

The background of the entire page is a repeating pattern of various retail-related icons in a light gray color. These icons include shopping bags, shopping carts, gift boxes, price tags, storefronts, hangers, magnifying glasses, and percentage symbols.

# RETAIL ORDER DATA

A Report on Insights

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**BDVA 07 , Group 3 - S.P. Jain School of Global Management**

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# Retail Order Data: A Report on Insights

## 1 BACKGROUND

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AIKIA, based out of California, USA is large retailer with Sales and Operations spread across the Globe. For efficiency of operations, it has divided its 5 Markets across 6 continents, which are further divided into Regions. The Regions comprise of Countries.

Similarly, the products are grouped in 3 Categories. The 3 Categories are Furniture, Technology and Office Supplies. Each of the 3 Categories are further classified into Sub-Categories.

On the Customer Side, customers are grouped into Segments such as Consumer, Corporate and Home Office. To efficiently serve these customers, the Supply Chain Operations are conducted through Warehouses (identified through “Order ID Prefixes”) across various countries.

## 2 OBJECTIVE

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Considering a diverse product mix and diverse markets being served, there is an acceptance of certain products in certain markets. To optimize the Profit and Sales, AIKIA has reached out to the Consulting Team from “SPJ BDVA07 Group 3” to help them with:

- Identifying which Products to sell
- Identifying Markets to sell
- With Focus on Growth, Forecast Sales and Profits
- Findings and Recommendations for Lowest Performing Category in USA

## 3 EXECUTIVE SUMMARY

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- This Report focusses on Findings and Insights using “Profit” and it’s derived measures as KPI’s.
- The Findings and Recommendations covered in this report include for:
  - Sub-Categories to Focus
  - Geographies to Focus
  - Profit Forecast
  - Focus on Sub-Category “Table” in USA
- This report is annexed with Predictive Models to predict:
  - Time-wise Profit Behavior (Hidden Markov Model)
  - “Profit” or “Loss” for new incoming orders (Naïve- Bayes & Logistic Regression Models)

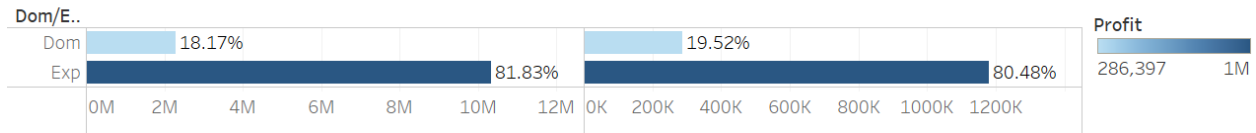
## 4 PROFIT SCENARIO

### 4.1 AN OVERVIEW

AIKIA Operations can be broadly categorized into Domestic (within USA) and Exports (outside USA). The chart below summarizes the profit and sales proportion:

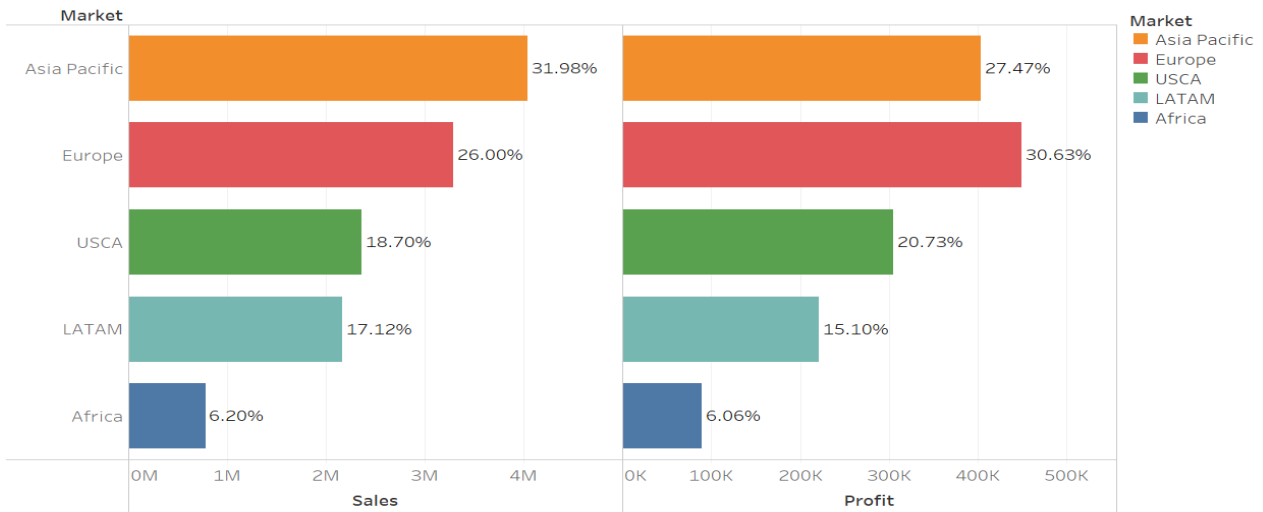
#### 4.1.1 Market-wise Sales and Profit

Market-wise Sales and Profit



S. No.	Findings	Action
1	More than 80 % Sales and Profits are attributed to Exports	

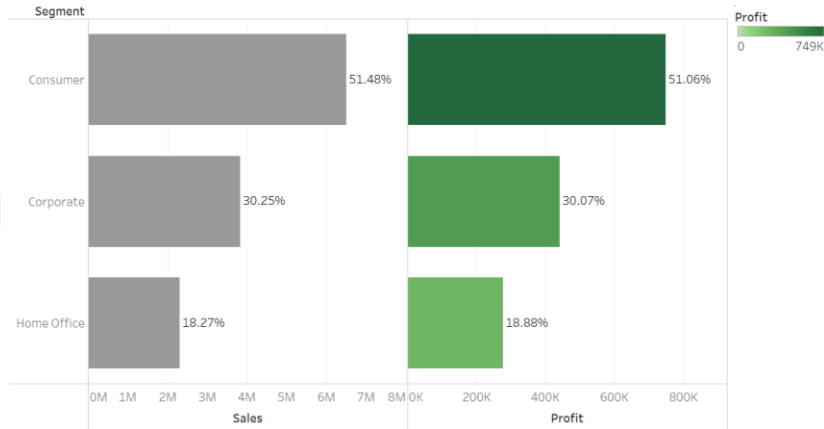
Market-wise Sales and Profit



S. No.	Findings	Action
2	Highest Contributor to Sales: APAC Market	
3	Highest Contributor to Profit : Europe Market	

#### 4.1.2 Segment-wise Sales and Profit

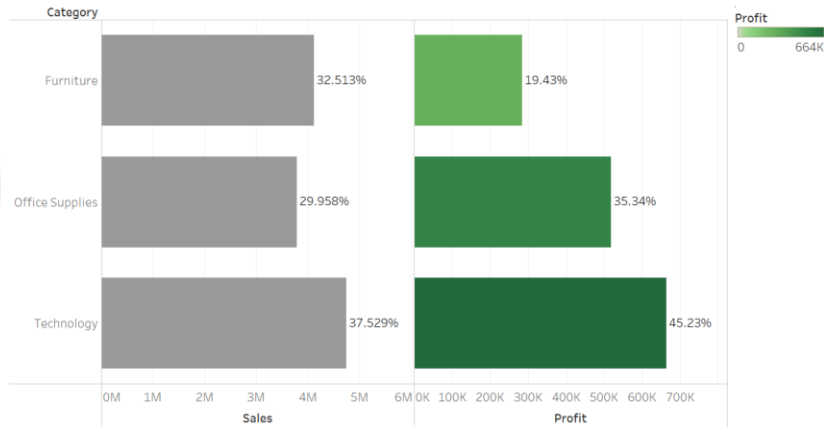
Segment-wise Sales and Profit



S. No.	Findings	Action
4	Consumer Segment is the highest contributor to both Sales and Profit	

#### 4.1.3 Category-wise Sales and Profit

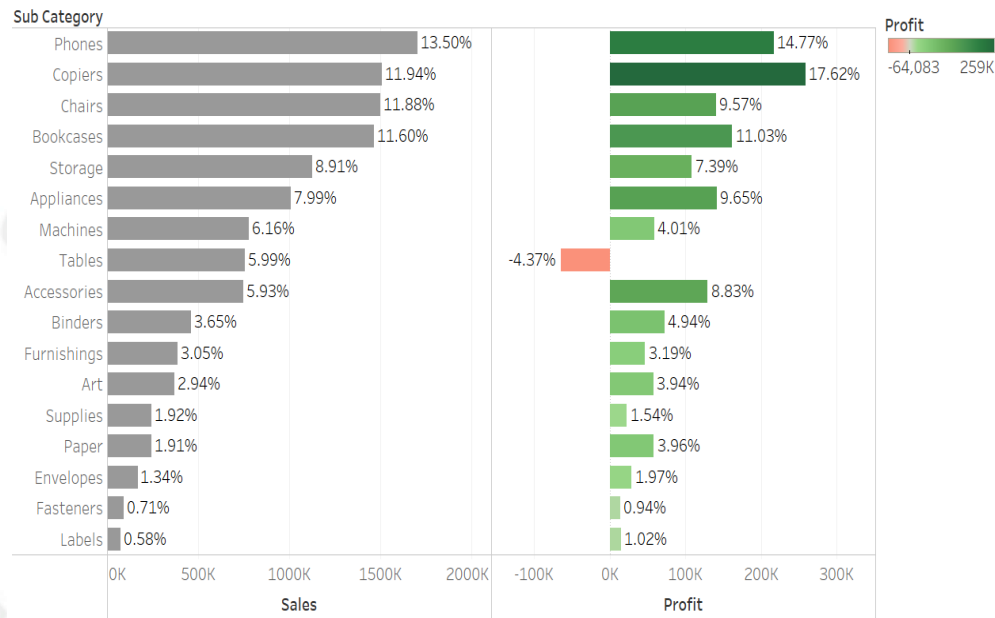
Category-wise Sales and Profit



S. No.	Findings	Action
5	Technology and Sales contribute to 80% Profit	
6	Furnitures Division is 2 <sup>nd</sup> Highest in Sales but has the lowest contribution to Profit	

#### 4.1.4 Sub Category-wise Sales and Profit

##### Sub Category-wise Sales and Profit



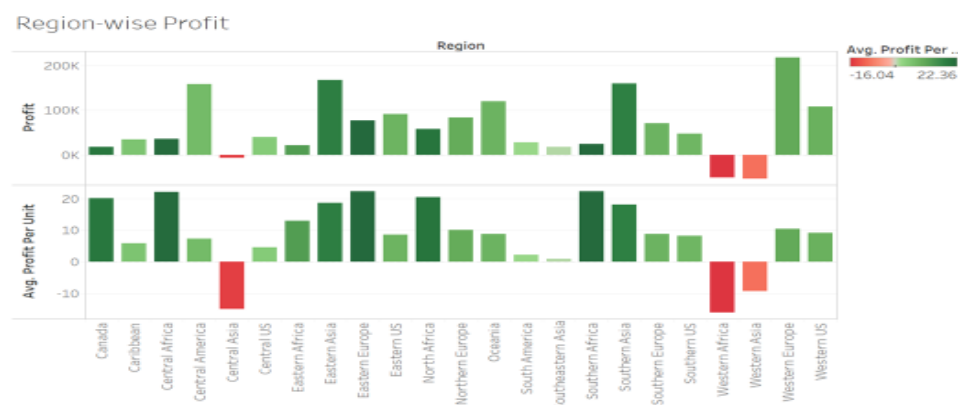
S. No.	Findings	Action
7	Tables are generating losses for AIKIA	

## 4.2 PROFIT BY GEOGRAPHICAL DIMENSIONS

Let us now, look at the Profit Scenario by Geography:

