



IS3005

Industrial Project

Group 05

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Abstract

The analysis was carried out using Power BI, MS Excel and Python. To point out some of the main insights, considering the months October, November and December, target sales are supposed to have a huge drop towards December (from well over 30 Million to below 20 Million rupees), but the actual sales do much better than that, although the actual sales does show a little drop. In terms of sales rep profiling, the sales reps with the highest sales in each month were found. The sales reps; 128, 126, 130, 131, and 124 are some of them. And possible cases of cheating were found (sales reps 131 and 133). In product profiling, the highest selling products (October, November and December) and the Return-to-order ratios (October and November) were found. And also, a set of frequently bought products were found. Under route profiling, the routes with the highest number of shops and the highest bill amounts over the months were found. And, under shop profiling, The outlets with the highest net value of sales and the best performing outlets were found. This information can be utilized by the company to increase their efficiency in sales, in several ways.

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1. Introduction

The overall objective here is to analyze the dataset and discover potential opportunities to increase the effectiveness of the business process. Since the dataset basically contains thoroughly detailed order details and additional information, it was possible to get an overview of the business and identify the drawbacks in the process and their roots, and possible solutions to address them.

2. Overview

A four-fold approach was taken, covering Product profiling, Shop profiling, Route profiling and Sales rep profiling. Under product profiling, it was focused on how to minimize returns and identifying customer preferences. And under shop profiling it was focused on identifying outlets with higher potential and optimising the supply. Likewise, increasing the route profitability under route profiling and recognising well performing sales reps and trying to discover cases of cheating under sales rep profiling.

3. KPI Architecture

P r o f i l i n g	Objectives	KPIs	Measures	Data Source
Product	Increase revenue by selling higher quantity	Drive sales with higher quantity per product according to location	Unit Quantity	FactOrders DimItem DimDistrict
		Understand the value of an average order	NetValue/NoofOrders	FactOrders DimItem
	Increase revenue by minimizing returns	Determine optimal suggested order quantities and recommend purchase quantities and allocations	UnitQtyReturn/UnitQtyOrders	FactOrders FactReturn DimItem

	Increase sales by identifying customer preferences	Identify the top 3 brands in each product range	UnitQty	FactOrders DimItem DimBrand
		Identify product mix and association patterns	UnitQty	FactOrders DimItem DimBrand
Shop	Increase revenue by identifying potential outlets	Identify the most valuable outlets	NetValue	FactOrders DimOutlet
	Increase revenue by optimising supply	Identify the most suitable products(brands) for a particular class of outlets	UnitQty, OutletClass	FactOrders DimOutlet DimItem
		Identify items bought at each visit	DateKey, ItemKey	FactOrders
Route	Increase revenue by increasing route profitability	Identify routes with the most number of shops	Outlet Count	DimRoute DimOutlet FactOrders
		Identify routes with the highest total bill amount	NetValue	DimRoute FactOrders
		Identify routes with the highest average invoice value	NetValue	DimRoute FactOrders
Sales Rep	Increase sales by identifying potential sales reps	Identify sales reps with higher target to actual sales ratio.	Actual Sales/Target Sales	Target Target2 DimSalesRep FactOrders
	Increase revenue by minimizing potential cheating opportunities	Identify potential cheating opportunities.	UnitQty, NetValue	FactOrders FactReturns DimSalesRep

4. Methodology

- Using Power BI software, FactOrders and the other required sheets was imported from the given data set.
- In shop profiling, a new column "Outlet_ID" had to be created using OutletID, OutletKey and OutletClass because there was no unique key for each and every outlet.
- Then the relationships among the above sheets (between the tables) were created by identifying unique keys in each.
- The errors were recognized and fixed, and the repeated records were removed using the query editor function.
- Measures and filters were created using power queries.
- Then the required tables and charts were created using the software, using matching colors and themes.

5. Analysis

5.1. Product Profiling

Increase revenue by selling higher quantity

KPI - Drive sales with higher quantity per product

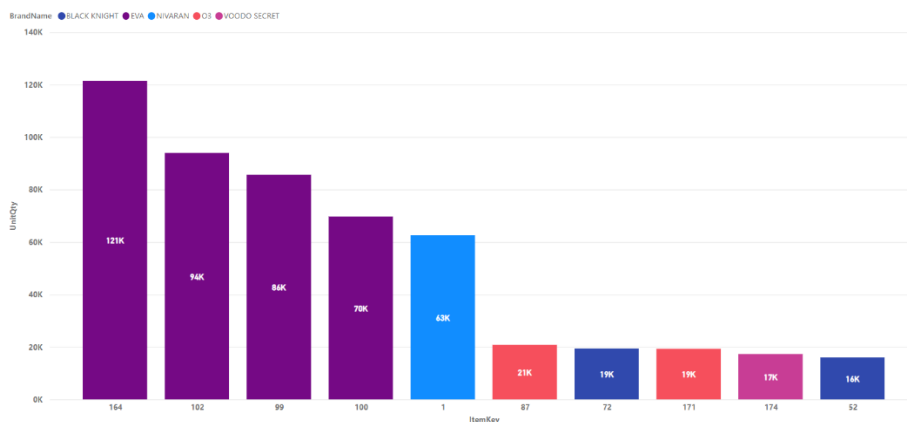


Figure 5-1 : Top 10 highest sold products in October

ItemKey	UnitQty	BrandName	ItemType	AgencyName	Material_group3	Material_group4	Material_group5	Material_group6
164	121475	EVA	NORMAL	SANITARY NAPKINS	CONTOUR	WINGS	PADS	1.00
102	93985	EVA	NORMAL	SANITARY NAPKINS	CONTOUR	WINGS	PADS	10.00
99	85636	EVA	NORMAL	SANITARY NAPKINS	CONTOUR	WINGS	PADS	1.00
100	69691	EVA	NORMAL	SANITARY NAPKINS	CONTOUR	WINGS	PADS	10.00
1	62636	NIVARAN	NORMAL	OTHER	SACHET	COUGH SYRUP	ml	8.00
87	20846	O3	NORMAL	MALE RANGE	SACHET	WET LOOK GEL	gm	4.00
72	19447	BLACK KNIGHT	NORMAL	MALE RANGE	SACHET	STRONG HOLD GEL	gm	4.00
171	19310	O3	NORMAL	MALE RANGE	SACHET	SPLASH-ON	ml	2.50
174	17322	VOODO SECRET	NORMAL	FEMALE RANGE	SACHET	SPLASH-ON	ml	2.50
52	16036	BLACK KNIGHT	NORMAL	MALE RANGE	SACHET	WET LOOK GEL	gm	4.00

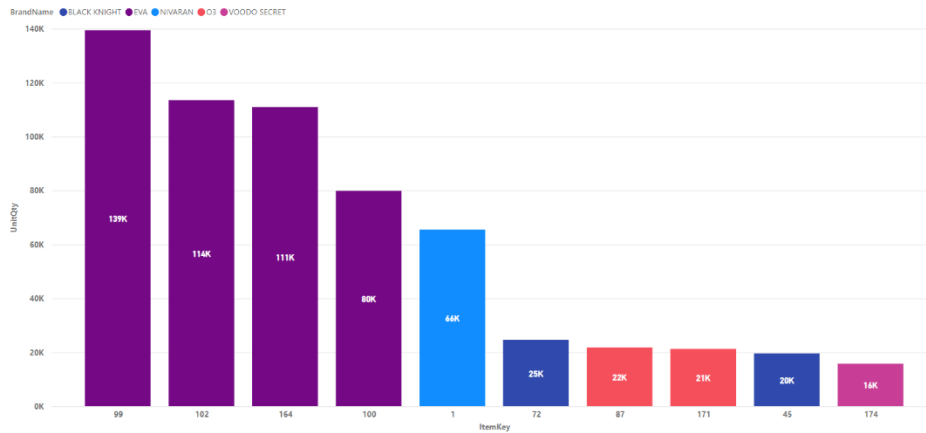


Figure 5-2: Top 10 highest sold products in November

ItemKey	OrderUnitQty	BrandName	ItemType	AgencyName	Material_group3	Material_group4	Material_group5	Material_group6
99	139429	EVA	NORMAL	SANITARY NAPKINS	CONTOUR	WINGS	PADS	1.00
102	113534	EVA	NORMAL	SANITARY NAPKINS	CONTOUR	WINGS	PADS	10.00
164	110926	EVA	NORMAL	SANITARY NAPKINS	CONTOUR	WINGS	PADS	1.00
100	79866	EVA	NORMAL	SANITARY NAPKINS	CONTOUR	WINGS	PADS	10.00
1	65510	NIVARAN	NORMAL	OTHER	SACHET	COUGH SYRUP	ml	8.00
72	24603	BLACK KNIGHT	NORMAL	MALE RANGE	SACHET	STRONG HOLD GEL	gm	4.00
87	21766	O3	NORMAL	MALE RANGE	SACHET	WET LOOK GEL	gm	4.00
171	21274	O3	NORMAL	MALE RANGE	SACHET	SPLASH-ON	ml	2.50
45	19584	BLACK KNIGHT	NORMAL	MALE RANGE	SACHET	VIT B5 GEL	gm	4.00
174	15780	VOODO SECRET	NORMAL	FEMALE RANGE	SACHET	SPLASH-ON	ml	2.50

