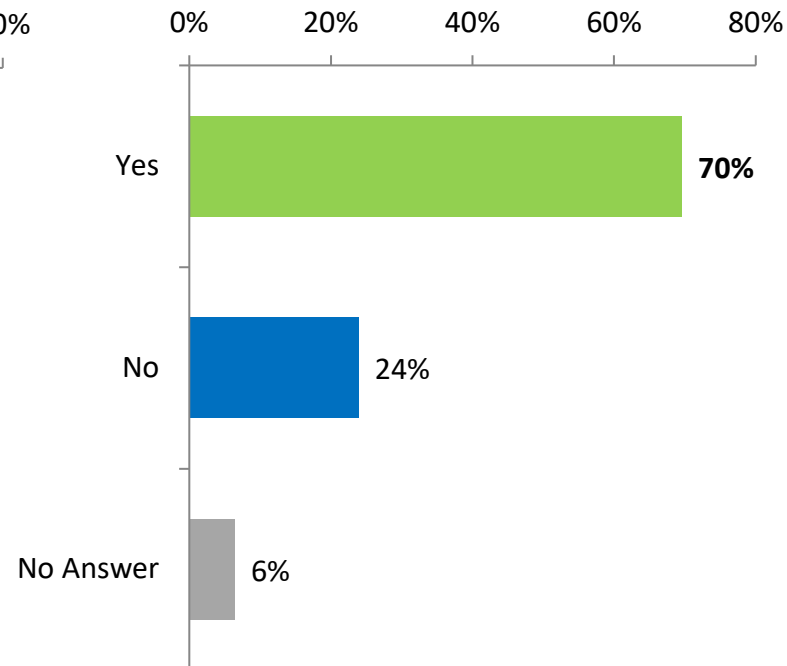
Customer willingness to wait

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

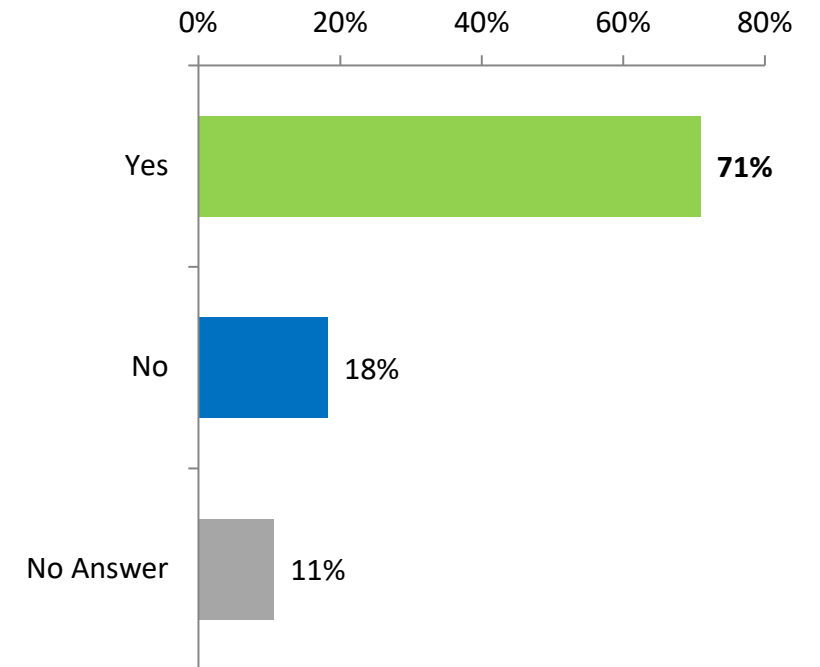
50% willing to wait with no incentive/information