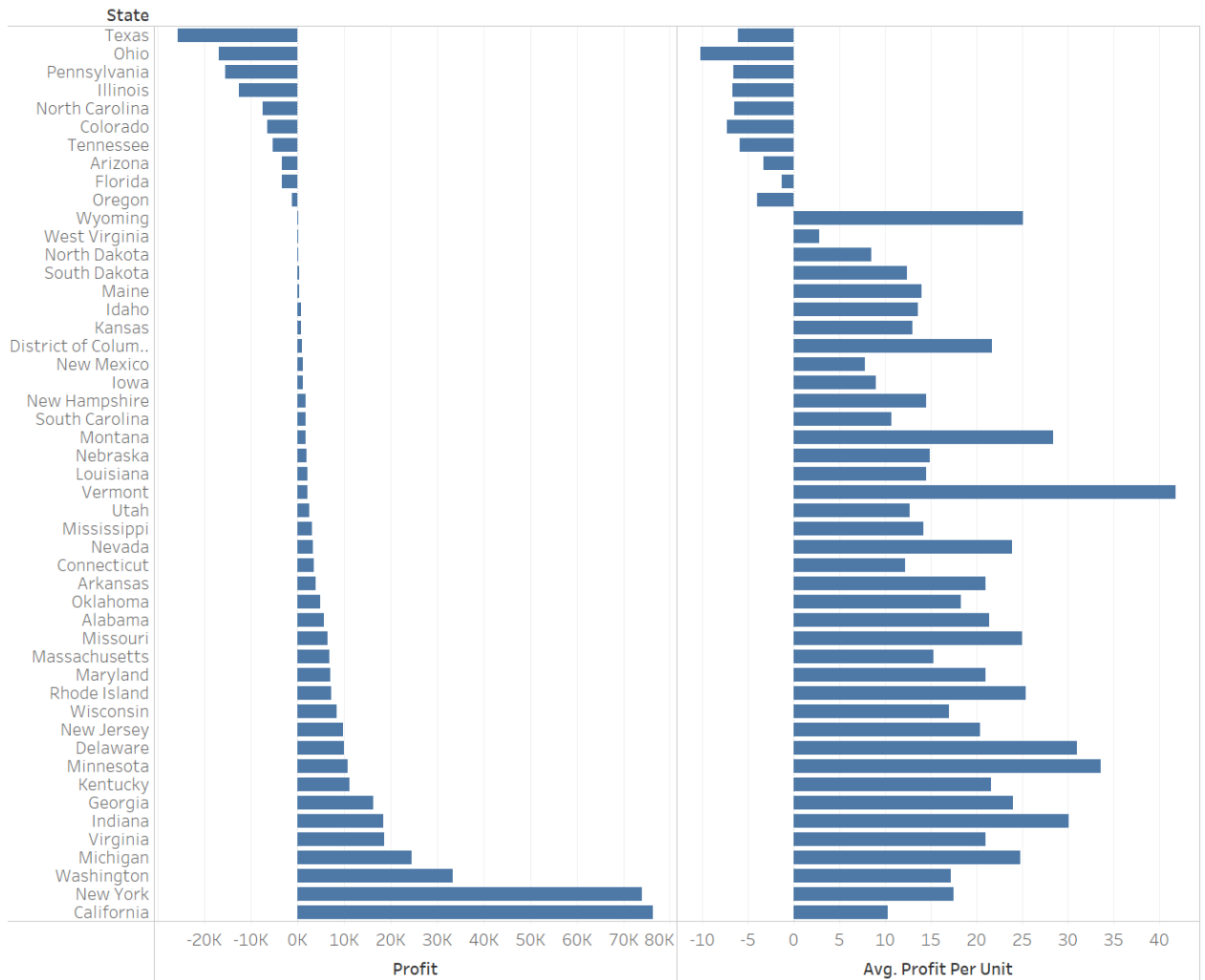
### 4.2.1 Region-wise Profit

## An Overview into Profit Scenario



S. No.	Findings	Action
8	Western Africa, Central Asia and Western Asia are contributing to losses	

#### 4.2.2 State-wise Profit:



S. No.	Findings	Action
9	Domestic Market : Loss Making States Texas, Ohio, Pennsylvania, Illinois, North Carolina, Colorado, Tennessee, Arizona, Florida, Oregon	

4.2.3 Loss-Making Countries

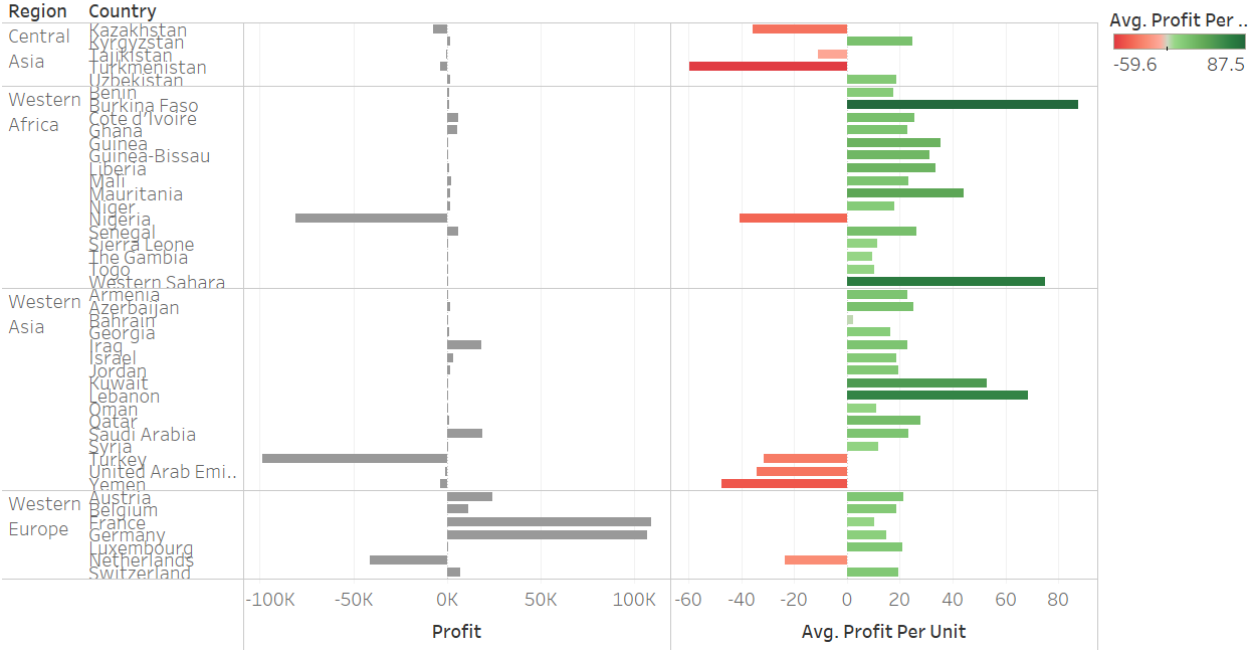
Loss-Making Countries : Geo Spatial View



S. No.	Findings	Action
10	EXPORTS: Countries with Highest Discounts are Loss Making	

4.2.4 Exports: Region-wise Country-wise Profits

Exports : Region-wise Country-wise Profits for Technology





S. No.	Findings	Action
11	EXPORTS: Kazakhstan, Turkmenistan, Turkey, UAE, Yemen, Nigeria and Netherlands are contributing to Losses	

### 4.3 PROFIT BY PRODUCT DIMENSIONS

Below sections represent charts across various dimensions of Product Hierarchy

#### 4.3.1 Domestic: Category-wise Sub Category-wise Profits

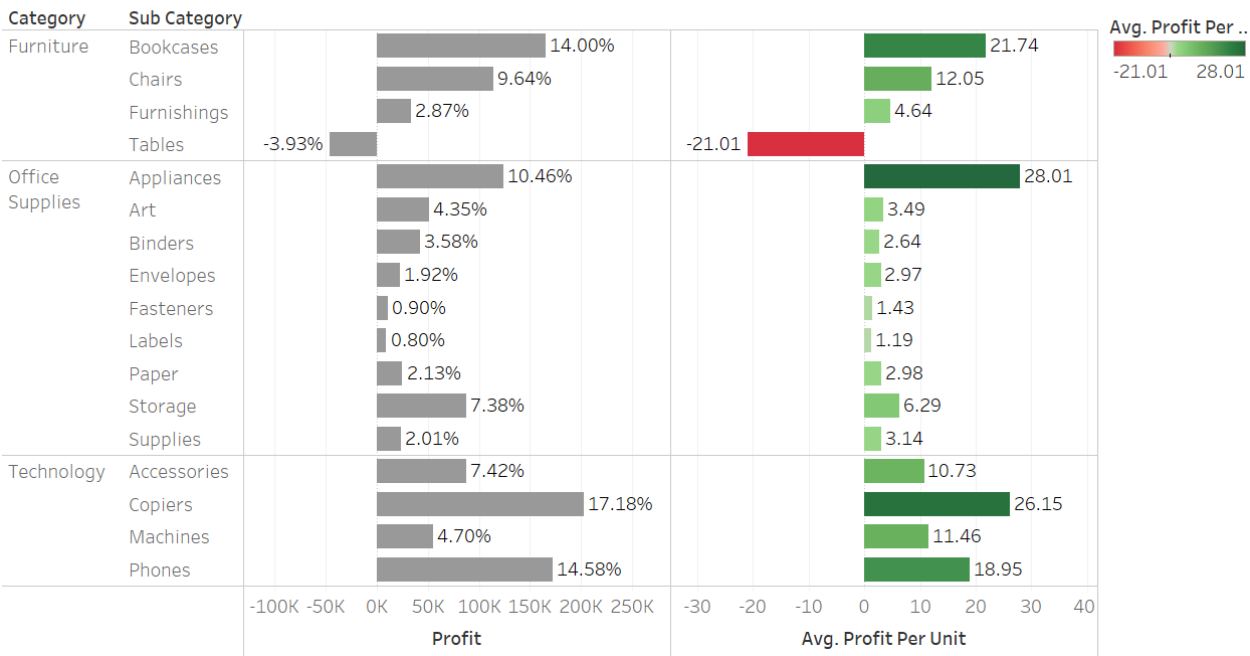
## An Overview into Profit Scenario



S. No.	Findings	Action
12	Domestic: Furniture is maximum loss-making categories (Tables and Bookcases)	
	Tables is generating highest losses in US Market	