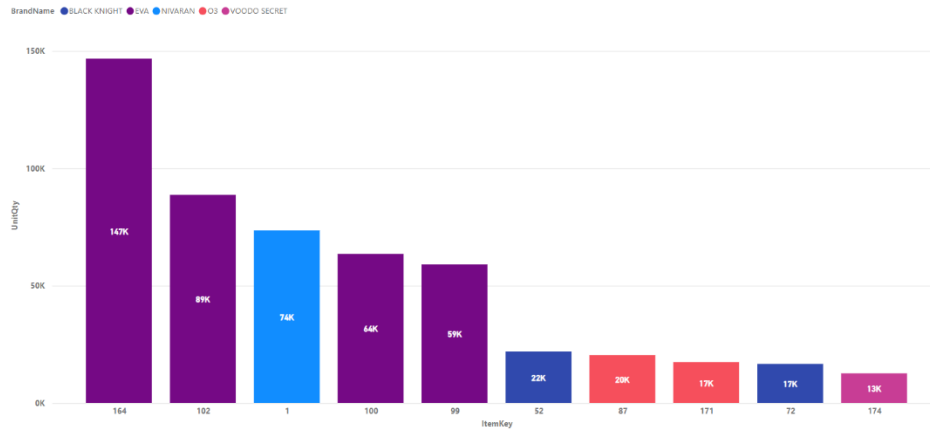


Figure 5-3: Top 10 highest sold products in December

ItemKey	OrderUnitQty	BrandName	ItemType	AgencyName	Material_group3	Material_group4	Material_group5	Material_group6
164	146745	EVA	NORMAL	SANITARY NAPKINS	CONTOUR	WINGS	PADS	1.00
102	88704	EVA	NORMAL	SANITARY NAPKINS	CONTOUR	WINGS	PADS	10.00
1	73561	NIVARAN	NORMAL	OTHER	SACHET	COUGH SYRUP	ml	8.00
100	63576	EVA	NORMAL	SANITARY NAPKINS	CONTOUR	WINGS	PADS	10.00
99	59036	EVA	NORMAL	SANITARY NAPKINS	CONTOUR	WINGS	PADS	1.00
52	21976	BLACK KNIGHT	NORMAL	MALE RANGE	SACHET	WET LOOK GEL	gm	4.00
87	20408	O3	NORMAL	MALE RANGE	SACHET	WET LOOK GEL	gm	4.00
171	17405	O3	NORMAL	MALE RANGE	SACHET	SPLASH-ON	ml	2.50
72	16647	BLACK KNIGHT	NORMAL	MALE RANGE	SACHET	STRONG HOLD GEL	gm	4.00
174	12641	VODOO SECRET	NORMAL	FEMALE RANGE	SACHET	SPLASH-ON	ml	2.50

Top 10 highest sold products for the months October, November and December are shown in the above charts. It can be seen that Eva Sanitary Napkins are the highest sold product each month. Other than that Nivaran Cough Syrup and Hair Gel and Splash On sachet packets from the brands O3 and Black Night are also among the top 10 highest sold products.

Average of NetValue	DateKey (groups)
731.12	OCT
772.50	NOV
730.11	DEC
745.81	

KPI - Understand the value of an average order

Average invoice value

As shown in the above table, the average value of an invoice does not differ much with the month. The overall average value of an invoice is Rs.745.81.

Increase revenue by minimizing returns

KPI - Determine optimal order quantities and recommend purchase quantities and allocations

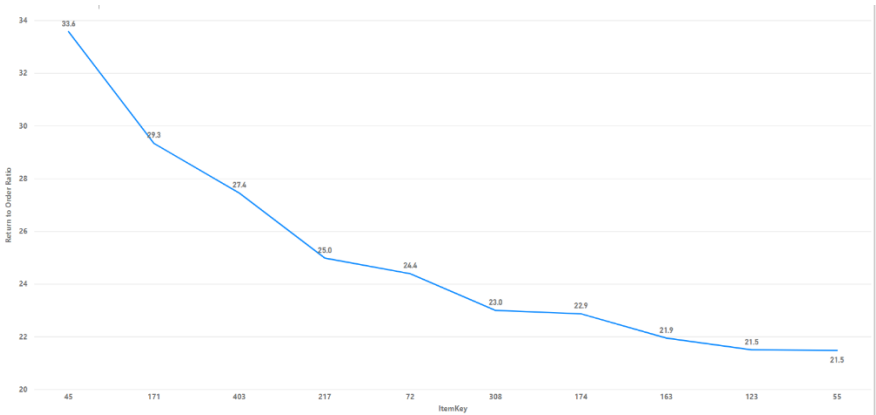


Figure 5-4: Top 10 highest Return-to-order ratios - October

ItemKey	OrderUnitQty	BrandName	AgencyName (groups)	Material_group3	Material_group4	Material_group5	Material_group6	ReturnUnitQty	Return to Order Ratio
45	14640	BLACK KNIGHT	MALE RANGE	SACHET	VIT B5 GEL	gm	4.00	4914	33.57
171	19310	O3	MALE RANGE	SACHET	SPLASH-ON	ml	2.50	5663	29.33
403	6253	JSBT	OTHER	POUCH	BLACK	gm	20.00	1716	27.44
217	1962	BAMBI	BABY PRODUCTS	DIAPER	SMALL	PADS	1.00	490	24.97
72	19447	BLACK KNIGHT	MALE RANGE	SACHET	STRONG HOLD GEL	gm	4.00	4742	24.38
308	1157	JSBT	OTHER	POUCH	BLACK	gm	100.00	266	22.99
174	17322	VOODO SECRET	FEMALE RANGE	SACHET	SPLASH-ON	ml	2.50	3960	22.86
163	3391	EVA	SANITARY NAPKINS	CONTOUR	WINGS	PADS	20.00	744	21.94
123	1754	BAMBI	BABY PRODUCTS	DIAPER	SMALL	PADS	4.00	377	21.49
55	4983	BLACK KNIGHT	MALE RANGE	SACHET	REGULAR CERAM	gm	4.00	1070	21.47

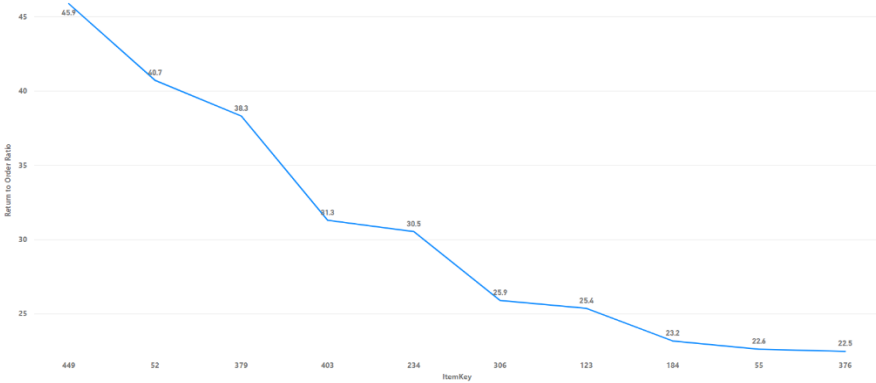


Figure 5-5: Top 10 highest Return-to-order ratios - November

ItemKey	OrderUnitQty	BrandName	AgencyName (groups)	ItemType	Material_group3	Material_group4	Material_group5	Material_group6	ReturnUnitQty	Return to Order Ratio
53	1332	BLACK KNIGHT	MALE RANGE	NORMAL	TUBS	WET LOOK GEL	ml	30.00	66	4.95
360	3592	SAFEGUARD	OTHER	NORMAL	DIAPER	MEDIUM	PADS	10.00	201	5.60
101	2934	EVA	SANITARY NAPKINS	NORMAL	CONTOUR	WINGS	PADS	16.00	168	5.73
237	3732	NIVARAN	OTHER	NORMAL	SACHET	PASPANGUWA	gm	30.00	214	5.73
61	1147	BLACK KNIGHT	MALE RANGE	NORMAL	BOTTLES	SPRAY	ml	50.00	67	5.84
191	1234	VOODO SECRET	FEMALE RANGE	NORMAL	BOTTLES	SPRAY	ml	30.00	75	6.08
160	2624	VOODOO	FEMALE RANGE	NORMAL	PLASTIC	ADULT TALC	gm	60.00	166	6.33
111	1279	OPTIMUM	FEMALE RANGE	NORMAL	PLASTIC	ADULT TALC	gm	125.00	81	6.33
404	1494	AMLA	OTHER	NORMAL	PLASTIC	HAIR OIL	ml	45.00	97	6.49
57	2963	BLACK KNIGHT	MALE RANGE	NORMAL	TUBS	REGULAR CERAM	ml	100.00	194	6.55

