

# Store clustering/segmentation analysis

## Boating and fishing supplies retailer

- Created store clusters to identify stores with similar purchase behavior using clustering algorithms and streamlined assortment process
- Built optimized SKU assortments by sub-departments customized for store clusters and physical store sizes, with an Excel tool to enable merchants finalize the assortments

# Boating and fishing supplies retailer needs store segmentation and SKU variety

## Picture this...

You're looking for store-level SKU assortment strategy as currently the assortment is defined by each store manager based on preference/experience, resulting in a time and resource intensive process. This is further leading to delayed internal approvals and line reviews with vendors impacting store performance.

## You turn to Accordion.

We partner with your team to streamline the SKU assortment strategy by defining stores clusters at a sub-department level based on historical customer purchase patterns, creating differentiated SKU assortments for each cluster, including:

- 1) Identifying store clusters for each sub-department which have similar purchase characteristics (store characteristics, customer type, products purchased etc.) based on a K-means clustering algorithm and identified optimal number of clusters using distortion and silhouette scores
- 2) Recommending SKU assortments for each cluster at a sub-department level which was customized by store size (small, medium and large), and analyzing the impact of the recommendations on the financial performance
- 3) Operationalizing the assortment strategy by creating an automated Excel based tool for merchants to finalize SKU assortments leveraging the recommendations by sub-departments and clusters, with visibility into financial impact of assortment changes
- 4) Identifying the control stores and setting-up an automated reporting suite to track the financial and operational performance of new assortments

## Your value is enhanced.

- You have streamlined SKU assortment creation process for merchants by enabling assortment definition at cluster level as opposed to store level. By creating optimized assortments for ~140 sub-departments covering ~30k active SKUs which would lead to overall potential increase of margin by ~15%
- You have enabled merchandizing team to drive data-driven & faster SKU assortment decisions which can be customized at a cluster level and anticipate the revenue impact of these changes resulting in timely line review with vendors

## KEY RESULT

- ~15% potential margin gain
- Optimized assortments for ~30k active SKUs

## VALUE LEVERS PULLED

- Category Management
- Clustering Analysis
- K-means clustering algorithm

# Store segmentation and differentiated SKU assortments by store cluster

## Situation

- Client had a store-level SKU assortment strategy where the assortment was defined by each store manager based on preference/experience, resulting in a time and resource intensive process. Leading to delayed internal approvals and line reviews with vendors impacting store performance
- Partnered with the client to streamline the SKU assortment strategy by defining stores clusters at a sub-department level based on historical customer purchase patterns, creating differentiated SKU assortments for each cluster