4.3.2 Exports: Category-wise Sub Category-wise Profits

Export: Category-wise Sub Category-wise Profits

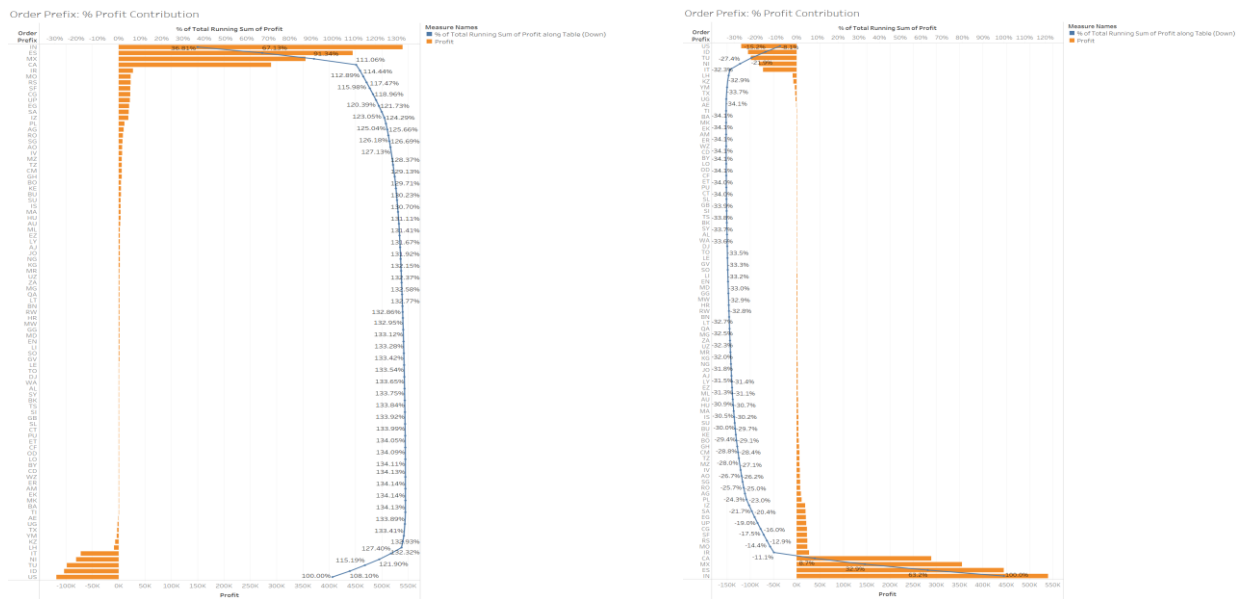


S. No.	Findings	Action
13	Tables are generating highest losses in Exports Market as well	

4.4 PROFIT BY ORDER DIMENSIONS

Let us look at the analysis of Profit by Order Dimensions

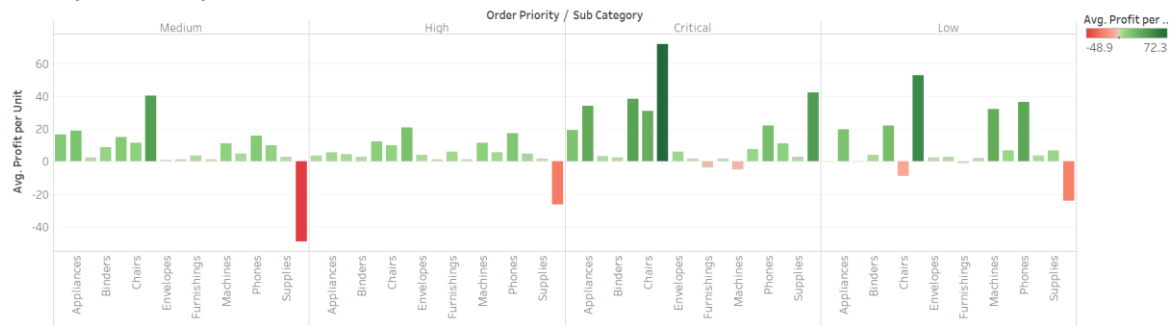
4.4.1 Shipping Points (Order Prefix): Profit Contribution



S. No.	Findings	Action
14	100% Profit is generated when shipping is from Warehouses in India, Spain, Mexico, California	
15	Shipping from Other than California (in USA), Indonesia, Turkey, Nigeria are generating losses from AIKIA	

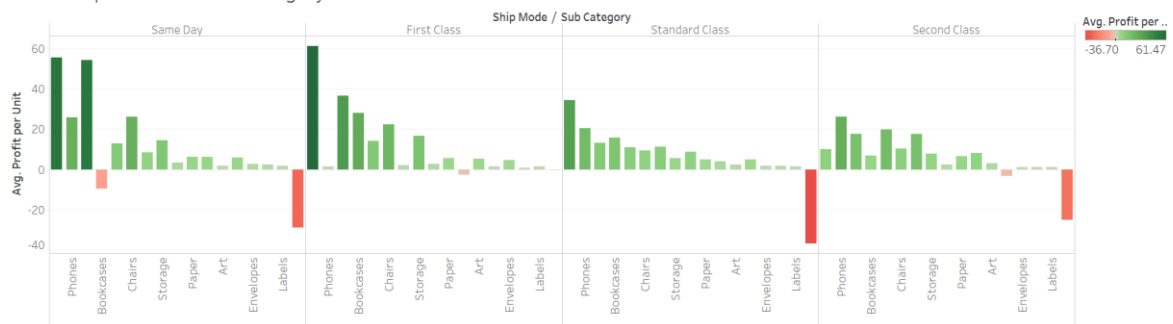
#### 4.4.2 Profit by Order Priority

Profit By Order Priority



#### 4.4.3 Profit: Ship Mode-wise Sub Category-wise

Profit: Ship Mode-wise Sub Category-wise

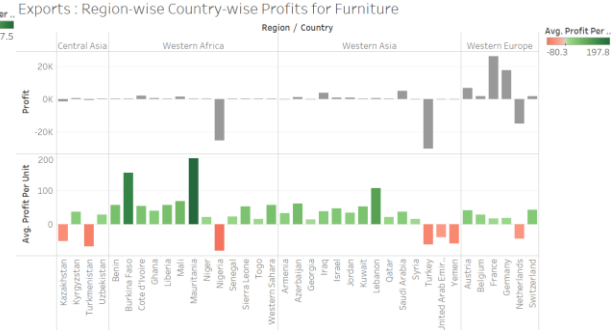
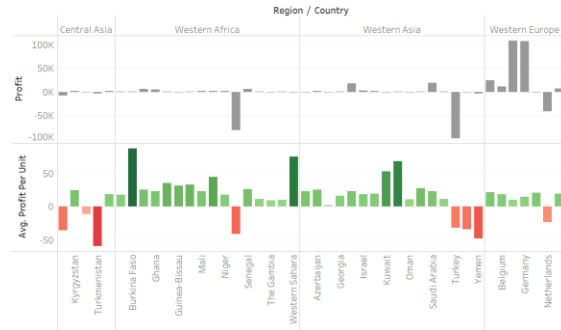


S. No.	Findings	Action
16	Sub Category "Tables" is making losses across all Order Priority, except for "Critical" Orders	
17	Sub-Category "Tables" is making losses across all Shipping Modes except "First Class"	
18	Shipment Handling for "Tables" requires special attention. Hence, Profits are seen for sub-category "Tables" send on Priority Basis through First Class Ship Modes	

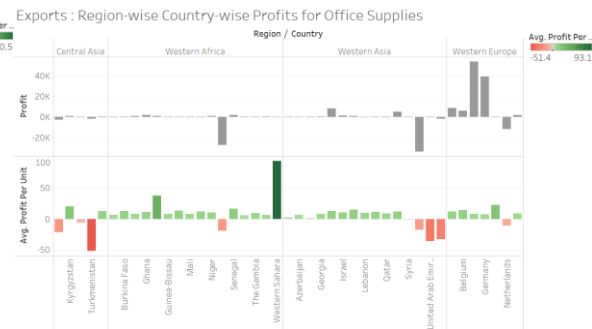
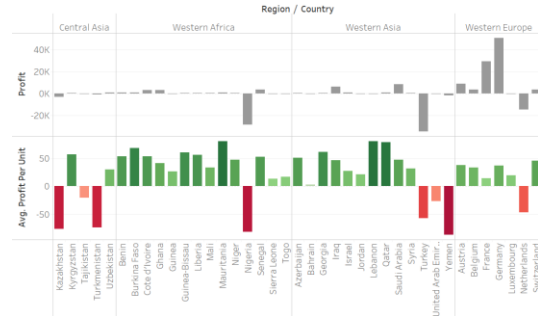
## 4.5 PROFIT MIX BY MIX OF GEOGRAPHY AND PRODUCT DIMENSIONS

### 4.5.1 Exports: Region-wise Country-wise Profits

Exports : Region-wise Country-wise Profits



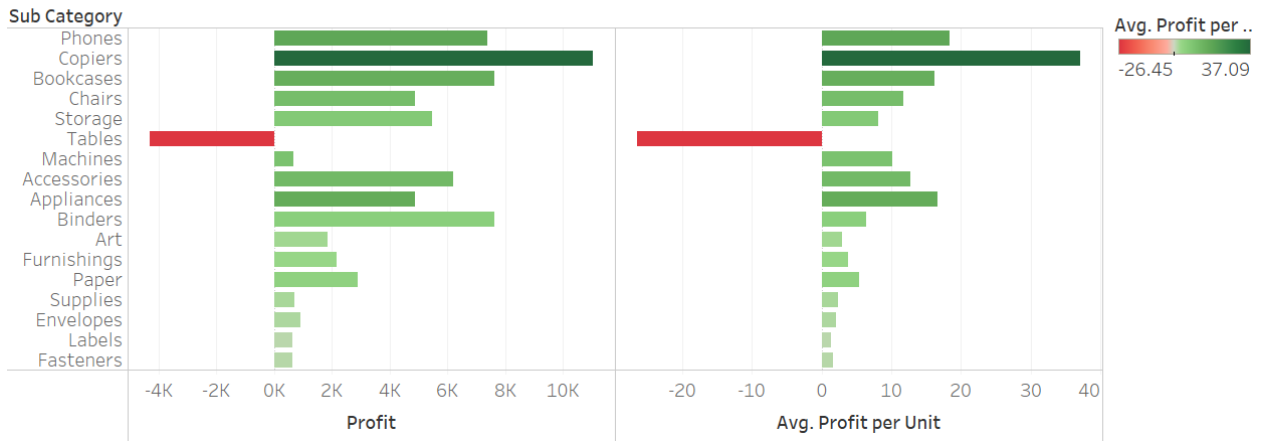
Exports : Region-wise Country-wise Profits for Technology



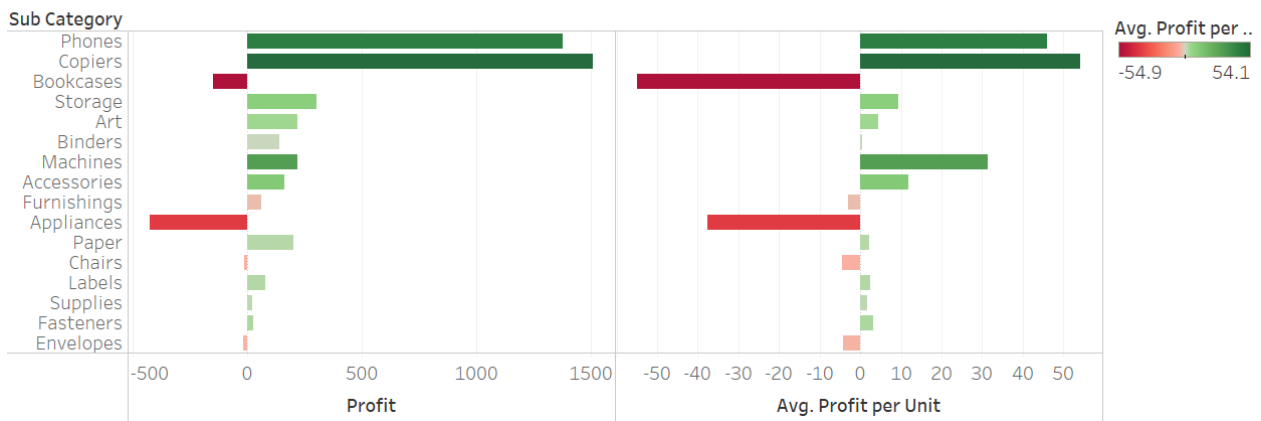
S. No.	Findings	Action
19	<p>Export Sales: Below Countries are making Losses across All Categories</p> <ul style="list-style-type: none"> <li>Central Asia: Kazakhstan, Turkmenistan, Tejkistan</li> <li>Western Africa: Nigeria</li> <li>Western Asia: UAE, Turkey, Yemen</li> <li>Europe : Netherlands</li> </ul>	