To identify the products with higher returns, we have calculated a Return to Order ratio using the Return Unit Quantities (of a certain month) and Order Unit Quantities (of the month before). Using the before mentioned measure, the top 10 products with the highest Return to Order ratios are shown in the above charts and tables. For this analysis, products with an order unit quantity above 1000 were considered. As shown in the above tables and charts, Black Night Hair Gel sachet packets and Sorbex Toilet Rolls show relatively high ratios. By allocating optimal order quantities for the above shown top 10 products, unnecessary expenses can be minimized.

Increase sales by identifying customer preferences

KPI - Identify the top 3 products in each product range

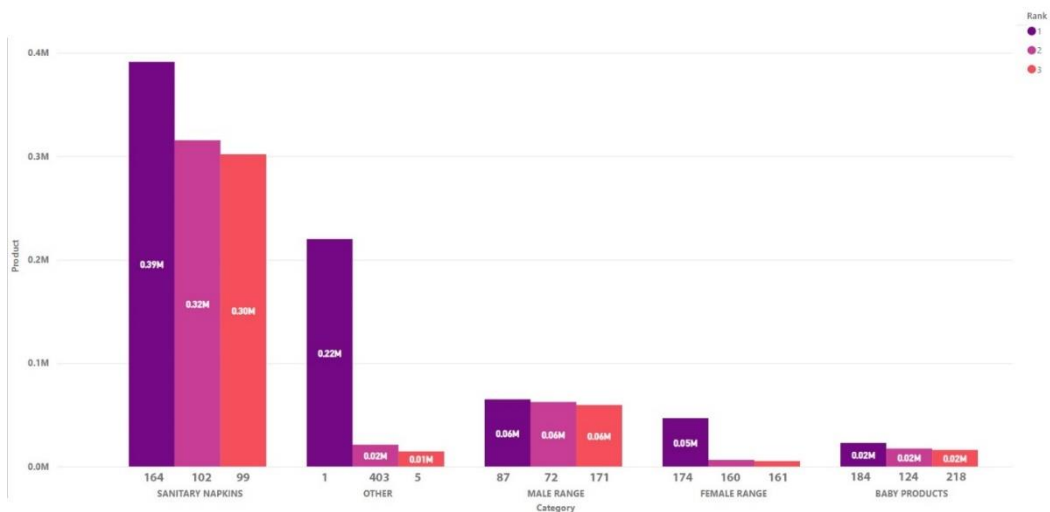


Figure 5-6: Top 3 highest sold products in each product range.

Top 3 highest sold products in each product range are shown in the above chart. According to the analysis, the top sold product in Sanitary Napkins is Eva Contour Wings 1 Pad (Item Key-164). Nivaran cough syrup (Item Key - 1) clearly stands out among the products in the range "Other". In the Male range O3 Wet Look Hair Gel sachet (Item Key - 87) has the highest number of sales. Voodoo Secret Splash On sachet (Item Key - 174) has a significantly higher number of sales compared to the other two. In the baby products range, Rebecalee Soap 75g (Item Key -187) has the highest number of sales. By focusing more on these customer preferences, the total number of sales can be increased.

Identifying customer preferences

Recognizing product mix patterns were done with Market Basket Analysis techniques using Python. Item key was extracted from “Factorders” and the relevant material groups were recognized from “DimItem”. From that, the records had to be transformed into a form where all the product names from a single outlet was in a single cell, separated with commas. That was done using excel functions.

After that, using the python code given below, products and combinations with the highest support, and the permutations (of two) with the highest confidence and lifts were obtained. The higher these numbers are, the better the combination.

KPI : Identify product mix and association patterns

```
In [46]: print(frequent_itemsets)
```

	support	itemsets
0	0.260610	(ADULT TALC)
1	0.299915	(COUGH SYRUP)
2	0.282256	(MEDIUM)
3	0.225719	(REGULAR)
4	0.331957	(SPLASH-ON)
5	0.318997	(SPRAY)
6	0.258616	(STRONG HOLD GEL)
7	0.324836	(WET LOOK GEL)
8	0.881373	(WINGS)
9	0.395899	(WINGS)
10	0.232412	(ADULT TALC, WINGS)
11	0.277129	(COUGH SYRUP, WINGS)
12	0.265167	(WINGS, MEDIUM)
13	0.211478	(WINGS, REGULAR)
14	0.299630	(SPLASH-ON, WINGS)
15	0.282541	(WINGS, SPRAY)
16	0.213472	(WET LOOK GEL, STRONG HOLD GEL)
17	0.229564	(WINGS, STRONG HOLD GEL)
18	0.291940	(WET LOOK GEL, WINGS)
19	0.388351	(WINGS, WINGS)

Figure 5-7 combinations with the highest support:

Permuatations with the highest confidence and lifts are given below. (Here, the “antecedents” are the 1st product, and the “consequents” are the 2nd product. So, basically the possibility of buying the 2nd product, given that the 1st product is bought, has been given a score.)

```
In [47]: print(rules1)
```

	antecedents	consequents	antecedent support		consequent support	support	confidence	lift	leverage	conviction
0	(ADULT TALC)	(WINGS)	0.260610	0	0.881373	0.232412	0.891803	1.011834	0.002718	1.096403
1	(WINGS)	(ADULT TALC)	0.881373	1	0.260610	0.232412	0.263694	1.011834	0.002718	1.004189
2	(COUGH SYRUP)	(WINGS)	0.299915	2	0.881373	0.277129	0.924027	1.048395	0.012792	1.561430
3	(WINGS)	(COUGH SYRUP)	0.881373	3	0.299915	0.277129	0.314429	1.048395	0.012792	1.021171
4	(WINGS)	(MEDIUM)	0.881373	4	0.282256	0.265167	0.300856	1.065900	0.016394	1.026605
5	(MEDIUM)	(WINGS)	0.282256	5	0.881373	0.265167	0.939455	1.065900	0.016394	1.959325
6	(WINGS)	(REGULAR)	0.881373	6	0.225719	0.211478	0.239942	1.063010	0.012535	1.018713
7	(REGULAR)	(WINGS)	0.225719	7	0.881373	0.211478	0.936909	1.063010	0.012535	1.880241
8	(SPLASH-ON)	(WINGS)	0.331957	8	0.881373	0.299630	0.902617	1.024103	0.007052	1.218150
9	(WINGS)	(SPLASH-ON)	0.881373	9	0.331957	0.299630	0.339958	1.024103	0.007052	1.012122
10	(WINGS)	(SPRAY)	0.881373	10	0.318997	0.282541	0.320569	1.004926	0.001385	1.002313
11	(SPRAY)	(WINGS)	0.318997	11	0.881373	0.282541	0.885714	1.004926	0.001385	1.037988
12	(WET LOOK GEL)	(STRONG HOLD GEL)	0.324836	12	0.258616	0.213472	0.657168	2.541097	0.129464	2.162529
13	(STRONG HOLD GEL)	(WET LOOK GEL)	0.258616	13	0.324836	0.213472	0.825441	2.541097	0.129464	3.867815
14	(WINGS)	(STRONG HOLD GEL)	0.881373	14	0.258616	0.229564	0.260462	1.007139	0.001627	1.002497
15	(STRONG HOLD GEL)	(WINGS)	0.258616	15	0.881373	0.229564	0.887665	1.007139	0.001627	1.056014
16	(WET LOOK GEL)	(WINGS)	0.324836	16	0.881373	0.291940	0.898729	1.019692	0.005638	1.171379
17	(WINGS)	(WET LOOK GEL)	0.881373	17	0.324836	0.291940	0.331233	1.019692	0.005638	1.009565
18	(WINGS)	(WINGS)	0.395899	18	0.881373	0.388351	0.980935	1.112963	0.039417	6.222331
19	(WINGS)	(WINGS)	0.881373	19	0.395899	0.388351	0.440620	1.112963	0.039417	1.079949

Figure 5-8: Permutations with the highest confidence and lifts

For an example, here in the 3rd row, “If – wings – then – cough syrup” permutation and the “adult talc -> wings” permutation (1st row) have shown higher confidence, meaning that there are frequently bought together.

