Finding Ideal User and Optimizing Product Demand

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01 Introduction

Preliminary Questions

How do we quantify and accommodate demand in a way that accurately reflects usage?

Is higher consumer traffic equal to higher demand? Who are the “best customers”?

How can we optimize dispenser combinations without increasing resource expenditure?

What are the most optimal dispenser configurations that generate the most demand? How do these differ by location?

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02 Methodology and Analysis

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Factor Analysis

Selection of variables and analyzing its relative importance across situations

Variables

- Timestamps
- User Volume
- Nations
- Dispenser Models
- Full/Empty Levels

Data: timestamp, vru_log, scu_log, empty_level, counter_in

Nation Analysis

A focused Factor Analysis on the various nations with users included in dataset

Latent Demand Analysis

Analysis between the likelihood of Red Warnings (Demand Proxy) and User Volume. Establish correlation between both factors.

Optimized Product Analysis

Combines Nation Analysis with Latent Demand Analysis on predicted optimal use dispenser configurations with observed usage patterns

Dispenser Types

H1	Tork Matic Hand Towel Roll Dispenser
H2	Tork Xpress Multifold Hand Towel Dispenser
H5	Tork PeakServe Continuous Hand Towel
T2	Tork Mini Jumbo Toilet Roll Dispenser
T6	Tork Twin Mid-size Toilet Roll Dispenser
T7	Tork Coreless Mid-size Toilet Roll Dispenser
T9	Tork SmartOne, Twin
B1	Tork Waste Bin 50 Ltr
S4	Tork Foam Soap Dispenser with Intuition sensor

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Nations Included

	CH	Switzerland
	DE	Germany
	DK	Denmark
	NL	Netherlands
	NO	Norway
	SE	Sweden
	UK	United Kingdom
	SG	Singapore

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Theme 1 Customer Acquisition

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Latent Demand Analysis

Red Warnings are measured by whether they appear or not during each day in the time period of the collected data. This allows for other external factors such as long refill times and variations in user's consumption to be controlled for, allowing for strictly the appearance of red warnings to be measured.

Focus: Understanding how demand varies across customer segments to enable effective customer targeting

Methodology: First create a machine learning model to predict the poxy demand function of each product from the given variables and inputs. Then using partial dependence technique, plot the probability of red warning with a given value of user volume (sensor1) and analyze the change in probability of red warning with different dummy indicator of nation. Partial dependence plot determines the probability as all other variables are held constant.

Hypothesis 1: Increasing the total customer volume would also increase the likelihood of a Red Warning occurrence

Hypothesis 2: There likely exist heterogeneity across product demand in different countries

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Theme 2 Product Optimization

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Optimized Product Analysis

Exploratory Analysis

The overall demand of a dispenser in a location is dependent on a number of things

- *Base Level Demand of Product*
- *Complementary Nature of Products*
- *Substitution Effect*

These effects needs to be fully taken into account to understand the best product offering

Focus: Optimize performance of dispensers based on combinations (type, location and amount) and comparing the highly used configurations between countries.

Variables Used: Sensor1, Empty_level, Full_level, Country, Presence of each type of dispenser (B1, T2, T6, T7, H5)

Methodology: Obtain individual demand for each dispenser in all the possible dispenser permutation that the company has. Find aggregate demand by finding the average value of dispenser demand across all dispensers in the location. This can be interpreted as a dispenser utilization rate. We are optimizing for this since as a company, one would like to ensure all dispensers in an area are meeting specific demand as opposed to standing idle. Subset by country and compare the best bundle by the model with the mostly used one in the nation.

Hypothesis 3: There is room for optimizing dispenser placement across different locations

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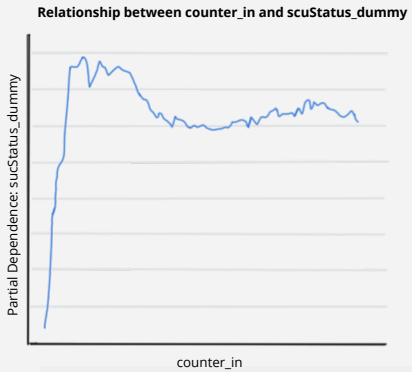
03 Findings and Inferences