#### 4.5.2 Market-wise Sub-Category-wise Profits

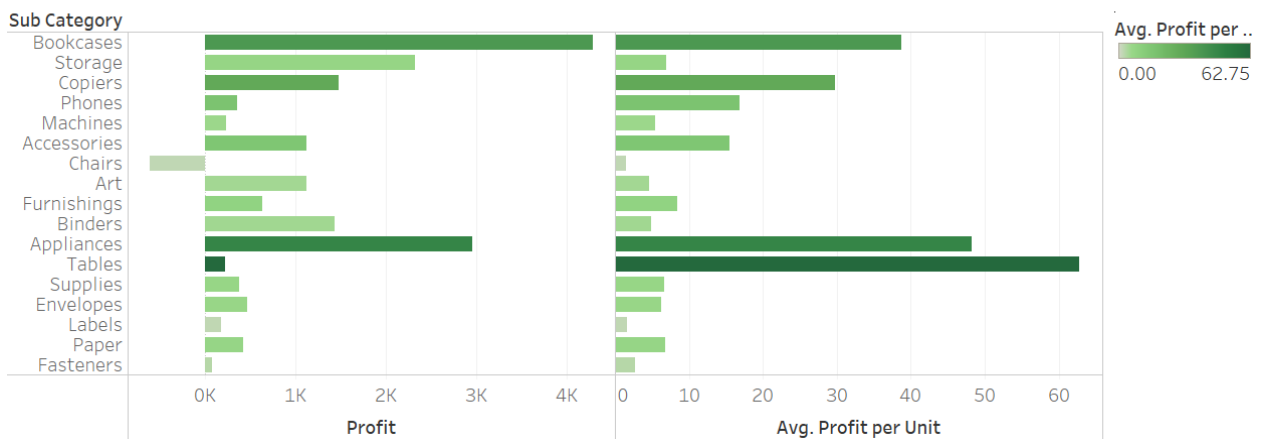
##### Market-wise Sub-Category-wise Profits: Overall



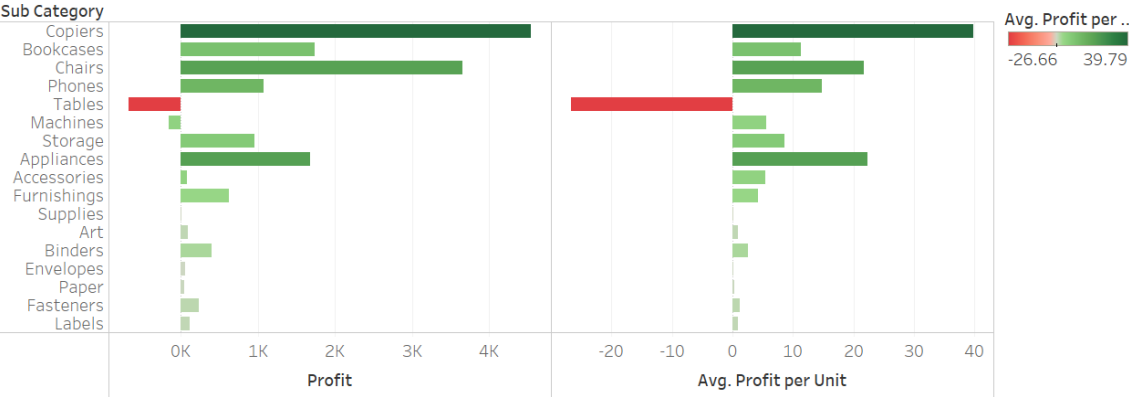
##### Market-wise Sub-Category-wise Profits: Africa



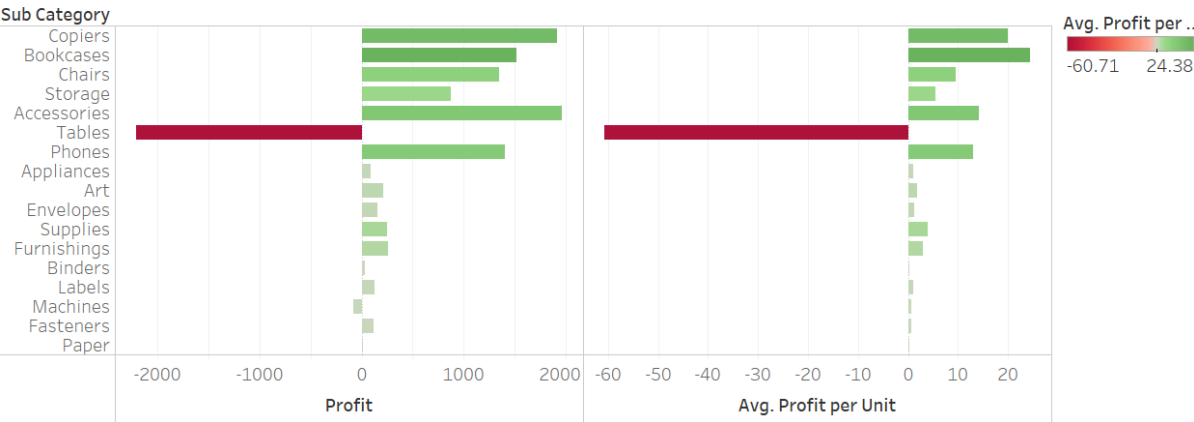
##### Market-wise Sub-Category-wise Profits: Europe



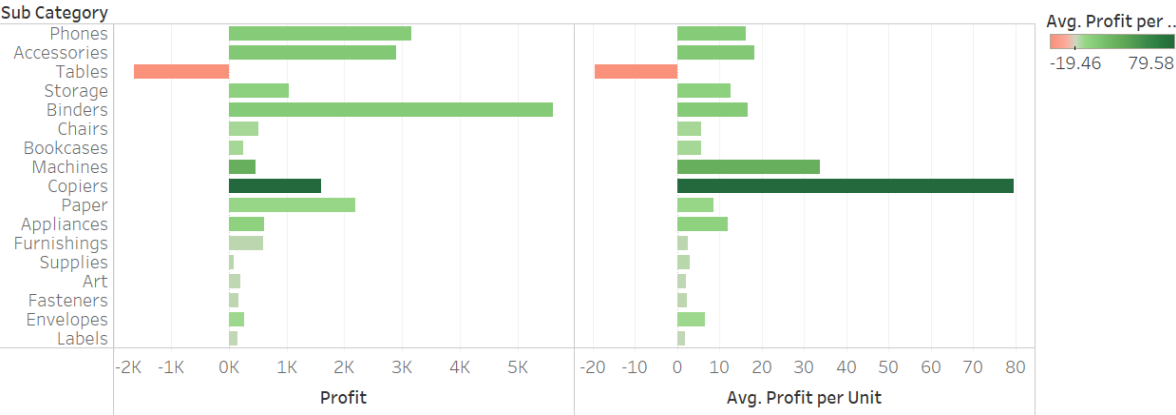
Market-wise Sub-Category-wise Profits: Asia Pacific



Market-wise Sub-Category-wise Profits: LATAM



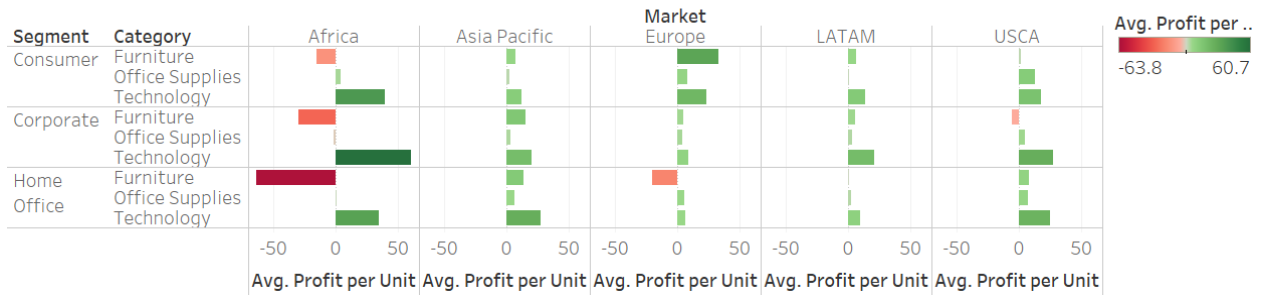
Market-wise Sub-Category-wise Profits: USCA



S. No.	Findings			Action
20	Market	Lowest Profit	Lowest Profit Per Unit	
	Overall	Tables	Tables	
	Africa	Appliances	Bookcases	
	APAC	Tables	Tables	
	Europe	Chairs	None	
	LATAM	Tables	Tables	
	USCA	Tables	Tables	