And in the 12th and 13th rows, “wet look gel” and “strong hold gel” products have shown a higher lift, which makes sense because these products are good matches.

As a recommendation, the outlets can be informed about these matches so they can arrange their selling techniques accordingly, to encourage more sales.

The code:

```
import pandas as pd
from itertools import permutations

items = pd.read_csv("MBA2.csv")
print(items.head(2))

# Split transaction strings into lists.
transactions = items['Comma'].apply(lambda t: t.split(','))

# Convert DataFrame into list of strings.
transactions = list(transactions)
print(transactions[0])
```

```

from itertools import permutations

# Extract unique items.
flattened = [item for transaction in transactions for item in transaction]
items = list(set(flattened))
# Compute and print rules.
rules = list(permutations(items, 2))
#print(rules)

from mlxtend.preprocessing import TransactionEncoder

# Instantiate transaction encoder
encoder = TransactionEncoder().fit(transactions)

# One-hot encode itemsets by applying fit and transform
onehot = encoder.transform(transactions)

# Convert one-hot encoded data to DataFrame
onehot = pd.DataFrame(onehot, columns = encoder.columns_)
print(onehot)

print(onehot.mean())

# Import the association rules function
from mlxtend.frequent_patterns import association_rules
from mlxtend.frequent_patterns import apriori

# Compute frequent itemsets using the Apriori algorithm
frequent_itemsets = apriori(onehot, min_support = 0.2,
max_len = 2, use_colnames = True)

# Compute all association rules for frequent_itemsets
rules1 = association_rules(frequent_itemsets, metric = "lift", min_threshold = 0.5)

print(frequent_itemsets)
print(rules1)

```

5.2. Shop profiling

Finding the most valuable outlets

KPI = Net Value of Orders of each Outlet

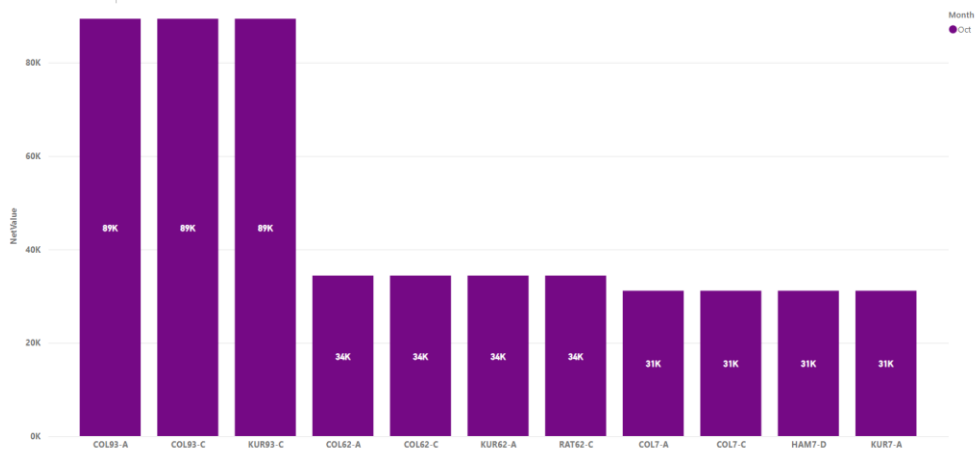
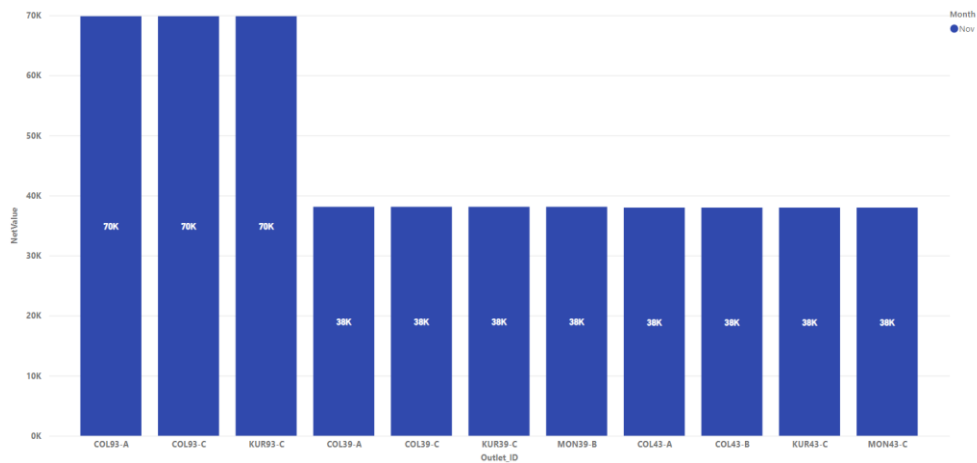


Figure 5-9: Net Order Value Vs Outlet_ID In Oct



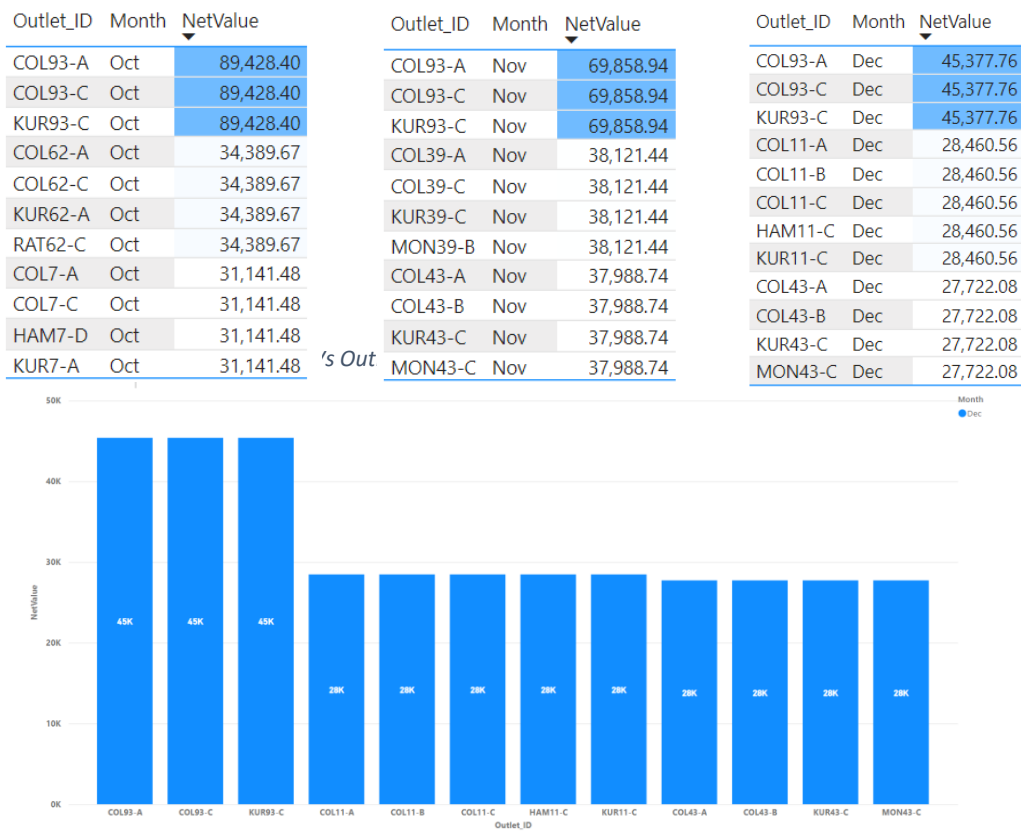


Figure 5-10: Net Order Value Vs Outlet_ID In Oct

A new column "Outlet_ID" had to be created using OutletID, OutletKey and OutletClass because there was no unique key for each and every outlet.

The above representations show that the outlets coded "COL93-A, COL93-C, KUR93-C" have come on top every month. (COL93-A came on top every month.) Their net order values for the months October, November and December are Rs. 89428.40, Rs. 69858.94 and Rs. 45377.76 respectively.