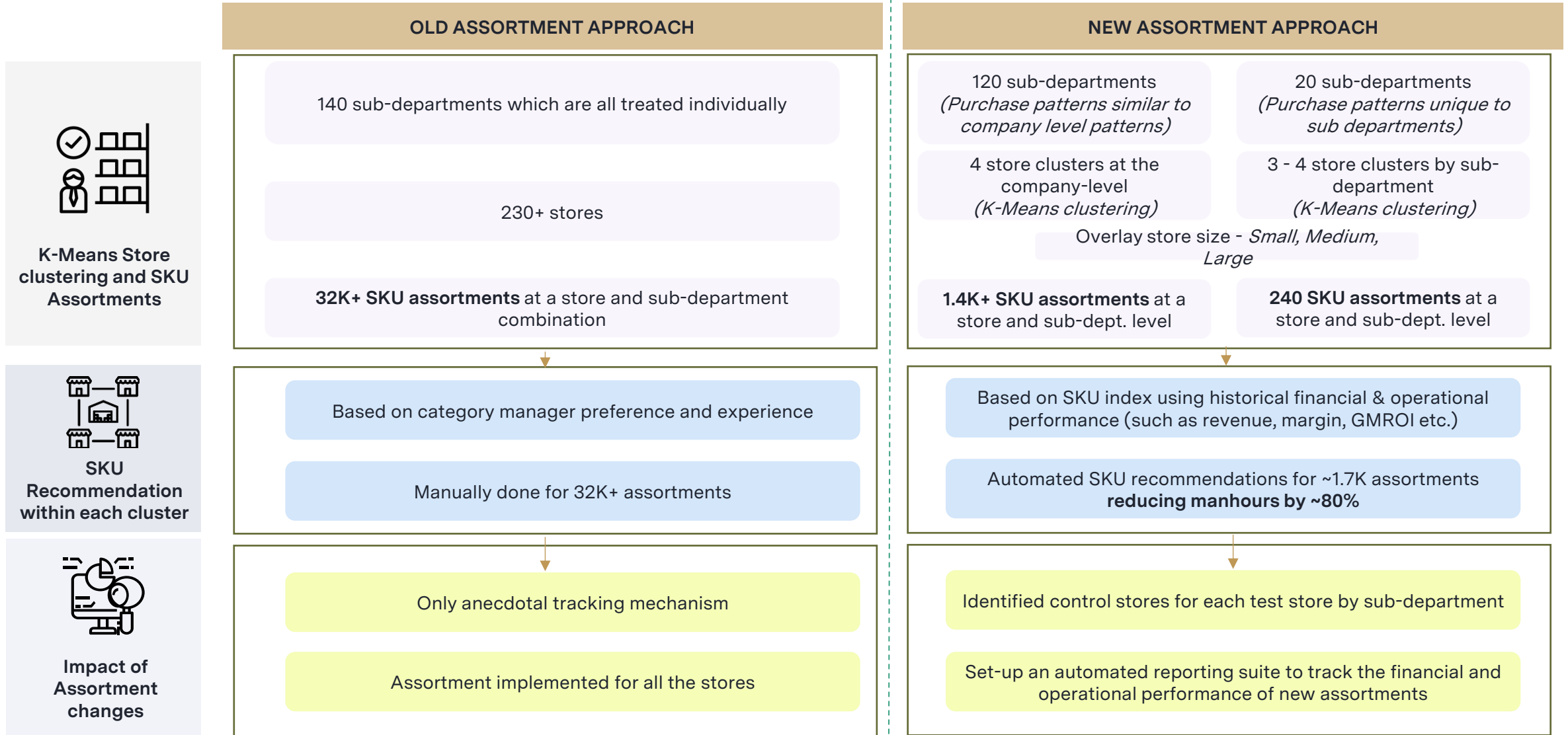
## Accordion Value Add

- Identified store clusters for each sub-department which have similar purchase characteristics based on a K-means clustering algorithm and identified optimal number of clusters using distortion and silhouette scores
- Analyzed each cluster within a sub-department to identify attributes defining the cluster based on store characteristics, customer type, products purchased etc.
- Recommended SKU assortments for each cluster at a sub-department level which was customized by store size (small, medium and large), and analyzed the impact of the recommendations on the financial performance
- Operationalized the assortment strategy by creating an automated Excel based tool for merchants to finalize SKU assortments leveraging the recommendations by sub-departments and clusters, with visibility into financial impact of assortment changes.
- Identified the control stores and set-up an automated reporting suite to track the financial and operational performance of new assortments