### 4.5.3 Segment-wise Market-wise Profit

#### Segment-wise Market-wise Profit



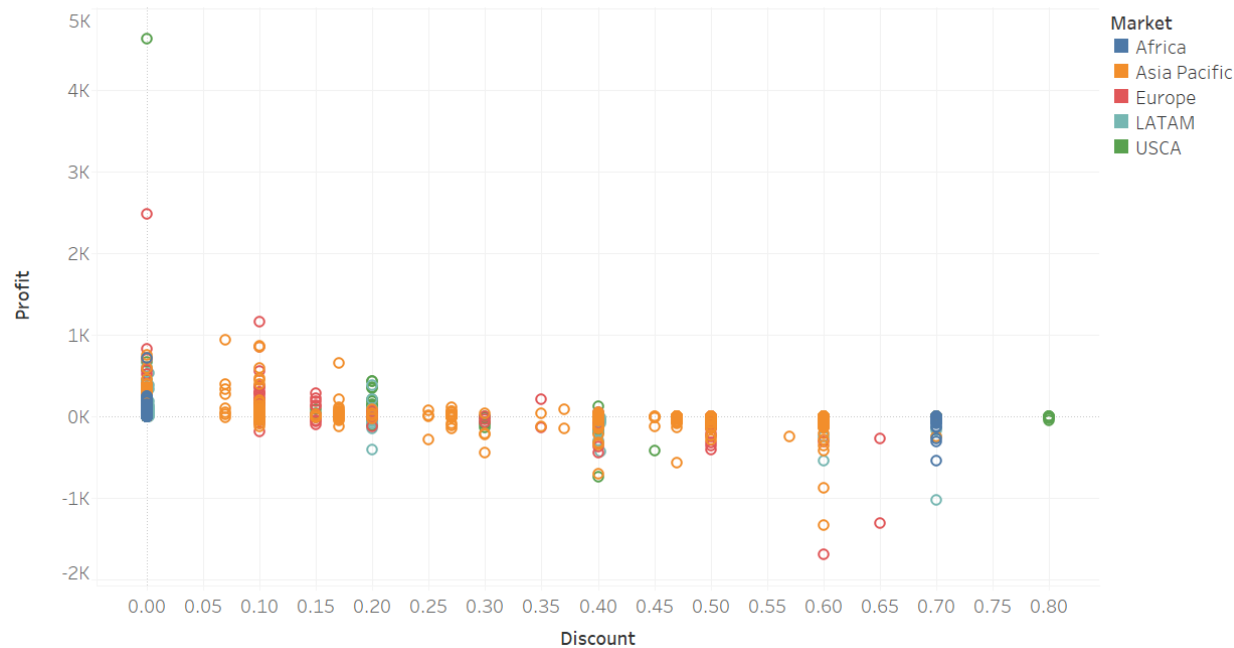
S. No.	Findings	Action																		
21	<p>Segment: Consumer</p> <table> <tr> <th>Market</th><th>Sell</th><th>Don't Sell</th></tr> <tr> <td>Africa</td><td>Technology</td><td>Furniture</td></tr> <tr> <td>APAC</td><td>Technology</td><td>Office Supplies</td></tr> <tr> <td>Europe</td><td>Tech/ Furniture</td><td>Office Supplies</td></tr> <tr> <td>LATAM</td><td>Tech/ Furniture</td><td>Office Supplies</td></tr> <tr> <td>USCA</td><td>Tech/ Office Supp</td><td>Furniture</td></tr> </table>	Market	Sell	Don't Sell	Africa	Technology	Furniture	APAC	Technology	Office Supplies	Europe	Tech/ Furniture	Office Supplies	LATAM	Tech/ Furniture	Office Supplies	USCA	Tech/ Office Supp	Furniture	
Market	Sell	Don't Sell																		
Africa	Technology	Furniture																		
APAC	Technology	Office Supplies																		
Europe	Tech/ Furniture	Office Supplies																		
LATAM	Tech/ Furniture	Office Supplies																		
USCA	Tech/ Office Supp	Furniture																		
	<p>Segment: Corporate</p> <table> <tr> <th>Market</th><th>Sell</th><th>Don't Sell</th></tr> <tr> <td>Africa</td><td>Technology</td><td>Furniture</td></tr> <tr> <td>APAC</td><td>Technology</td><td>Office Supplies</td></tr> <tr> <td>Europe</td><td>All</td><td>None</td></tr> <tr> <td>LATAM</td><td>Tech/ Furniture</td><td>Office Supplies</td></tr> <tr> <td>USCA</td><td>Tech/ Office Supp</td><td>Furniture</td></tr> </table>	Market	Sell	Don't Sell	Africa	Technology	Furniture	APAC	Technology	Office Supplies	Europe	All	None	LATAM	Tech/ Furniture	Office Supplies	USCA	Tech/ Office Supp	Furniture	
Market	Sell	Don't Sell																		
Africa	Technology	Furniture																		
APAC	Technology	Office Supplies																		
Europe	All	None																		
LATAM	Tech/ Furniture	Office Supplies																		
USCA	Tech/ Office Supp	Furniture																		
	<p>Segment: Home Office</p> <table> <tr> <th>Market</th><th>Sell</th><th>Don't Sell</th></tr> <tr> <td>Africa</td><td>Technology</td><td>Furniture</td></tr> <tr> <td>APAC</td><td>Technology</td><td>Office Supplies</td></tr> <tr> <td>Europe</td><td>Tech/ Office Supp</td><td>Furniture</td></tr> <tr> <td>LATAM</td><td>Tech/ Office Supp</td><td>Furniture</td></tr> <tr> <td>USCA</td><td>Tech/ Furniture</td><td>Office Supplies</td></tr> </table>	Market	Sell	Don't Sell	Africa	Technology	Furniture	APAC	Technology	Office Supplies	Europe	Tech/ Office Supp	Furniture	LATAM	Tech/ Office Supp	Furniture	USCA	Tech/ Furniture	Office Supplies	
Market	Sell	Don't Sell																		
Africa	Technology	Furniture																		
APAC	Technology	Office Supplies																		
Europe	Tech/ Office Supp	Furniture																		
LATAM	Tech/ Office Supp	Furniture																		
USCA	Tech/ Furniture	Office Supplies																		

## 4.6 PROFIT RELATIONSHIP WITH DISCOUNT

In this section, insights for Profit with respect to discounts is covered

### 4.6.1 Profit Relationship with Market-wise Discounts : Overall

Profit Relationship with Market-wise Discounts: Overall

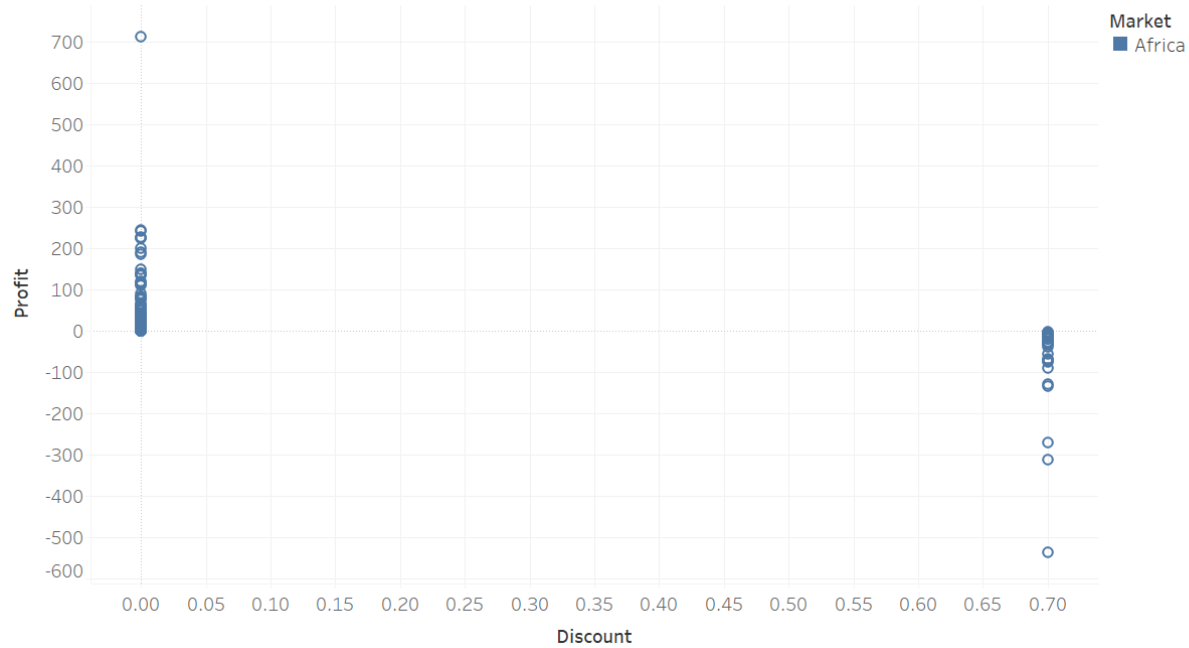


S. No.	Findings	Action
22	In General, it can be observed from above chart that discount above 25% would lead to a loss	



#### 4.6.2 Profit Relationship with Market-wise Discounts : AFRICA

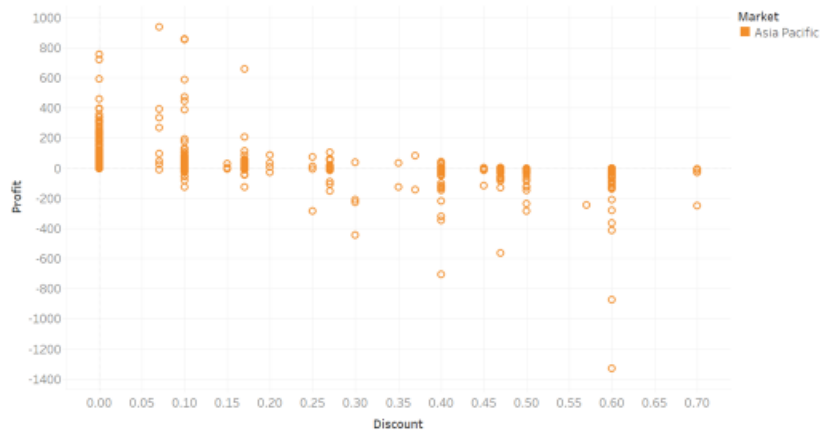
Profit Relationship with Market-wise Discounts: Africa



S. No.	Findings	Action
23	For Africa Market, there are only two discount slabs (0% and 80%)	
	0% Discount Transactions are Profitable 80% Discount Transactions are Losses	

#### 4.6.3 Profit Relationship with Market-wise Discounts : APAC

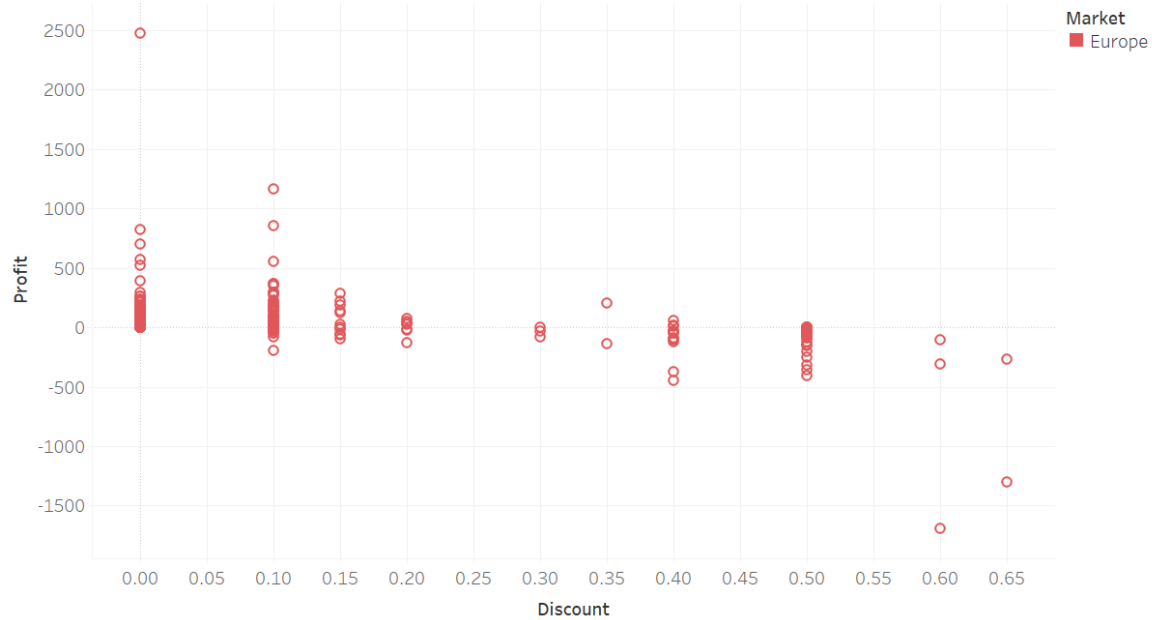
Profit Relationship with Market-wise Discounts: Asia-Pacific



S. No.	Findings	Action
24	For APAC Market, Discount Higher than 20% is a loss	

#### 4.6.4 Profit Relationship with Market-wise Discounts : EUROPE

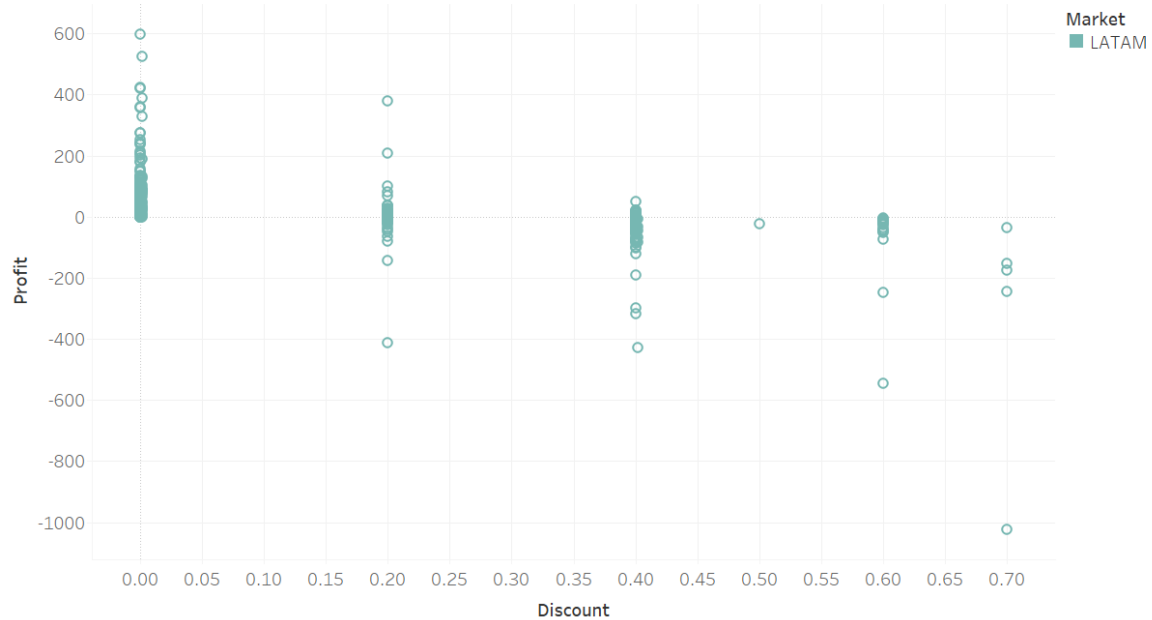
Profit Relationship with Market-wise Discounts: Europe