Increase revenue by optimizing supply

KPI - Identify the most suitable products(brands) for a particular class of outlets

OutletClass	ItemKey	BrandName	AgencyName (groups)	UnitQty	OutletClass	ItemKey	BrandName	AgencyName (groups)	UnitQty
A+	164	EVA	SANITARY NAPKINS	1257	A	164	EVA	SANITARY NAPKINS	4057
A+	99	EVA	SANITARY NAPKINS	755	A	102	EVA	SANITARY NAPKINS	3569
A+	1	NIVARAN	OTHER	92	A	99	EVA	SANITARY NAPKINS	3431
A+	72	BLACK KNIGHT	MALE RANGE	72	A	100	EVA	SANITARY NAPKINS	3095
A+	100	EVA	SANITARY NAPKINS	52	A	1	NIVARAN	OTHER	2731
A+	102	EVA	SANITARY NAPKINS	52	A	72	BLACK KNIGHT	MALE RANGE	756
A+	45	BLACK KNIGHT	MALE RANGE	48	A	87	O3	MALE RANGE	684
A+	125	BAMBI	BABY PRODUCTS	30	A	45	BLACK KNIGHT	MALE RANGE	636
A+	124	BAMBI	BABY PRODUCTS	25	A	94	EVA	SANITARY NAPKINS	556
A+	94	EVA	SANITARY NAPKINS	19	A	171	O3	MALE RANGE	488
A+	123	BAMBI	BABY PRODUCTS	19	A	124	BAMBI	BABY PRODUCTS	406
A+	359	SAFEGUARD	OTHER	18	A	163	EVA	SANITARY NAPKINS	372
A+	104	YEHELI	SANITARY NAPKINS	14	A	5	NIVARAN	OTHER	312
A+	87	O3	MALE RANGE	12	A	423	REAL	OTHER	292
A+	180	REBECALEE	BABY PRODUCTS	10	A	97	EVA	SANITARY NAPKINS	278

OutletClass	ItemKey	BrandName	AgencyName (groups)	UnitQty	OutletClass	ItemKey	BrandName	AgencyName (groups)	UnitQty
B	99	EVA	SANITARY NAPKINS	2628	C	164	EVA	SANITARY NAPKINS	4024
B	164	EVA	SANITARY NAPKINS	2307	C	102	EVA	SANITARY NAPKINS	3441
B	102	EVA	SANITARY NAPKINS	1427	C	99	EVA	SANITARY NAPKINS	3431
B	100	EVA	SANITARY NAPKINS	1277	C	100	EVA	SANITARY NAPKINS	3006
B	1	NIVARAN	OTHER	1158	C	1	NIVARAN	OTHER	2601
B	94	EVA	SANITARY NAPKINS	417	C	72	BLACK KNIGHT	MALE RANGE	648
B	87	O3	MALE RANGE	340	C	45	BLACK KNIGHT	MALE RANGE	612
B	72	BLACK KNIGHT	MALE RANGE	300	C	94	EVA	SANITARY NAPKINS	556
B	171	O3	MALE RANGE	244	C	87	O3	MALE RANGE	528
B	124	BAMBI	BABY PRODUCTS	211	C	171	O3	MALE RANGE	488
B	359	SAFEGUARD	OTHER	186	C	124	BAMBI	BABY PRODUCTS	406
B	125	BAMBI	BABY PRODUCTS	181	C	163	EVA	SANITARY NAPKINS	372
B	123	BAMBI	BABY PRODUCTS	170	C	423	REAL	OTHER	292
B	360	SAFEGUARD	OTHER	167	C	97	EVA	SANITARY NAPKINS	278
B	5	NIVARAN	OTHER	164	C	125	BAMBI	BABY PRODUCTS	278

OutletClass	ItemKey	BrandName	AgencyName (groups)	UnitQty	OutletClass	ItemKey	BrandName	AgencyName (groups)	UnitQty
D	164	EVA	SANITARY NAPKINS	2034	E	1	NIVARAN	OTHER	446
D	1	NIVARAN	OTHER	1771	E	164	EVA	SANITARY NAPKINS	345
D	99	EVA	SANITARY NAPKINS	1640	E	100	EVA	SANITARY NAPKINS	257
D	102	EVA	SANITARY NAPKINS	1615	E	99	EVA	SANITARY NAPKINS	231
D	100	EVA	SANITARY NAPKINS	1477	E	102	EVA	SANITARY NAPKINS	183
D	72	BLACK KNIGHT	MALE RANGE	552	E	72	BLACK KNIGHT	MALE RANGE	108
D	45	BLACK KNIGHT	MALE RANGE	540	E	171	O3	MALE RANGE	108
D	87	O3	MALE RANGE	512	E	87	O3	MALE RANGE	96
D	171	O3	MALE RANGE	366	E	45	BLACK KNIGHT	MALE RANGE	60
D	5	NIVARAN	OTHER	229	E	5	NIVARAN	OTHER	48
D	184	REBECALEE	BABY PRODUCTS	199	E	55	BLACK KNIGHT	MALE RANGE	48
D	124	BAMBI	BABY PRODUCTS	188	E	124	BAMBI	BABY PRODUCTS	26
D	234	SORBEX	OTHER	187	E	306	JSBT	OTHER	26
D	94	EVA	SANITARY NAPKINS	162	E	52	BLACK KNIGHT	MALE RANGE	24
D	423	REAL	OTHER	145	E	125	BAMBI	BABY PRODUCTS	23

Above tables show the top 15 product quantities in each outlet class with their brands. Almost all the outlet classes EVA Sanitary Napkins (ItemKey 164) and Nivaran Paspanguwa (ItemKey 1) are the items that are ordered the most. Item quantities in class A is higher than other classes. Item quantities do not depend on outlet class.

A method in the form of “introducing the highest selling quantity items in each class to every outlet in that class. Will be a good idea.

KPI - Identify items bought at each visit

Outlet_ID	Outlet_ID	Month	InvoiceKey	DateKey	ItemKey	AgencyName (groups)	BrandName	UnitQty
COL109-C	COL109-C	Dec	240053	20161206	45	MALE RANGE	BLACK KNIGHT	12
	COL109-C	Dec	240054	20161206	87	MALE RANGE	O3	12
	COL109-C	Dec	240063	20161206	171	MALE RANGE	O3	12
	COL109-C	Nov	138912	20161111	171	MALE RANGE	O3	12
	COL109-C	Nov	138913	20161111	174	FEMALE RANGE	VOODOO SECRET	12
	COL109-C	Nov	206232	20161126	45	MALE RANGE	BLACK KNIGHT	12
	COL109-C	Nov	206234	20161126	72	MALE RANGE	BLACK KNIGHT	12
	COL109-C	Oct	106183	20161030	87	MALE RANGE	O3	12
	COL109-C	Dec	285294	20161222	99	SANITARY NAPKINS	EVA	10
	COL109-C	Nov	138908	20161111	99	SANITARY NAPKINS	EVA	10
	COL109-C	Oct	106186	20161030	164	SANITARY NAPKINS	EVA	10
	COL109-C	Dec	240060	20161206	126	BABY PRODUCTS	BAMBI	6
	COL109-C	Dec	285296	20161222	100	SANITARY NAPKINS	EVA	6
	COL109-C	Nov	138910	20161111	102	SANITARY NAPKINS	EVA	6
	COL109-C	Nov	206235	20161126	100	SANITARY NAPKINS	EVA	6
	COL109-C	Oct	106184	20161030	100	SANITARY NAPKINS	EVA	6
	COL109-C	Oct	106185	20161030	126	BABY PRODUCTS	BAMBI	6
	COL109-C	Dec	240057	20161206	124	BABY PRODUCTS	BAMBI	3
	COL109-C	Dec	240059	20161206	125	BABY PRODUCTS	BAMBI	3
	COL109-C	Dec	285297	20161222	102	SANITARY NAPKINS	EVA	3
	COL109-C	Dec	285299	20161222	257	OTHER	SORBEX	3
	COL109-C	Nov	206236	20161126	102	SANITARY NAPKINS	EVA	3
	COL109-C	Dec	240055	20161206	87	MALE RANGE	O3	2
	COL109-C	Dec	240056	20161206	109	FEMALE RANGE	OPTIMUM	2
	COL109-C	Dec	240061	20161206	157	FEMALE RANGE	VOODOO	2
	COL109-C	Dec	240062	20161206	161	FEMALE RANGE	VOODOO	2
	COL109-C	Dec	240064	20161206	171	MALE RANGE	O3	2
	COL109-C	Nov	138907	20161111	85	MALE RANGE	BLACK KNIGHT	2

Using the above table, Items that are bought in a selected day, in the selected outlet can be filtered in. The outlets and the items bought in each visit, can be taken into consideration by sales reps, using this table, hence being more efficient in their service. And also the company gets to the items bought at each visit by the relevant outlets, which will also be of help in managing the stocks of products, hence maintaining the customers without losing them.