## Impact

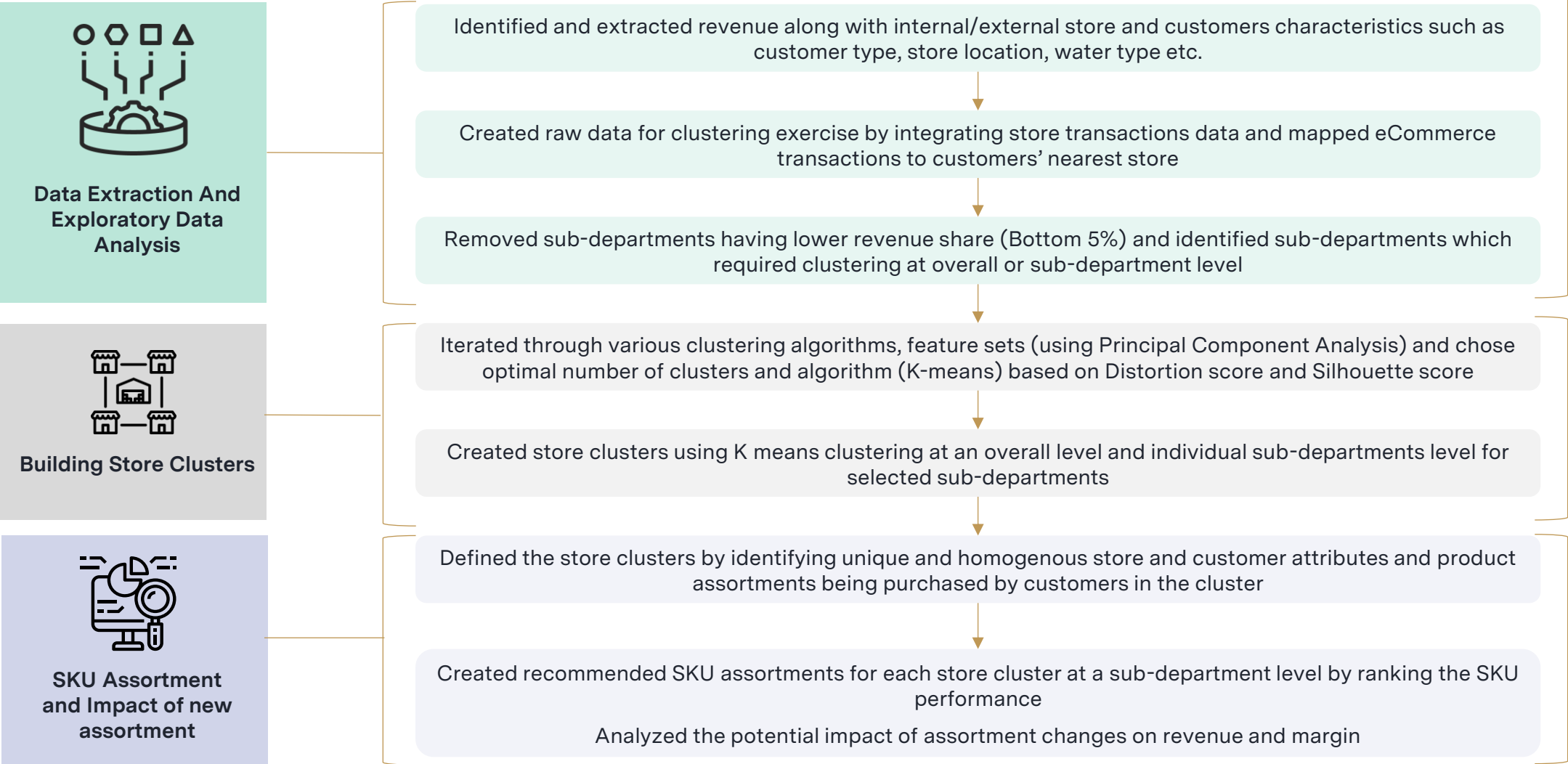
- Streamlined SKU assortment creation process for merchants by enabling assortment definition at cluster level as opposed to store level
- Created optimized assortments for ~140 sub-departments covering ~30k active SKUs which would lead to overall potential increase of margin by ~15%
- Enabled merchandizing team to drive data-driven & faster SKU assortment decisions which can be customized at a cluster level and anticipate the revenue impact of these changes resulting in timely line review with vendors