S. No.	Findings	Action
25	For Europe, discount of more than 30% is a loss	

#### 4.6.5 Profit Relationship with Market-wise Discounts : LATAM

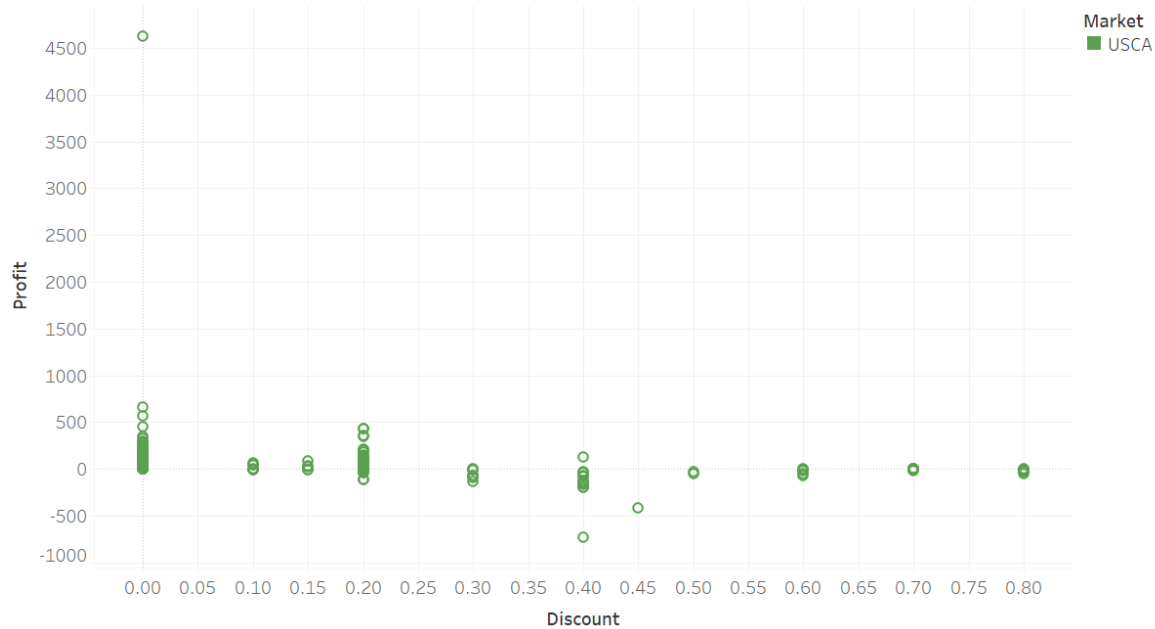
Profit Relationship with Market-wise Discounts: LATAM



S. No.	Findings	Action
26	For LATAM, any form of discount is a loss	

#### 4.6.6 Profit Relationship with Market-wise Discounts : USCA

Profit Relationship with Market-wise Discounts: USCA



S. No.	Findings	Action
27	For USCA, Discount of 40% to 50% is a loss	

#### 4.6.7 Loss-Making Countries: A Geo Spatial View

Loss-Making Countries : Geo Spatial View



S. No.	Findings	Action
28	Above chart, indicates all loss making countries offer very high discounts	

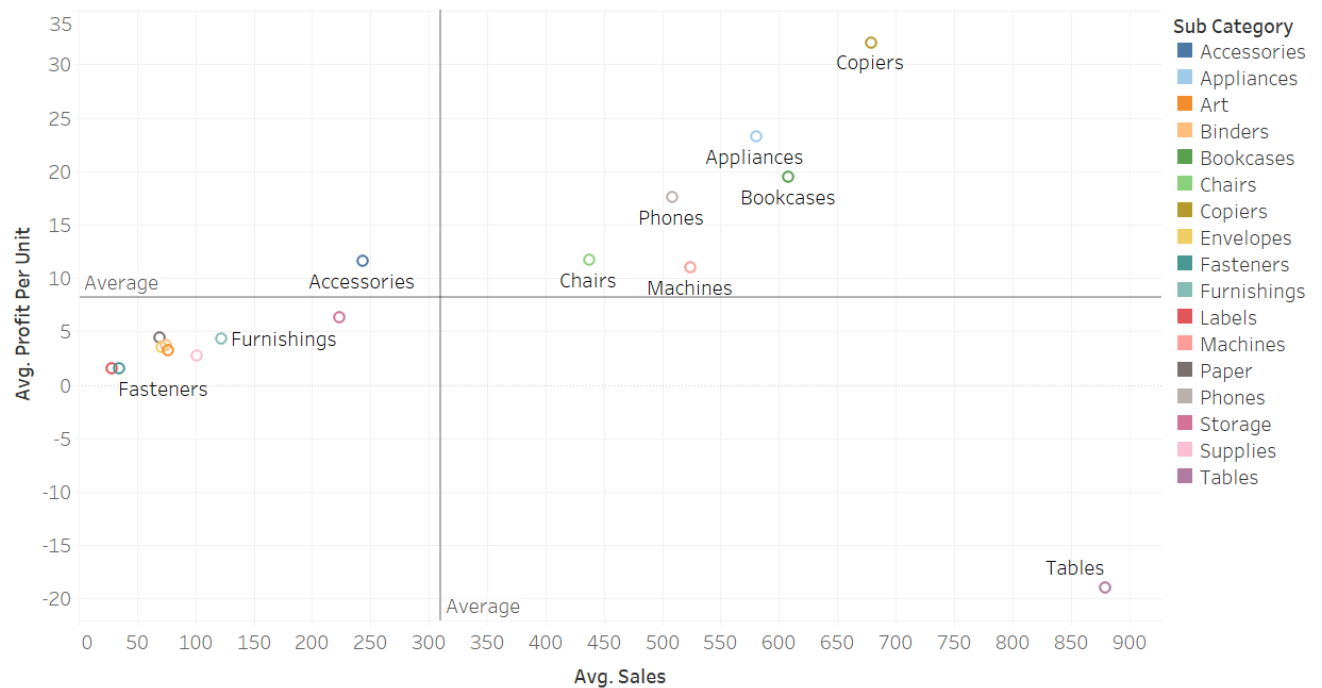
## 4.7 RECOMMENDATIONS

In this section, we cover the recommendations to be implemented to optimize the Profit

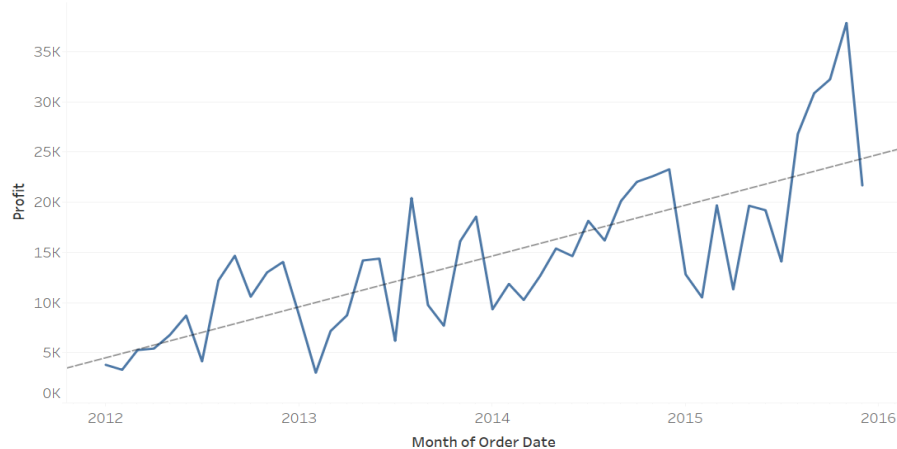
### 4.7.1 What to Sell?

- For Higher Profits and Best Profit Growth, it is recommended to sell below sub-categories:
  - Copiers
  - Appliances
  - Art
  - Envelopes
  - Fasteners
  - Paper
  - Storage
  - Supplies
- Shipment Handling for “Tables” requires special attention. To make Profits for sub-category “Tables” serve only Critical Priority Orders through First Class Ship Modes

Sub-Category Mix



Best Profit Growth: Appliances, Art, Copiers, Envelopes, Fasteners, Paper, Storage, Supplies



#### 4.7.2 Where to Sell?

- Restrain Sales in the following countries:
  - Central Asia: Kazakhstan, Turkmenistan, Tejkistan
  - Western Africa: Nigeria
  - Western Asia: UAE, Turkey, Yemen
  - Europe : Netherlands
- For Best Profit and Growth, focus on following recommendations

Segment	Market	Sell	Don't Sell
<b>Consumer</b>	Africa	Technology	Furniture
	APAC	Technology	Office Supplies
	Europe	Tech/ Furniture	Office Supplies
	LATAM	Tech/ Furniture	Office Supplies
	USCA	Tech/ Office Supp	Furniture

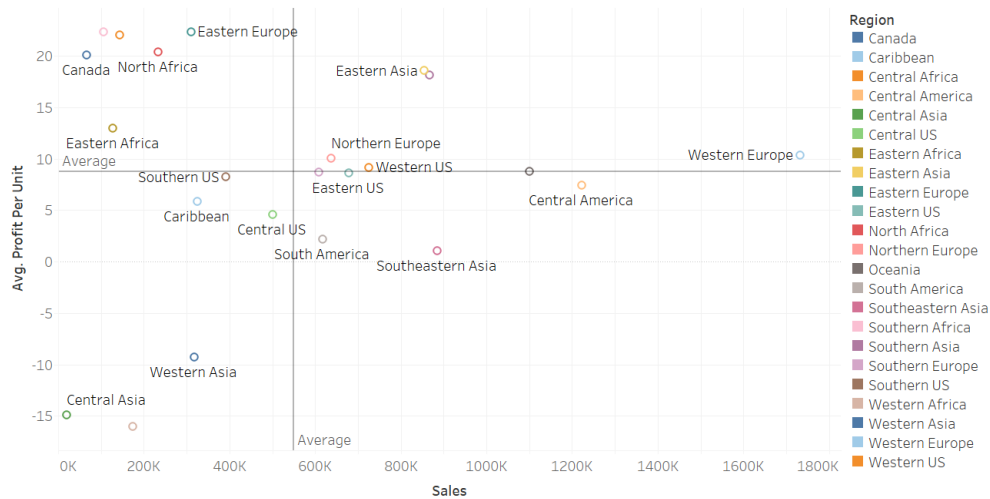
Segment	Market	Sell	Don't Sell
<b>Corporate</b>	Africa	Technology	Furniture
	APAC	Technology	Office Supplies
	Europe	All	None
	LATAM	Tech/ Furniture	Office Supplies
	USCA	Tech/ Office Supp	Furniture