5.3. Route profiling

Increase revenue by increasing route profitability

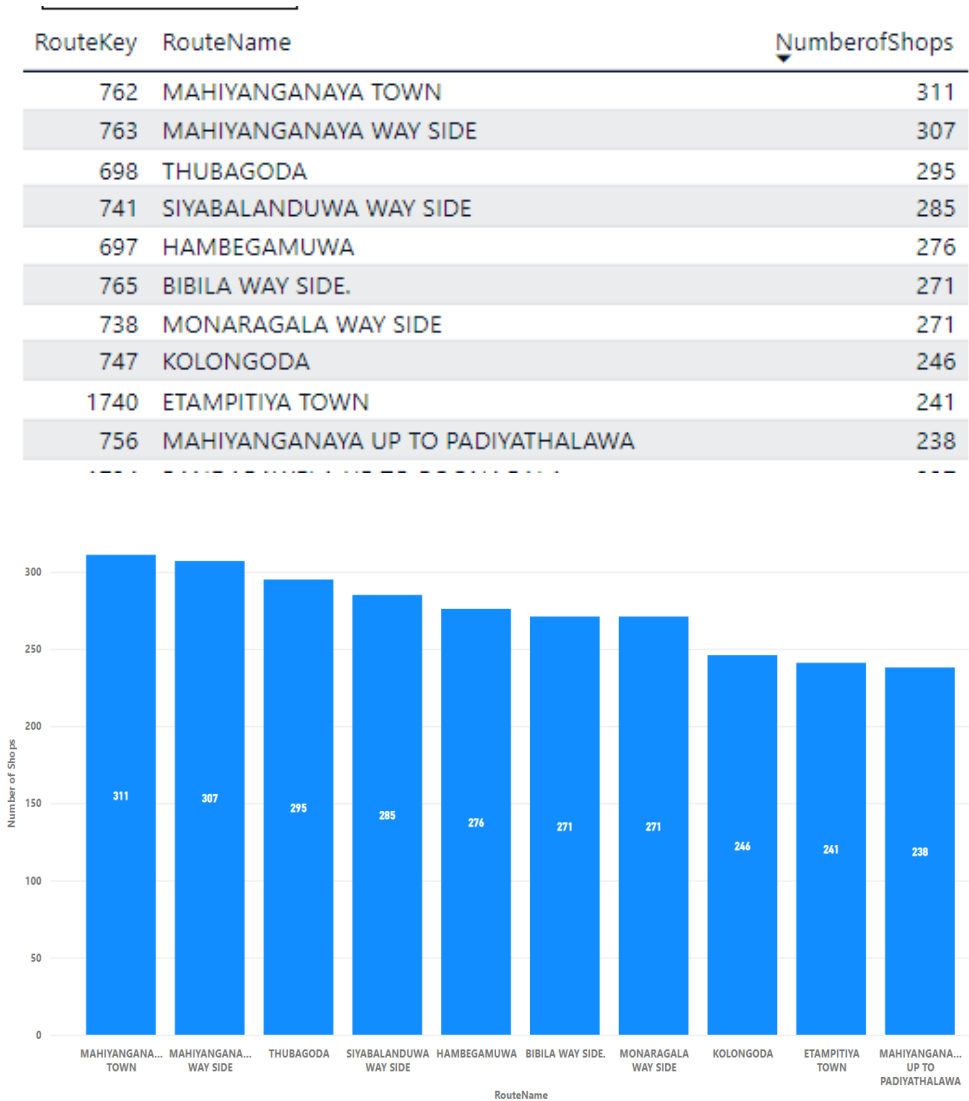


Figure 5-12 Bar chart - Routes with the highest number of shops

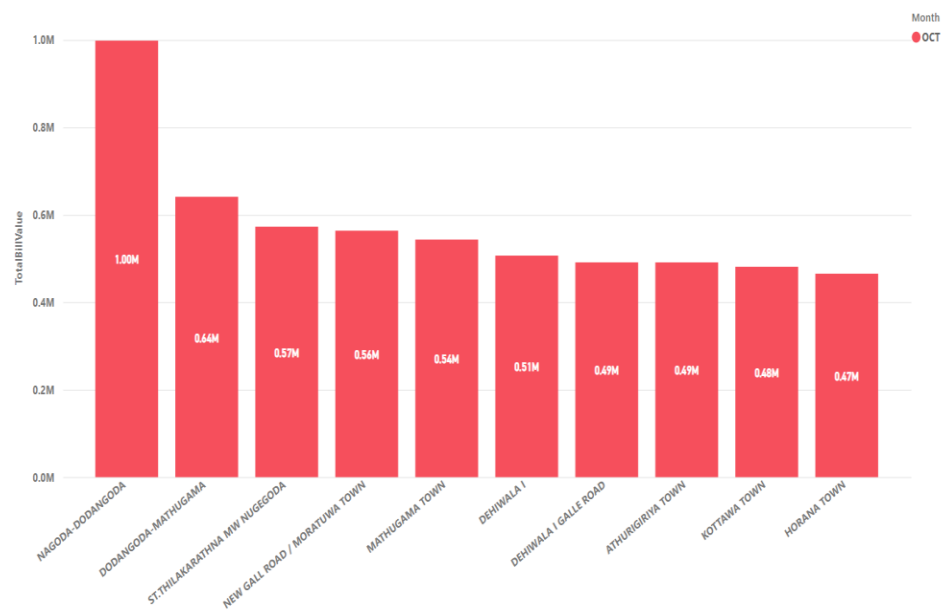
This bar chart shows 10 routes with the highest number of shops. That's the 'Mahiyanganaya town' route that is "311". The second highest number of shops belong to 'Mahiyanganaya way side' route.

'Thubagoda', 'Siyabalanduwa way side' and 'Hambegamuwa' are the routes next in the list.

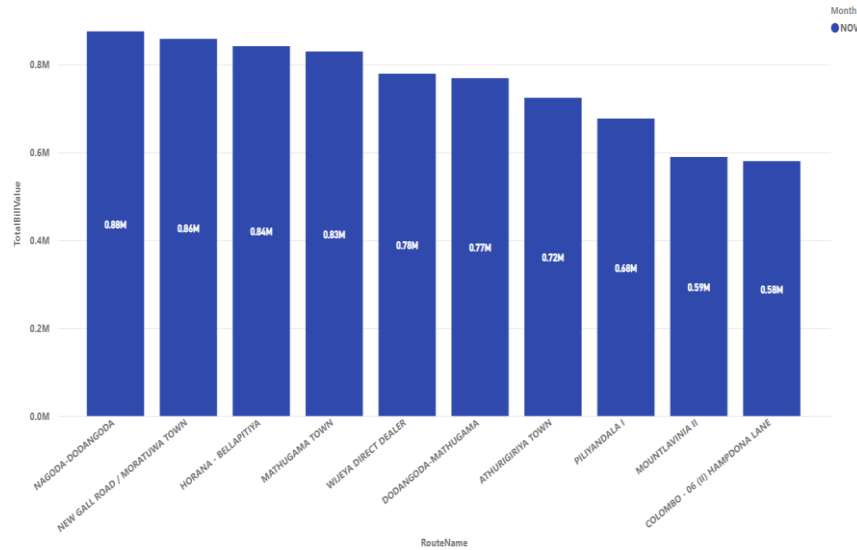
Many of the routes with high numbers of shops are located outside the western province

Identify routes with the highest total bill amount

RouteKey	RouteName	TotalBillValue	Month
145	NAGODA-DODANGODA	998,054.41	OCT
141	DODANGODA-MATHUGAMA	641,059.64	OCT
186	ST.THILAKARATHNA MW NUGEGODA	572,696.98	OCT
44	NEW GALL ROAD / MORATUWA TOWN	563,549.78	OCT
169	MATHUGAMA TOWN	543,230.67	OCT
63	DEHIWALA I	506,546.96	OCT
8	DEHIWALA I GALLE ROAD	491,084.66	OCT
23	ATHURIGIRIYA TOWN	491,033.88	OCT
888	ATHURIGIRIYA TOWN	491,033.88	OCT
224	KOTTAWA TOWN	481,050.14	OCT
254	HORANA TOWN	465,220.52	OCT