# Approach & methodology



# Detailed modeling approach

## MODEL APPROACH

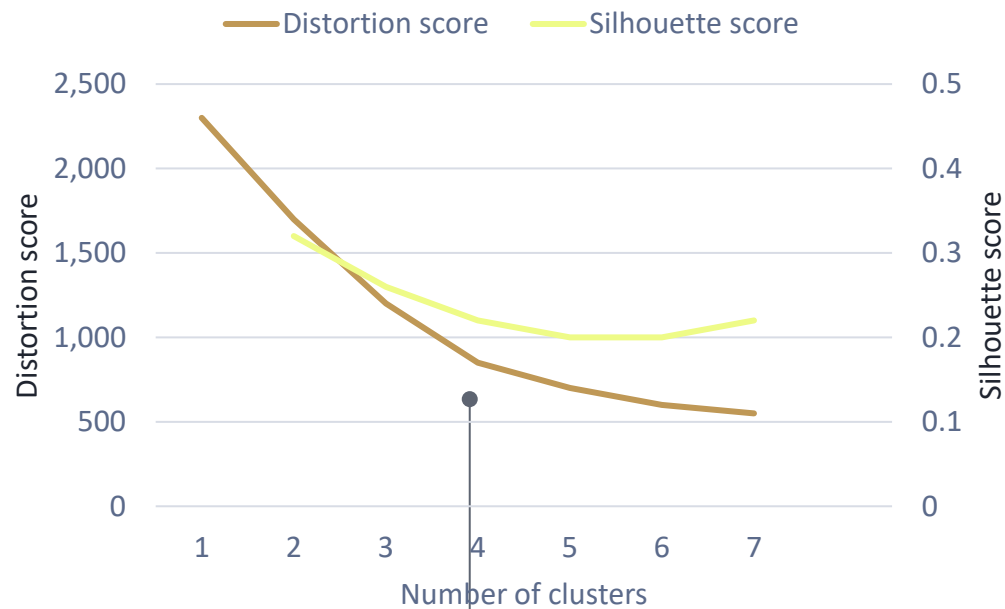


# Selecting number of clusters for a particular sub-department

**Distortion score:** Used to measure fit of the clusters by identifying how well data points within a cluster are grouped together. A lower distortion score indicates tightly packed data points.

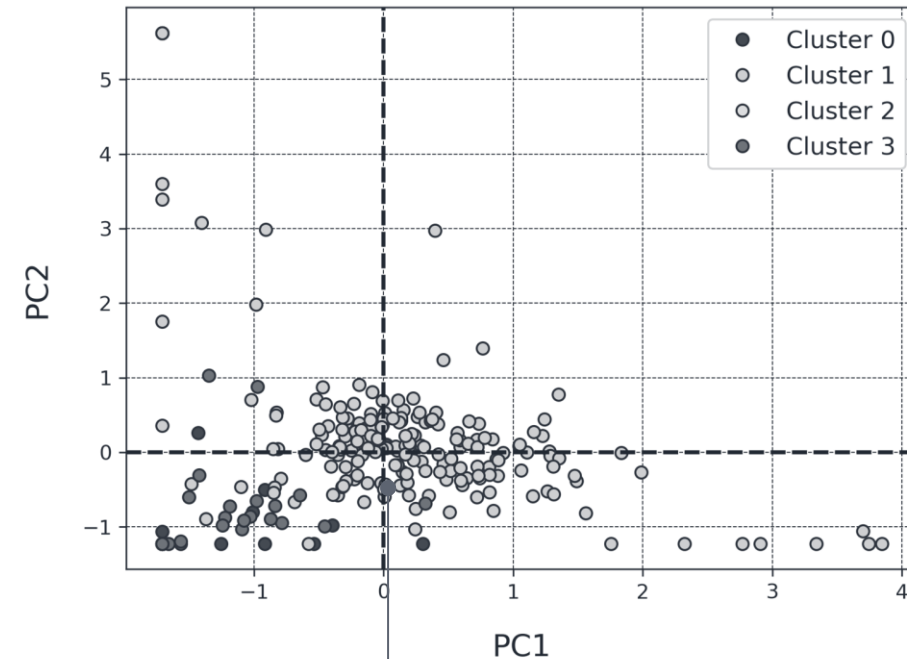
**Silhouette score:** Used to measure how clusters are separated from each other. A higher silhouette score indicates clusters are well separated.

Silhouette and Distortion scores vs Number of clusters



Number of clusters are selected based on Silhouette and Distortion score using elbow plot

Distribution of Stores as data points across PC1 and PC2



Data points within clusters are packed well and close to each other (Distortion score)

# Cluster definition using attributes and assortments

**Attribute Definition:** Defined each store cluster using unique and dominant customer and store attributes for that cluster

**Assortment Definition:** Defined each store cluster using the dominant products/product categories being purchased in that cluster

Cluster 1 can be defined as stores with Value 2 (Attribute 1) and Value A (Attribute 2)

# of Stores	Cluster Metrics		Attribute 1		Attribute 2		
Cluster	#Stores	% Stores	Value 1	Value 2	Value A	Value B	Value C
Cluster 1	20	13%	2	18	19	1	0
Cluster 2	60	40%	50	10	5	52	3
Cluster 3	40	27%	5	35	2	5	33
Cluster 4	30	20%	68	7	6	7	62
Total	150	100%	112	126	86	81	71

Cluster 1 is dominated by products from Classes 1 and 5.