Segment	Market	Sell	Don't Sell
<b>Home Office</b>	Africa	Technology	Furniture
	APAC	Technology	Office Supplies
	Europe	Tech/ Office Supp	Furniture
	LATAM	Tech/ Office Supp	Furniture
	USCA	Tech/ Furniture	Office Supplies

- Discounts:

Market	Discounts
Africa	No Discount
APAC	Don't offer discount more than 20%
Europe	Don't offer discount more than 30%
LATAM	No Discount
USCA	Don't offer discount between 40% - 50%

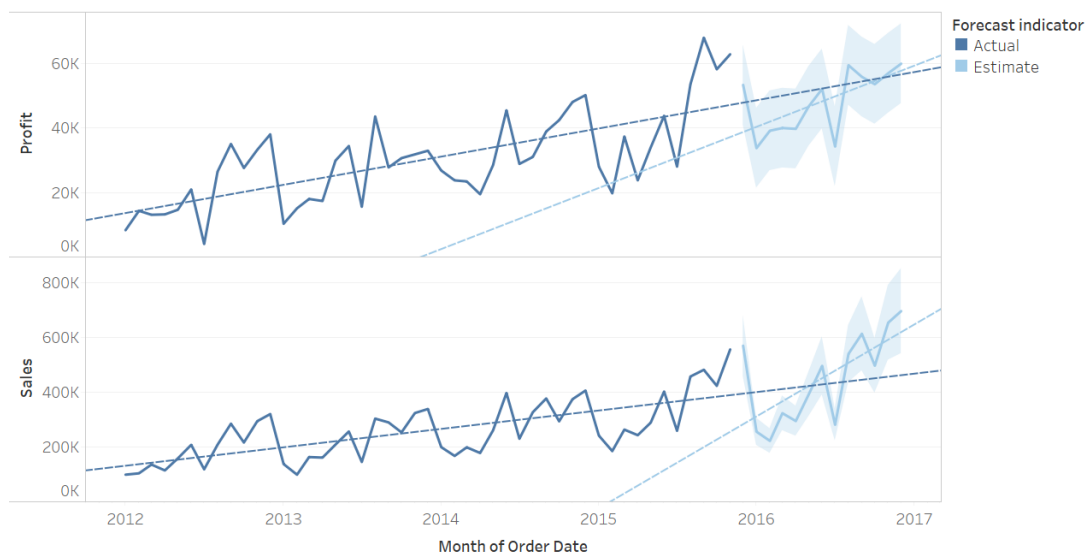
Region-Mix



#### 4.7.3 FORECAST: Focus on Sales Growth and Profit Growth

Below are the forecast charts for Profit and Sales

Forecast : Profit and Sales

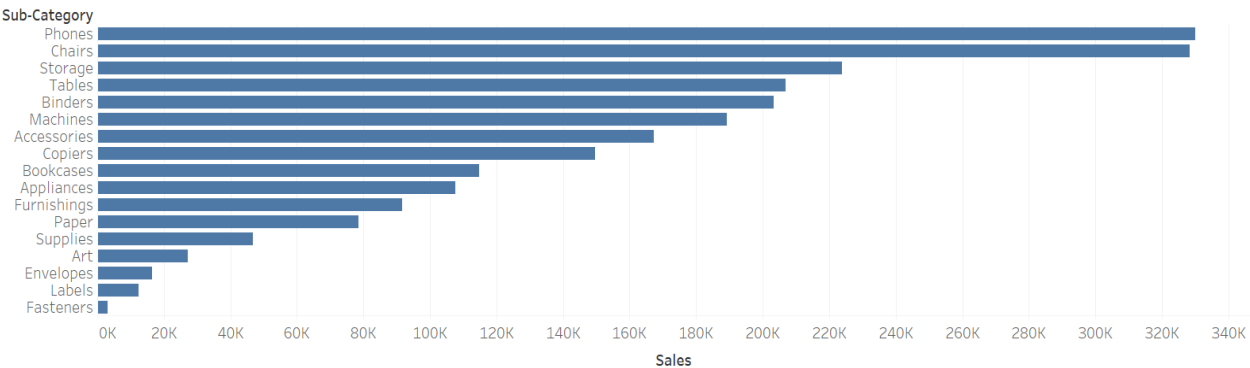


## 5 “TABLE” THE STORY

### 5.1 FINDINGS

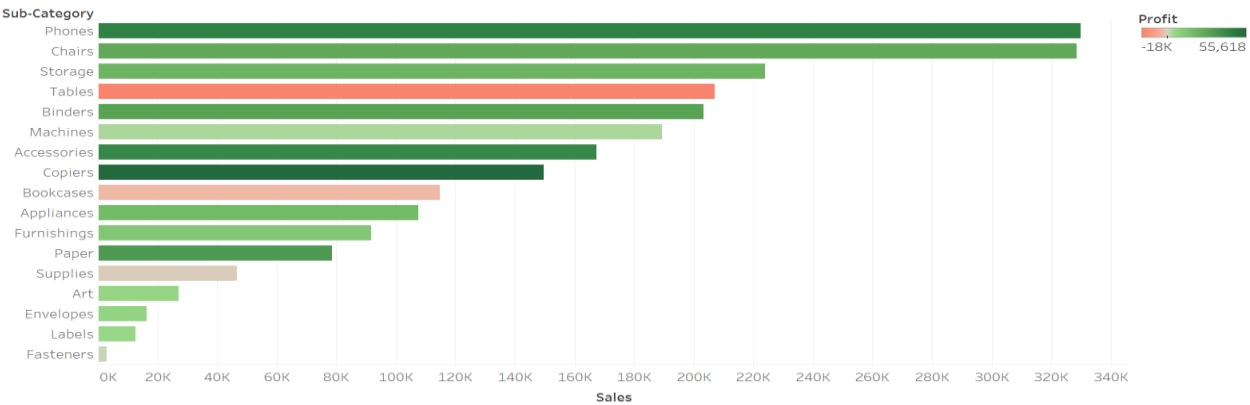
“Tables” is the 4<sup>th</sup> Highest Category in terms of Sales in USA:

Sales Mix



However, the sub category “Tables” is generating heavy losses:

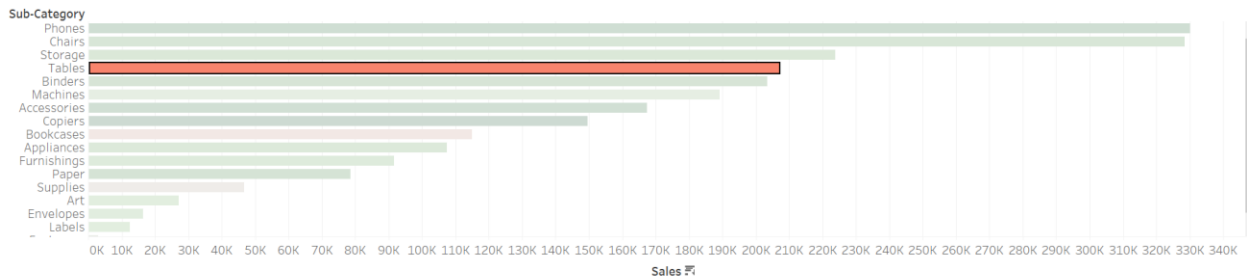
Sales & Profit Mix



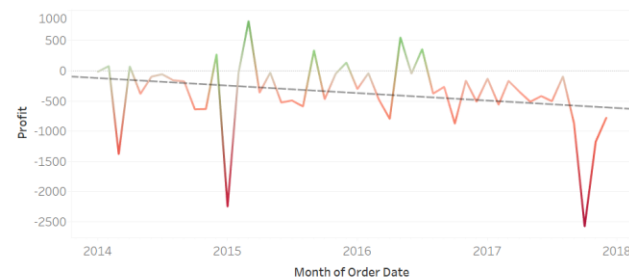
“Tables” show Negative Trends. No Significant Profits over Time

## "Table", The Story!

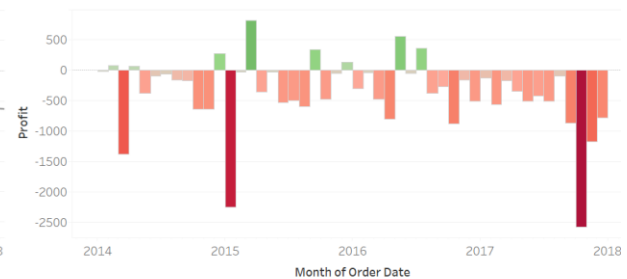
### Sales & Profit Mix



### Profit Trend

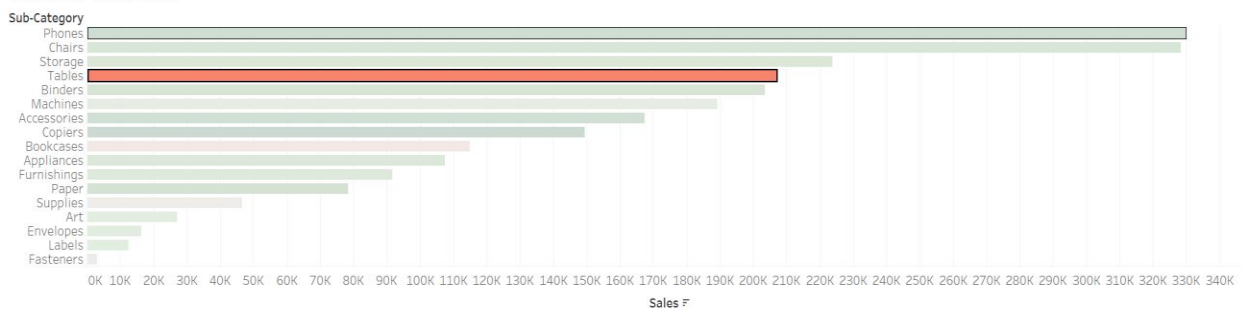


### Profit Values

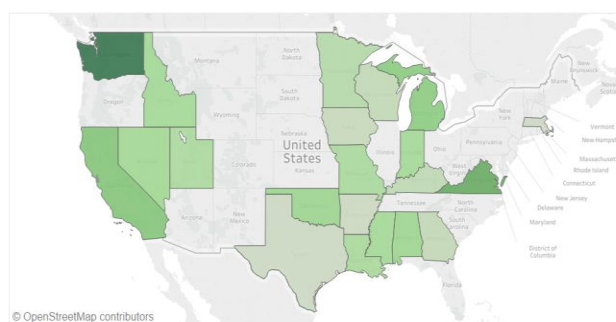


## Seattle represents a Model City for Sales Performance of "Tables"

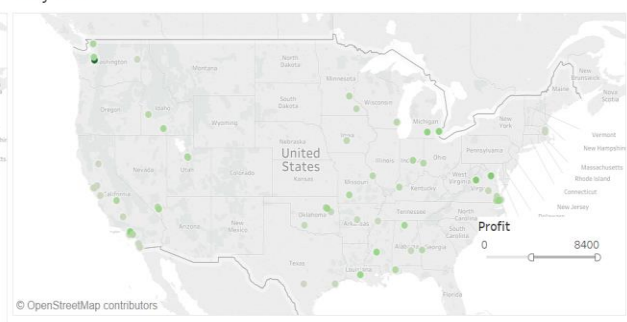
### Sales & Profit Mix



### State Profits



### City Profits



## 5.2 RECOMMENDATION

- Shipment Handling for "Tables" requires special attention. To make Profits for sub-category "Tables" serve only Critical Priority Orders through First Class Ship Modes