70% willing to wait with economic incentive

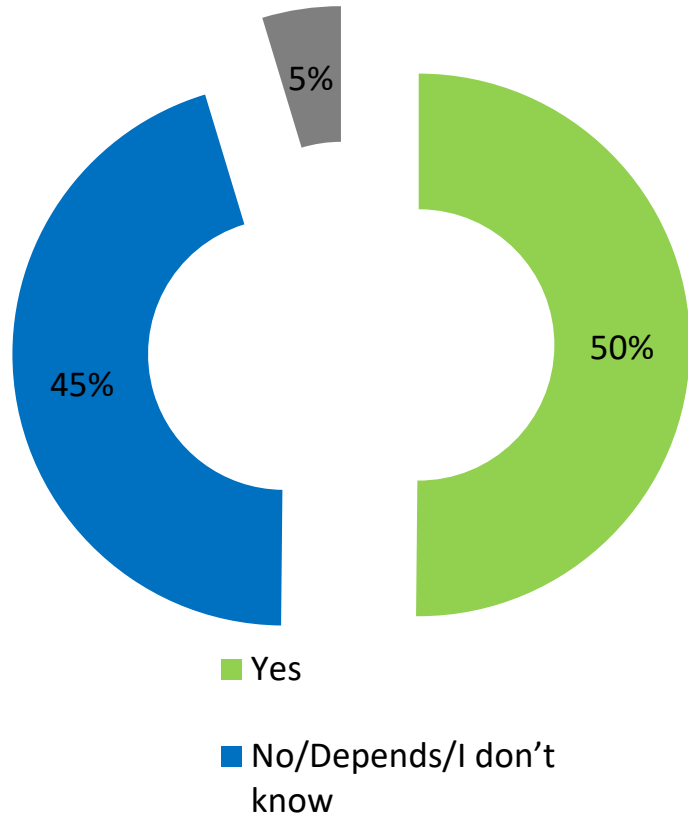


71% willing to wait with environmental information

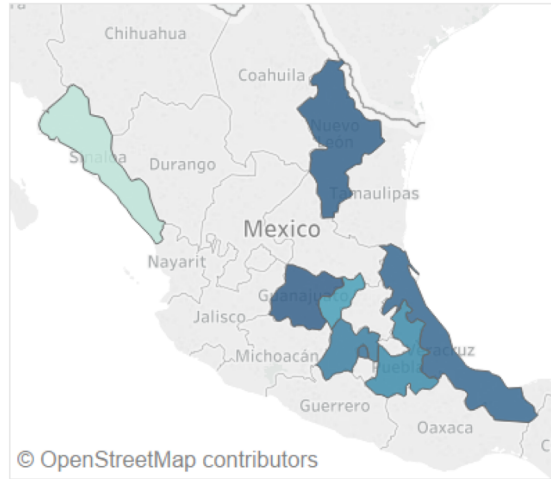


Can you wait for your delivery?

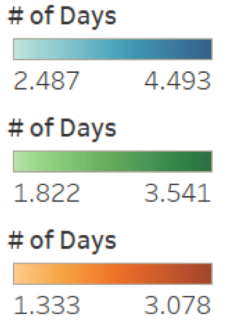
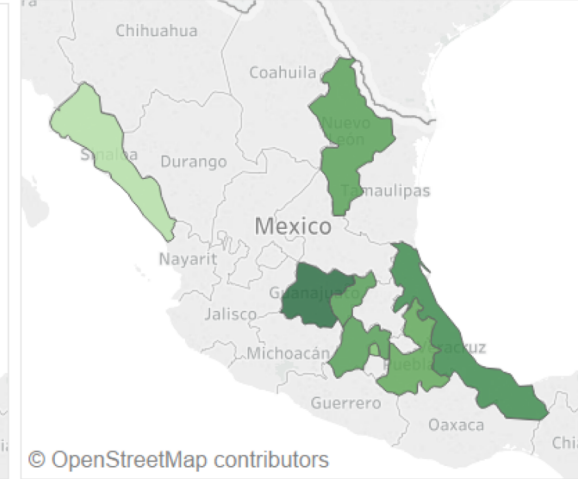
50% of customer said they can wait for their delivery a little longer



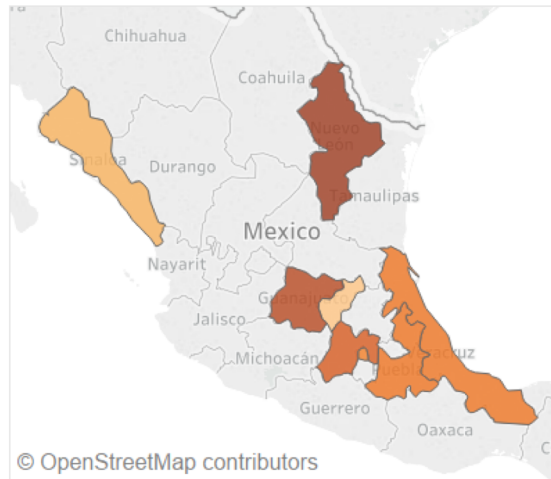
Willingness to wait - Economical Incentive