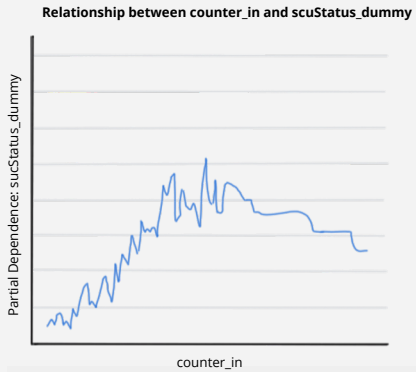
Hypothesis 1

B1

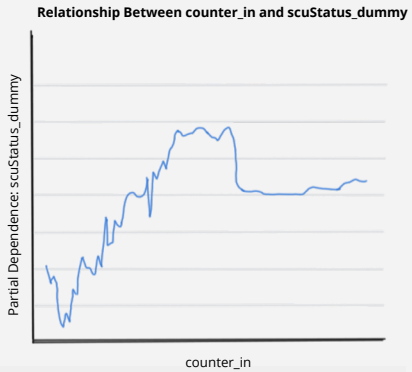


T6

H1



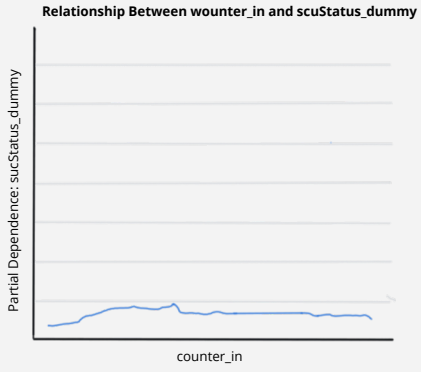
H5



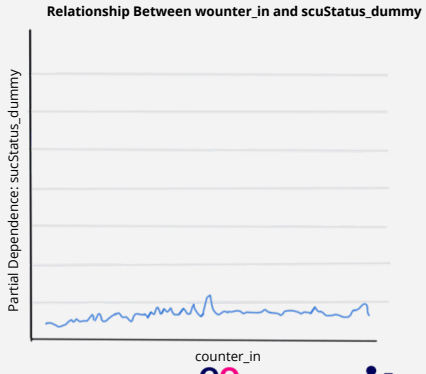
T2

T7

H2



S4



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Customer Acquisition

Recommendation

To increase customer/user engagement, we must move beyond simply just proximity and sheer volume and target customer behavior.

Customer behavior varies with the:

- *Model/Type of Dispenser*
- *Combinations of Several Dispensers*
- *Country where dispenser is used*

Hypothesis 1

Findings:

- Partial dependence increases relatively linearly across all dispenser products. The plot then plateaus or change at smaller rate in monotonic fashion for B1, T2, T6, T7, H5
- Partial dependence increases linearly throughout for H2 H4

Special Features of Graph

- Sudden drop around where user volume is around 1000

Inferences:

- Increasing user volume DOES NOT NECESSARILY increase demand/usage of dispensers
- Simply having users pass by the dispenser DOES NOT GUARANTEE an increase in demand/usage of dispenser

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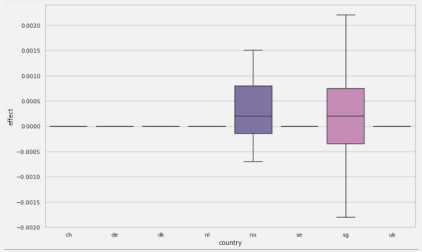
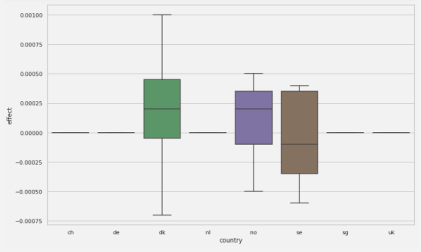
Hypothesis 2

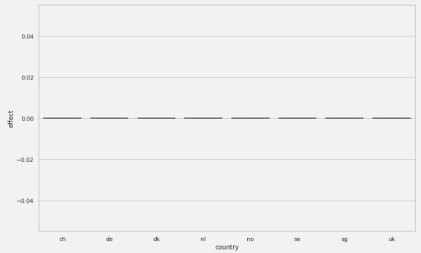
B1



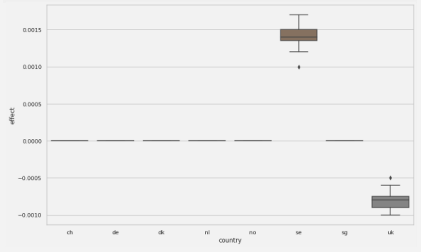
T6



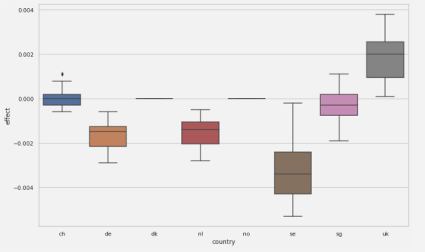
H1



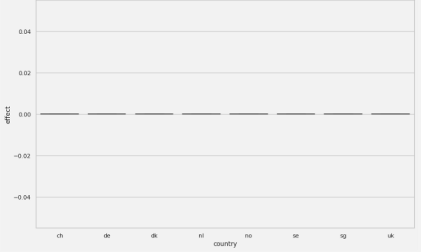
H5



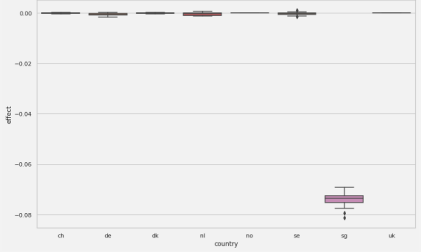
T2



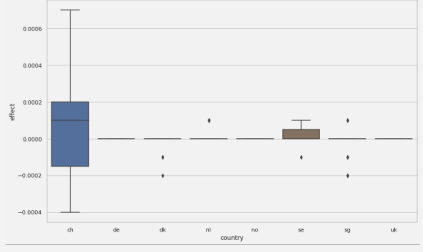
T7



H2



S4



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Customer Acquisition

Recommendation

Target Singapore specifically for the purchase of H5 products (Continuous Hand Towel) and target UK for the purchase of T2 Products (Mini Jumbo Toilet Roll Dispenser)