Classes	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Grand Total
Assortments	Class 1 + Class 5	Class 3 + Class 6	Class 2 + Class 5	General Assortment	
Class 1	55%	5%	6%	22%	73%
Class 2	7%	8%	60%	10%	14%
Class 3	1%	40%	2%	22%	1%
Class 4	3%	4%	3%	16%	4%
Class 5	25%	3%	26%	16%	2%
Class 6	8%	40%	3%	14%	6%
Grand Total	100%	100%	100%	100%	100%

# Geographical visualization of store clusters

Clusters Names ● 1 - Mid Atlantic ● 2 - Florida ● 3 - Inland ● 4 - West Coast



Geographical distribution  
of store clusters across  
Mainland US

Stores within a region being clustered in the same  
segment/group as geography is a key driver



# SKU recommendations for each cluster for a particular sub department

**SKU Recommendation:** Built SKU Recommendations by sub-department customized for store cluster and store sizes, using their TTM financial performance and analyzed potential financial impact of recommendations

Recommended action for each SKU, customized for store cluster and store sizes

Financial impact of recommended action

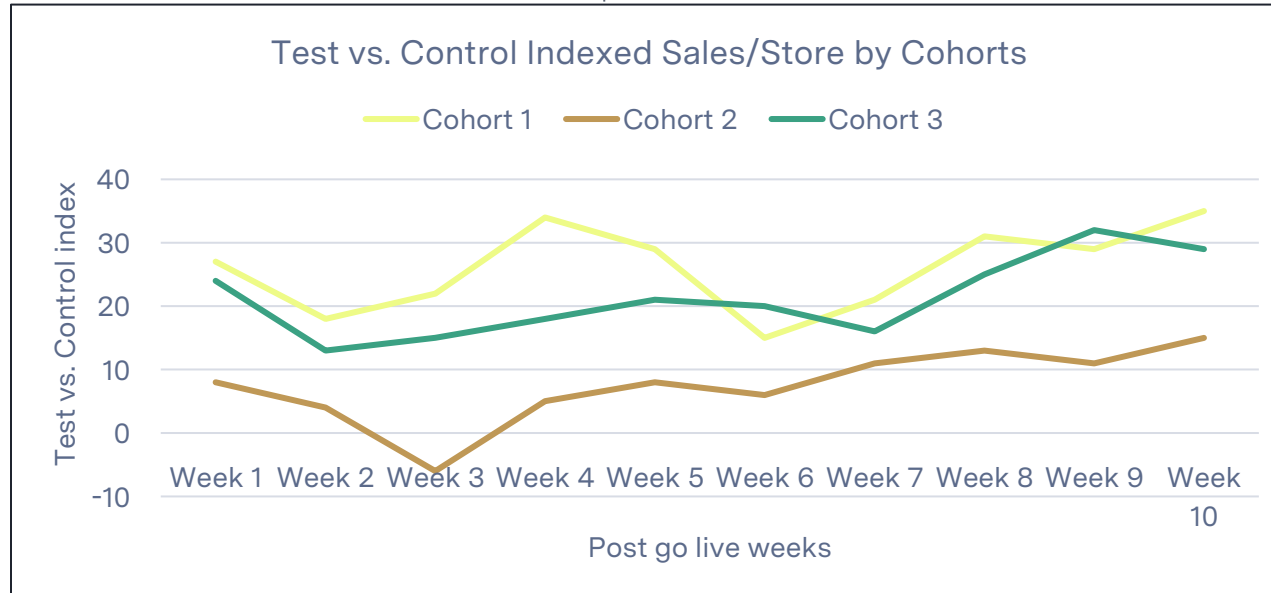
SKU Data			Cluster Recommendations			TTM Financial Performance							Assortment Impact		
SKU	SKU Descriptions	SKU Setup Date	Small Stores	Medium Stores	Large Stores	SKU Index	Sales/Store (\$)	Margin/Store (\$)	Units/Store (\$)	Customer Penetration	Transaction Penetration	GMROI	Margin impact	Sales impact	Units impact
SKU 1	Product #1	Date 1	X	✓	✓	0.25	\$7,081	\$2,832	3.75	0%	0%	4.29	\$425	\$1,062	100
SKU 2	Product #2	Date 2	X	X	X	0.04	\$5,360	\$2,144	1.25	0%	0%	0.22	\$0	\$0	0
SKU 3	Product #3	Date 3	X	X	X	0.05	\$7,587	\$3,035	5.50	0%	0%	0.19	\$0	\$0	0
SKU 4	Product #4	Date 4	X	✓	✓	0.22	\$6,833	\$2,733	14.08	1%	0%	1.57	\$410	\$1,025	200
SKU 5	Product #5	Date 5	X	✓	✓	0.20	\$6,540	\$2,616	13.48	0%	0%	1.42	\$392	\$981	250
SKU 6	Product #6	Date 6	X	X	X	0.04	\$3,220	\$1,288	1.33	0%	0%	0.42	\$0	\$0	0
SKU 7	Product #7	Date 7	?	?	?	0.15	\$1,671	\$668	5.50	0%	0%	8.99	\$0	\$0	0
SKU 8	Product #8	Date 8	✓	✓	✓	0.50	\$7,893	\$3,157	448.33	2%	1%	3.67	\$474	\$1,184	300
SKU 9	Product #9	Date 9	X	X	X	0.01	\$9,701	\$3,880	34.56	0%	0%	9.61	\$0	\$0	0