Willingness to Wait - Environmental Information



Willingness to wait - No incentive



Days
Environmental
Information

State

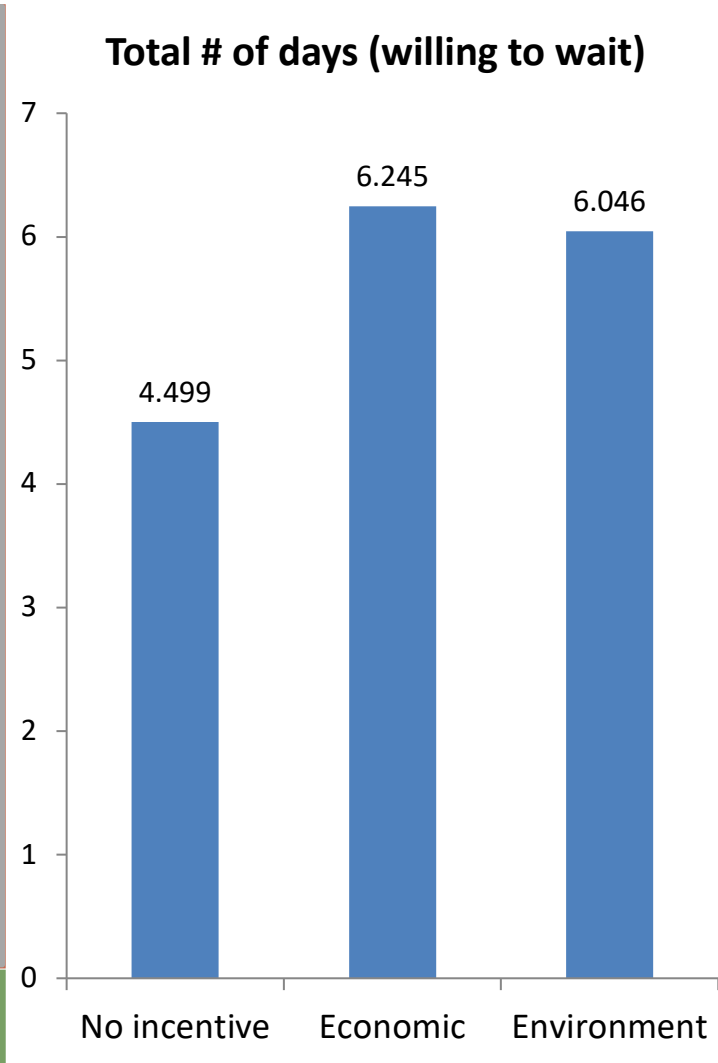
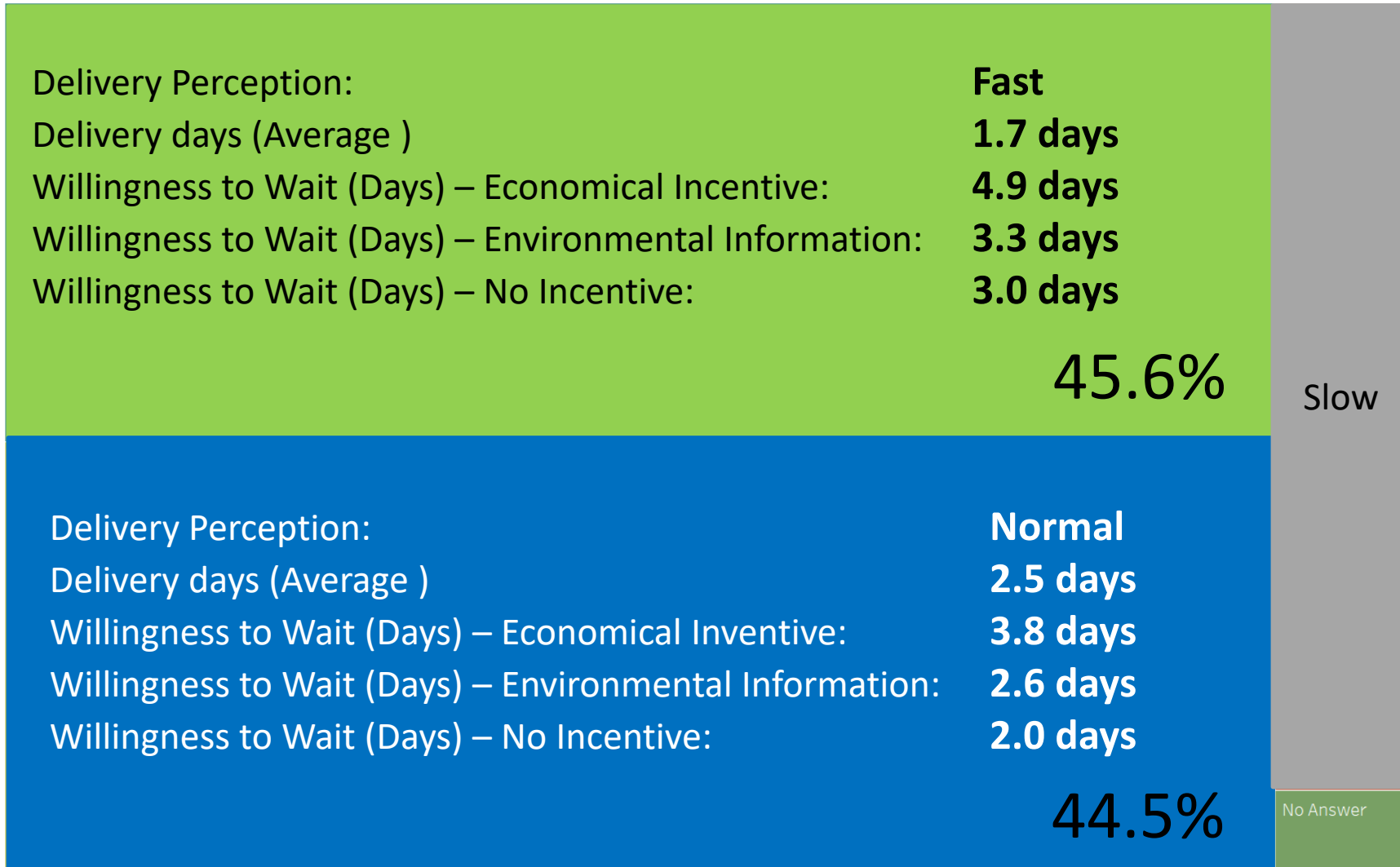
Distrito Fed..	2.301
Guanajuato	3.541
México	2.826
Nuevo León	2.805
Puebla	2.708
Querétaro	2.831
Sinaloa	1.822
Veracruz	3.116