## 6 ANNEXURES

### 6.1 SUMMARY OF FINDINGS

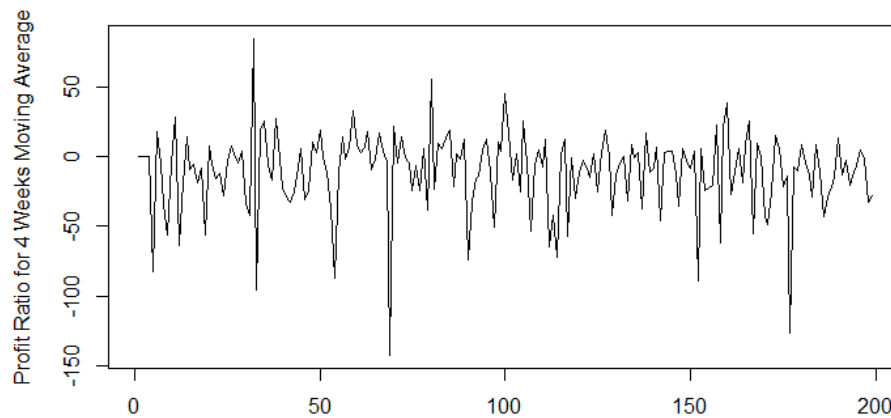
S. No.	Findings
1	More than 80 % Sales and Profits are attributed to Exports
2	Highest Contributor to Sales: APAC Market
3	Highest Contributor to Profit : Europe Market
4	Consumer Segment is the highest contributor to both Sales and Profit
5	Technology and Sales contribute to 80% Profit
6	Furnitures Division is 2 <sup>nd</sup> Highest in Sales but has the lowest contribution to Profit
7	Tables are generating losses for AIKIA
8	Western Africa, Central Asia and Western Asia are contributing to losses
9	Domestic Market : Loss Making States Texas, Ohio, Pennsylvania, Illinois, North Carolina, Colorado, Tennessee, Arizona, Florida, Oregon
10	EXPORTS: Countries with Highest Discounts are Loss Making
11	Domestic: Furniture is maximum loss-making categories (Tables and Bookcases)
12	Tables is generating highest losses in US Market
13	Tables are generating highest losses in Exports Market as well
14	100% Profit is generated when shipping is from Warehouses in India, Spain, Mexico, California
15	Shipping from Other than California (in USA), Indonesia, Turkey, Nigeria are generating losses from AIKIA
16	Sub Category "Tables" is making losses across all Order Priority, except for "Critical" Orders
17	Sub-Category "Tables" is making losses across all Shipping Modes except "First Class"
18	Shipment Handling for "Tables" requires special attention. Hence, Profits are seen for sub-category "Tables" send on Priority Basis through First Class Ship Modes
19	Export Sales: Below Countries are making Losses across All Categories <ul style="list-style-type: none"> <li>• Central Asia: Kazakhstan, Turkmenistan, Tejkistan</li> <li>• Western Africa: Nigeria</li> <li>• Western Asia: UAE, Turkey, Yemen</li> <li>• Europe: Netherlands</li> </ul>
20	In General, it can be observed from above chart that discount above 25% would lead to a loss
21	For Africa Market, there are only two discount slabs (0% and 80%)
22	For APAC Market, Discount Higher than 20% is a loss
23	For Europe, discount of more than 30% is a loss
24	For LATAM, any form of discount is a loss
25	For USCA, Discount of 40% to 50% is a loss
26	Above chart, indicates all loss-making countries offer very high discounts

## 6.2 PREDICTIVE MODELS DEPLOYED

### 6.2.1 Hidden Markov Model : Week-wise Forecasting Profits for Sub-Category “Tables” in USA

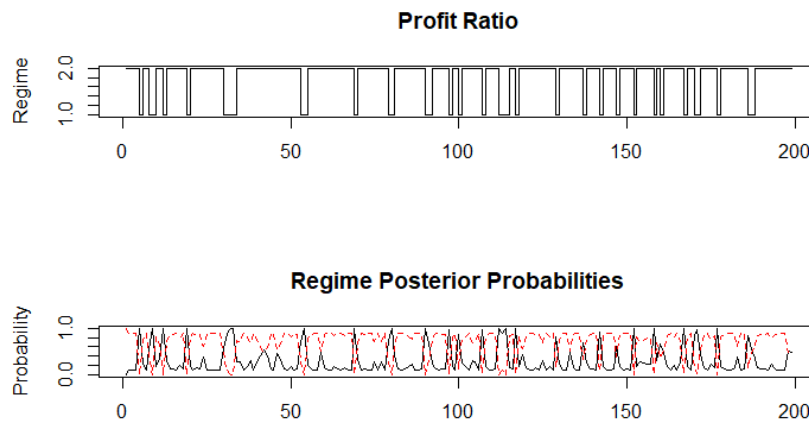
#### 6.2.1.1 *Hidden Markov Model : Input*

Below is the chart for Week-wise Forecast of Profit Ratio for Sub-category Tables. This is based on the 4-weeks Moving Average



#### 6.2.1.2 *Hidden Markov Model : Output*

Below is the output of the Hidden Markov Model on the Profit Ratio for 4 Weeks Moving Average Sale



### 6.2.1.3 Hidden Markov Model : Key Metrics

Some Metrics to Note for the Hidden Markov Model:

- Transition Probability Matrix

State 1 (Profit)	0.305	0.695
State 2 (Loss)	0.275	0.725

### 6.2.1.4 Hidden Markov Model : Interpretation and Summary

- Tables in USA is likely to remain in Losses
- The Frequency of Loss Periods will most likely be 7 weeks, followed by 2 Weeks of surge in Profit

## 6.2.2 Logistics Regression: Predicting Class, Profit or Loss for Tables in USA based on Discount and Region

### 6.2.2.1 Logistics Regression: Inputs

For sub-category Tables in USA, below are the details of the model

- Output Variables: Class is Profit or Loss
- Quantitative Variables: Discount
- Qualitative Variables: Region
- Model : Logit
- Response type: Binary
- Constraints: a1=0
- Confidence interval (%): 95
- Stop conditions: Iterations = 100 / Convergence = 0.000001
- Maximization of the likelihood function using the Newton-Raphson algorithm

### 6.2.2.2 Logistics Regression: The Model Equation

The Model Equation is as below:

Equation of the model (Variable loss):

$$\text{Pred(loss)} = 1 / (1 + \exp(-(3.63264072887955 + 3.69333833216107E-04 * 171.288 + 0.314276232420851 * \text{Western US-Eastern US} + 0.69255260209317 * \text{Western US-Southern US} + 0.164092403737075 * \text{Western US-Western US} - 3.75404991335532 * 0.2 - 0.2 - 6.8276014446134 * 0.2 - 0.3 - 8.83396174205132 * 0.2 - 0.4 - 7.64584425774111 * 0.2 - 0.45 - 7.7926189355535 * 0.2 - 0.5)))$$

### 6.2.2.3 Logistics Regression: Parameters of the Model

The Model Parameters are as below:

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)	Odds ratio	Odds ratio Lower bound (95%)	Odds ratio Upper bound (95%)

Intercept	3.633	1.300	7.803	0.005	1.084	6.181			
171.288	0.000	0.000	0.983	0.322	0.000	0.001	1.000	1.000	1.001
Western US- Central US	0.000	0.000							
Western US- Eastern US	0.314	1.153	0.074	0.785	-1.945	2.574	1.369	0.143	13.112
Western US- Southern US	0.693	1.836	0.142	0.706	-2.907	4.292	1.999	0.055	73.106
Western US- Western US	0.164	1.610	0.010	0.919	-2.991	3.320	1.178	0.050	27.649
0.2-0	0.000	0.000							
0.2-0.2	-3.754	1.414	7.051	0.008	-6.525	-0.983	0.023	0.001	0.374
0.2-0.3	-6.828	1.446	22.307	< 0.0001	-9.661	-3.994	0.001	0.000	0.018
0.2-0.4	-8.834	1.791	24.331	< 0.0001	- 12.344	-5.324	0.000	0.000	0.005
0.2-0.45	-7.646	2.297	11.083	0.001	- 12.147	-3.144	0.000	0.000	0.043
0.2-0.5	-7.793	1.626	22.982	< 0.0001	- 10.979	-4.607	0.000	0.000	0.010

#### 6.2.2.4 Logistics Regression: Evaluation

The Model Evaluation is as below:

##### 6.2.2.4.1 Logistics Regression: Evaluation: Goodness of Fit Statistics

Goodness of fit statistics (Variable loss):

Statistic	Independent	Full
Observations	318	318
Sum of weights	318.000	318.000
DF	317	308
-2 Log(Likelihood)	415.018	98.610
R <sup>2</sup> (McFadden)	0.000	0.762
R <sup>2</sup> (Cox and Snell)	0.000	0.630
R <sup>2</sup> (Nagelkerke)	0.000	0.865
AIC	417.018	118.610
SBC	420.781	156.231
Iterations	0	12

#### 6.2.2.4.2 Logistics Regression: Evaluation: Confusion Matrix

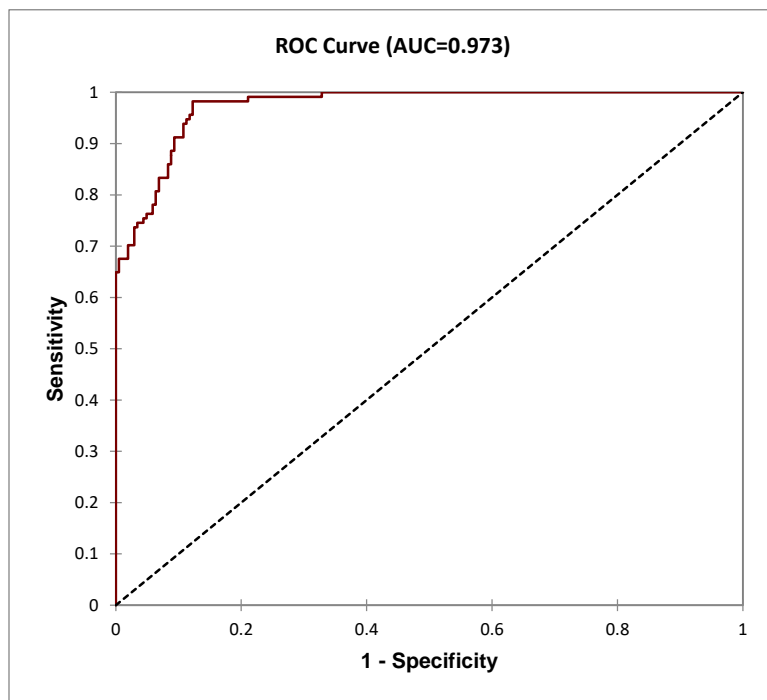
Confusion Matrix:

From \ To	Loss	Profit	Total	% Correct
Loss	174	30	204	85.29%
Profit	2	112	114	98.25%
Total	176	142	318	89.94%

Overall Model Accuracy is 89.94%

#### 6.2.2.4.3 Logistics Regression: ROC Curve

The Model selects a AUC of 0.973, which is a very good outcome



### 6.2.3 Naïve- Bayes Classifier: Predicting Class, Profit or Loss for Tables in USA based on Discount

In this section, use of Naïve – Bayes Classifier is depicted for predicting class – Profit or Loss for Tables in USA based on Discounts given

#### 6.2.3.1 *Naïve-Bayes Classifier: Inputs*

- Output Variables: Class is Profit or Loss
- Quantitative Variables: Discount
- Model : Naïve- Bayes Classifier
- Ties handling: Smallest index
- Prior distribution: Empirical
- Smoothing parameter: 20
- Size of the training set: 319
- Size of the prediction set: 319

#### 6.2.3.2 *Naïve-Bayes Classifier: Outcome of Naïve-Bayes Classifier*

Outcome of Naïve-Bayes:

Confusion matrix	Loss	Profit
Loss	205	0
Profit	42	72

Global accuracy of the model: 0.868