# Impact of assortment changes

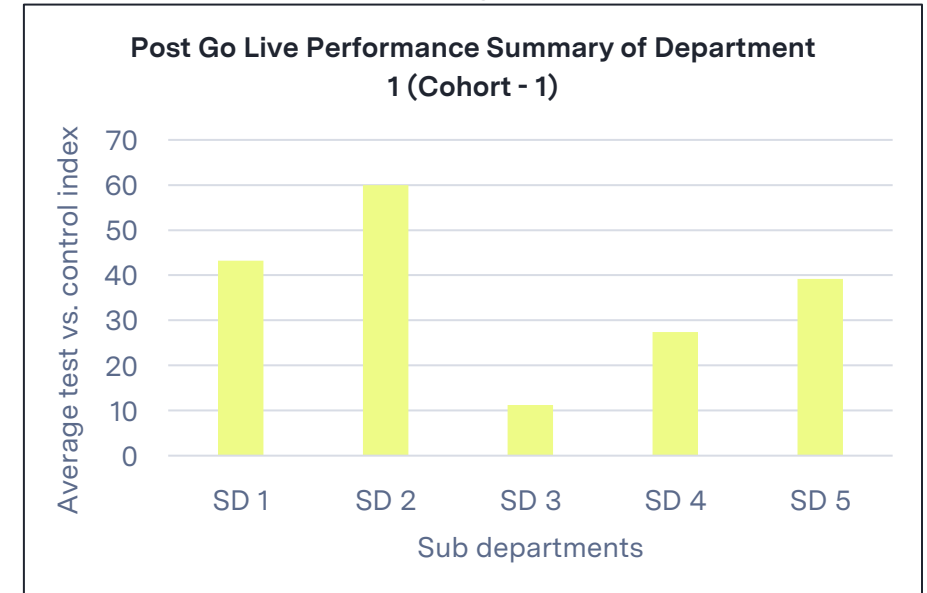
**Test Control Stores Analysis:** Built refreshable weekly reports to track financial performance of assortment changes in test stores vis a vis control stores segmented by go-live cohorts

**Test vs Control Index:** Difference of index score at test and control stores where index score is defined as ratio of 'Current week sales' and 'Go-live week sales'

Financial Performance of test stores vis a vis control stores



Cohort performance post implementation of assortment



# Learnings

- 1) Expanded the knowledge in clustering algorithms and identifying the correct algorithms and feature sets to derive meaningful results.
- 2) Created the definition of each store clusters with the store and customer attributes to define each store cluster.
- 3) Identified the dominant set of product categories (classes) & brands being purchased in each store cluster at a sub-department level.
- 4) Recommended SKU assortments for each store cluster based on their performance