RouteKey	RouteName	TotalBillValue	Month
145	NAGODA-DODANGODA	875,508.46	NOV
44	NEW GALL ROAD / MORATUWA TOWN	858,513.04	NOV
249	HORANA - BELLAPITIYA	841,822.96	NOV
169	MATHUGAMA TOWN	829,719.23	NOV
262	WIJEYA DIRECT DEALER	779,189.85	NOV
141	DODANGODA-MATHUGAMA	769,073.91	NOV
23	ATHURIGIRIYA TOWN	724,432.94	NOV
888	ATHURIGIRIYA TOWN	724,432.94	NOV
236	PILIYANDALA I	677,093.93	NOV
64	MOUNTLAVINIA II	589,697.02	NOV



RouteKey	RouteName	TotalBillValue	Month
64	MOUNTLAVINIA II	1,001,573.52	DEC
249	HORANA - BELLAPITIYA	864,813.49	DEC
141	DODANGODA-MATHUGAMA	839,299.01	DEC
236	PILIYANDALA I	836,914.58	DEC
145	NAGODA-DODANGODA	733,698.86	DEC
224	KOTTAWA TOWN	668,388.88	DEC
228	MAHARAGAMA DEHIWALA ROAD	651,886.55	DEC
44	NEW GALL ROAD / MORATUWA TOWN	565,688.86	DEC
178	KIRULAPONE TOWN	552,890.07	DEC
183	JUBILEE POST EMBULDENIYA	494,506.20	DEC

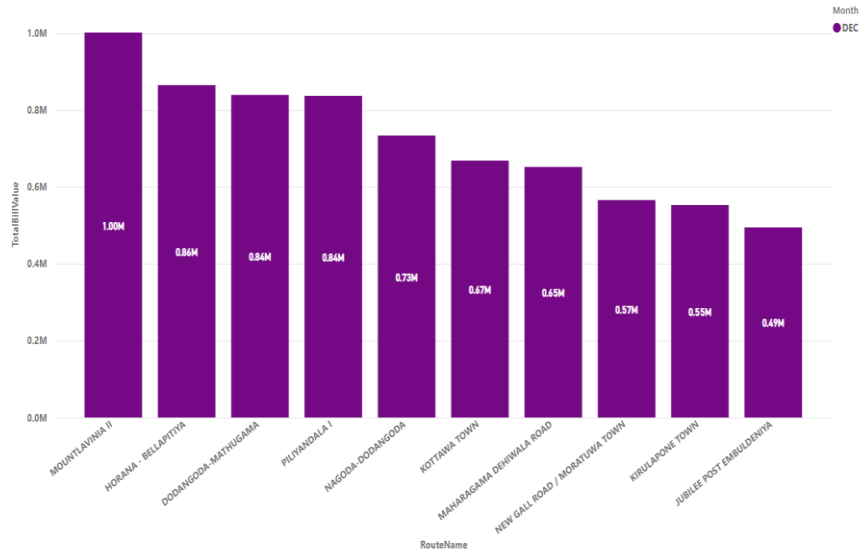


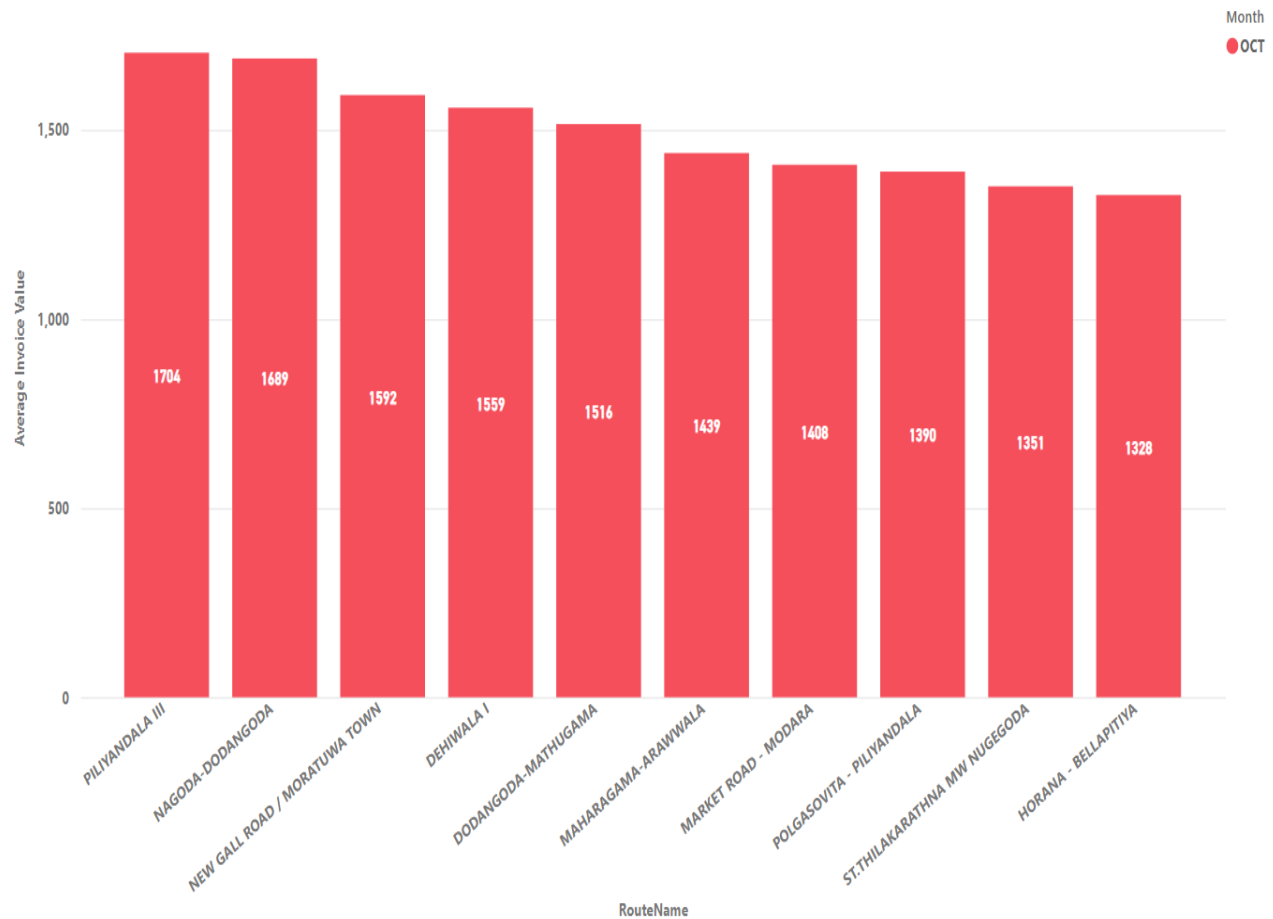
Figure 5-13 Bar chart(s) - routes with highest bill values

These bar charts show the top 10 routes with highest total bill values according to the months. In October and November, 'Nagoda-Dodangoda' route had the highest total bill value, but in December, 'Mount-Lavinia II' route had the highest bill value.

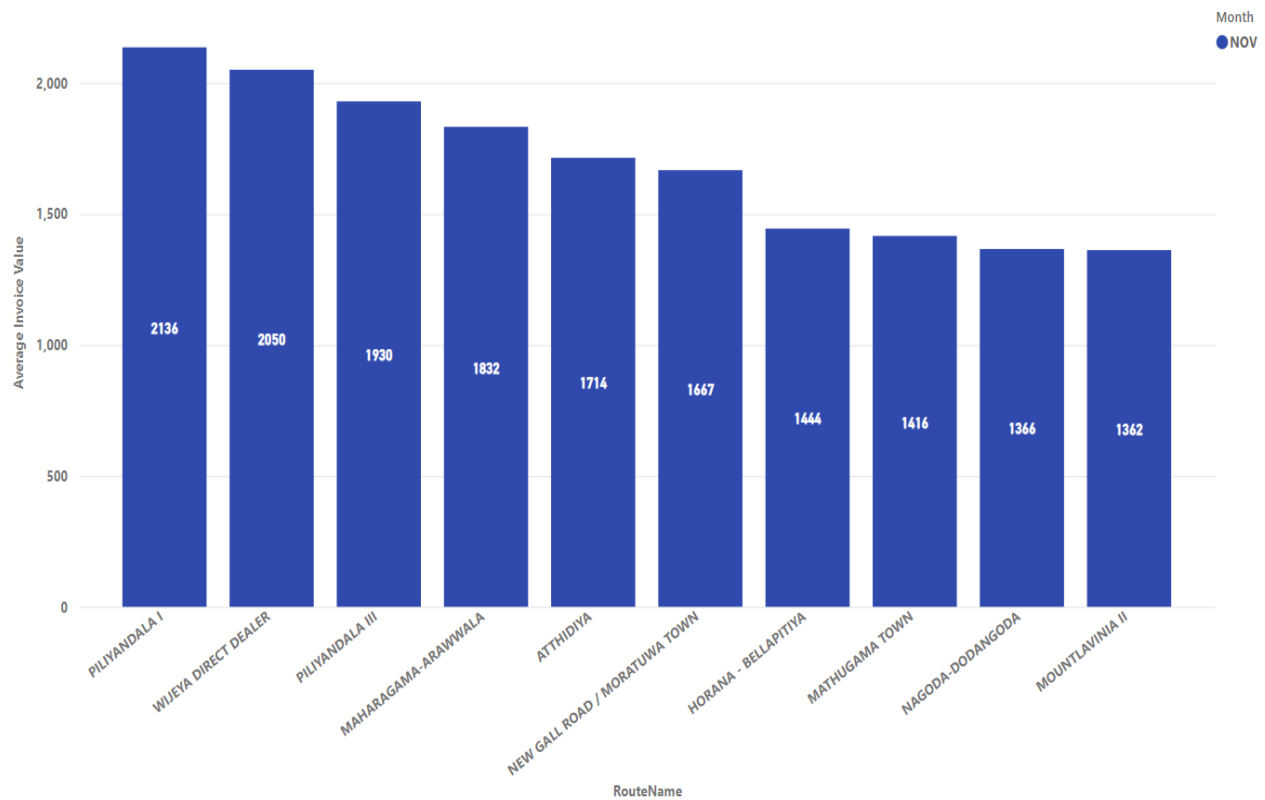
Also 'Nagoda-Dodangoda', 'Dodangoda-Mathugama' and 'New Galle road-Moratuwa town' routes are in the top 10 routes with highest total bill values in all three months.