Days
Economical
Incentive

State

Distrito Fed..	4.200
Guanajuato	4.493
México	4.043
Nuevo León	4.445
Puebla	3.857
Querétaro	3.569
Sinaloa	2.487
Veracruz	4.339

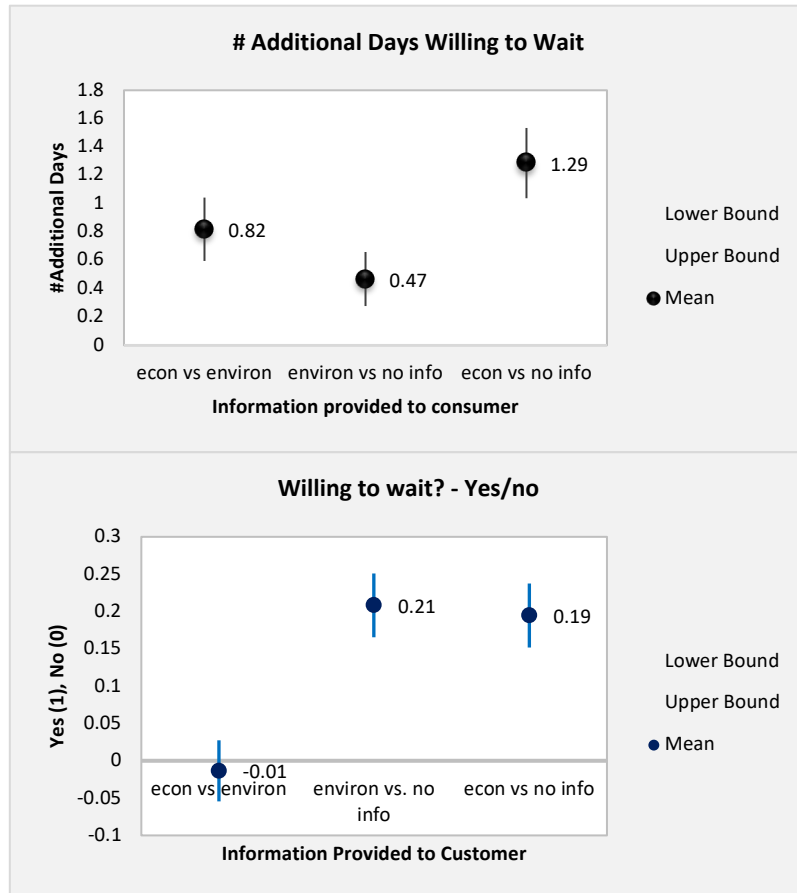
Customer's Feedback



Comparison of Incentives (Difference of Means)

Willingness to wait increases with incentives

Confidence Intervals



Question	Comparison	Difference of Means	Confidence Interval		Statistically Significant at 0.05?
			CI 95% LHS	CI 95% RHS	
Willing to Wait? (Y/N)	econ vs environ	-0.01	-0.05	0.03	
	environ vs. no info	0.21	0.17	0.25	Yes
	econ vs no info	0.19	0.15	0.24	Yes
Additional # of Days Wait	econ vs environ	0.82	0.60	1.04	Yes
	environ vs no info	0.47	0.28	0.66	Yes
	econ vs no info	1.30	1.04	1.5	Yes

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