Cast a wide net for the other products given that targeting does not appear to provide differential gain

Hypothesis 2

Findings:

- Partial dependence of Locations does reveal heterogeneity for selected dispenser in different areas
- Some dispensers are only distributed in one area and hence does not have significant values in place

Special Features of Graph

- T2 is strong in UK while H5 is strong in SG. B1, T6 and S4 seems more location neutral but also have heterogeneity

Inferences:

- While some dispenser are location agnostic and performs evenly in all locations, such locations appears to have found stronger product market in selected market
- **Simply having the current scheme of customer acquisition may not be optimal in capturing this heterogeneity**

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Hypothesis 3

Overall Base Level Demand (Marginal Demands Over All Contribution)							
B1 demand	*H1 demand*	*H2 demand*	*H5 demand*	*S4 demand*	*T2 demand*	*T6 demand*	*T7 demand*
0.478128	**0.199626**	**0.066147**	**0.208031**	**0.066518**	**0.284096**	**0.176260**	**0.329482**

Germany (de)

Optimal placements | [demand]	Current best placement | [demand]
B1, T2 | [0.327619]	T6 | [0.111104]

Switzerland (ch)

Optimal placement | [demand]	Current best placement | [demand]
B1,T2: 0.3626	H2,H4,T7: 0.143447

Denmark (dk)

Optimal placements | [demand]	Current best placement | [demand]
T2, B1 | 0.365795	T6: 0.223097

Netherlands (nl)

Optimal placements | [demand]	Current best placement | [demand]
T2, B1 | 0.335233	H2,, T2: 0.173579

Norway (no)

Optimal placements | [demand]	Current best placement | [demand]
H2, B1: 0.352829	T6: 0.114009

Sweden (se)

Optimal placements | [demand]	Current best placement | [demand]
T2 | 0.53709	H2, S4, T2: 0.173579

UK (uk)

Optimal placements | [demand]	Current best placement | [demand]
B1, H2, T2 0.421667	B1, H2, T2 0.421667

Singapore (sg)

Optimal placements | [demand]	Current best placement | [demand]
B1,T2 | 0.3626	H5, S4, T9 0.149063

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Product Optimization

Recommendation

The optimal product mix should be capitalized maximally especially since it is robust to seasonal spikes that changes people counter

According to the model , the optimal combination would improve the utilization rate of the most used combination by ~2 times

Hypothesis 3

Findings:

- The optimal combination we have attached earlier is in fact largely invariant to changing demand. That is the most optimal product mix appears to be rather robust in various locations
- With the exception of UK, the top combination recommended for each nation, actually has a zero/close to zero utilization rate in the nation

Inferences:

- There is huge upside to potentially bringing the most optimized offering as it is currently not being used at all.
- There does exist some clear product compliments and substitutes, but overall such effect seems inferior to the base level demand

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04 Conclusions

1. Customer Acquisition Findings

H1: Partial dependence **increases relatively linearly** across all dispenser products, however plateaus change at smaller rate in monotonic fashion for B1, T2, T6, T7, H5.

Partial dependence **increases linearly throughout for H2 H4**

H2: Partial dependence of Locations reveal **heterogeneity** for selected dispenser in different areas

2. Product Optimization Findings

H3: The optimal combination we have attached earlier is in fact largely invariant to changing demand. That is the most optimal product mix appears to be rather robust to seasonal changes.

With the exception of UK, the top combination recommended for each nation, actually has a zero/close to zero utilization rate in the nation

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1. Customer Acquisition Recommendations

Increase Specific Dispenser Types in Target Areas:

Target Singapore specifically for the purchase of H5 products (Continuous Hand Towel) and target UK for the purchase of T2 Products (Mini Jumbo Toilet Roll Dispenser)

To increase customer/user engagement, we must move beyond simply just proximity and sheer volume and target customer behavior. Customer behavior varies with the:

- *Model/Type of Dispenser*
- *Combinations of Several Dispensers*
- *Country where dispenser is used*

2. Product Optimization Recommendations

The optimal product mix should be capitalized maximally especially since it is robust to seasonal spikes that changes people counter

According to the model, the optimal combination would improve the utilization rate of the most used combination by ~2 times

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Questions?

Thank you!