KPI : Identifying routes with higher invoice values.

RouteKey	RouteName	Average Invoice Value	Month
232	PILIYANDALA III	1,704.06	OCT
145	NAGODA-DODANGODA	1,688.76	OCT
44	NEW GALL ROAD / MORATUWA TOWN	1,591.95	OCT
63	DEHIWALA I	1,558.61	OCT
141	DODANGODA-MATHUGAMA	1,515.51	OCT
230	MAHARAGAMA-ARAWWALA	1,438.75	OCT
193	MARKET ROAD - MODARA	1,407.90	OCT
244	POLGASOVITA - PILIYANDALA	1,389.66	OCT
186	ST.THILAKARATHNA MW NUGEGODA	1,350.70	OCT
249	HORANA - BELLAPITIYA	1,327.72	OCT



RouteKey	RouteName	Average Invoice Value	Month
236	PILIYANDALA I	2,135.94	NOV
262	WIJEYA DIRECT DEALER	2,050.50	NOV
232	PILIYANDALA III	1,929.73	NOV
230	MAHARAGAMA-ARAWWALA	1,832.45	NOV
67	ATTHIDIYA	1,714.15	NOV
44	NEW GALL ROAD / MORATUWA TOWN	1,667.02	NOV
249	HORANA - BELLAPITIYA	1,443.95	NOV
169	MATHUGAMA TOWN	1,415.90	NOV
145	NAGODA-DODANGODA	1,365.85	NOV
64	MOUNTLAVINIA II	1,361.89	NOV
224	KOTTAWA TOWN	1,332.75	NOV



RouteKey	RouteName	Average Invoice Value	Month
232	PILIYANDALA III	4,257.08	DEC
64	MOUNTLAVINIA II	2,235.66	DEC
262	WIJEYA DIRECT DEALER	1,995.27	DEC
236	PILIYANDALA I	1,932.83	DEC
249	HORANA - BELLAPITIYA	1,790.50	DEC
224	KOTTAWA TOWN	1,533.00	DEC
145	NAGODA-DODANGODA	1,458.65	DEC
63	DEHIWALA I	1,399.43	DEC
197	MAIN STREET	1,383.15	DEC
188	BANDARAGAMA UPTO KURUSAHANDIYA	1,280.77	DEC
41	KATUBADDA	1,271.19	DEC

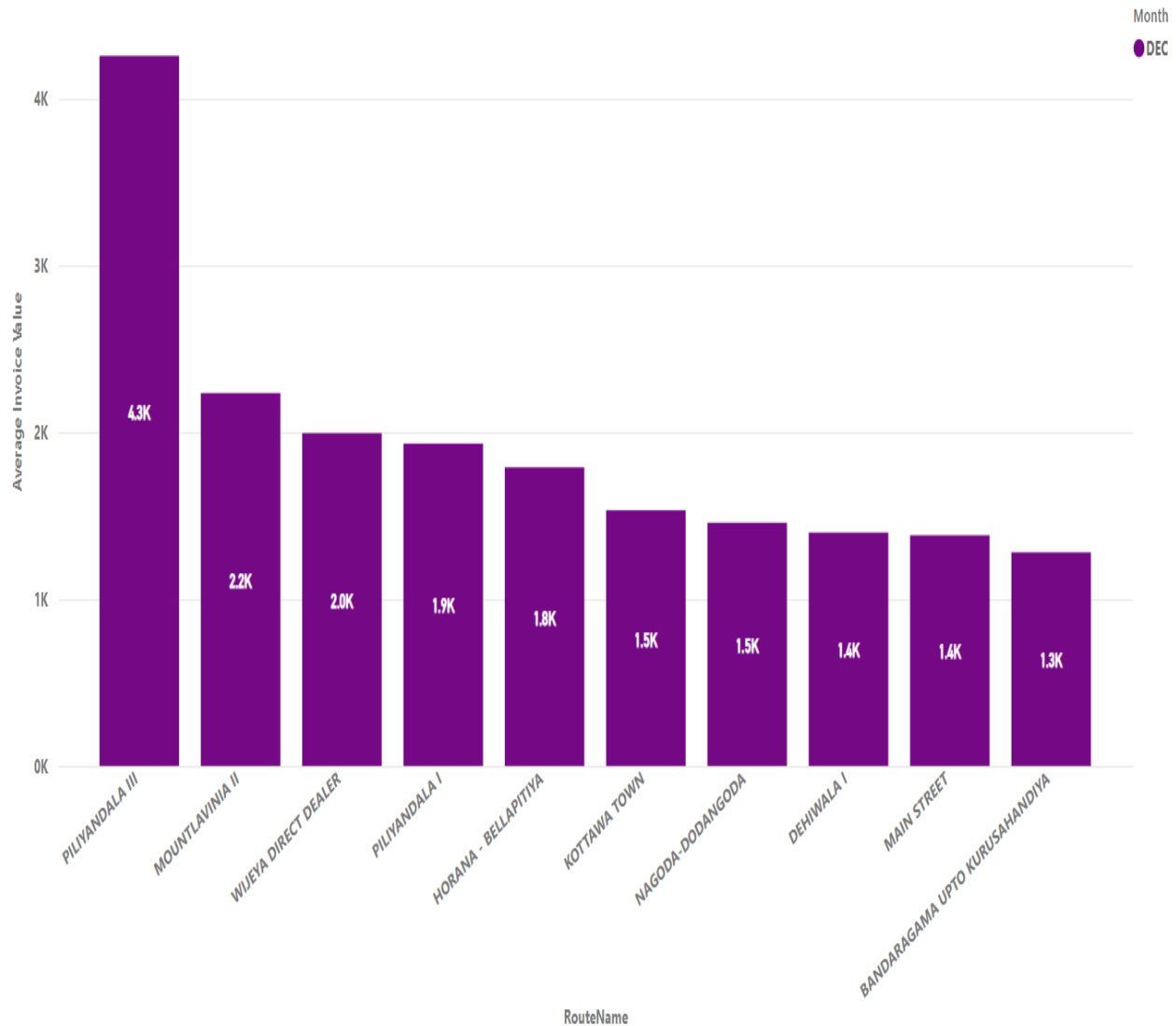


Figure 5-14 Bar chart(s) - highest average invoice values

These bar charts show the top 10 routes with the highest average invoice values according to the months. In October and December, 'Piliyandala III' route had the highest average invoice bill values but in November, 'Piliyandala I' route had the highest average bill value. Also 'Piliyandala I' route had the third highest average invoice value in November.

Also 'Nagoda-Dodangoda', 'Piliyandala III' and 'Horana-Bellapitiya' routes are in the top 10 routes with highest average invoice values in all three months.

As mentioned above, route 'Mahiyanganaya town' had the highest number of shops. This information will be useful for the company to supply an appropriate amount of products, and also to conduct promotional campaigns accordingly.

‘Nagoda-Dodangoda’ had the highest total bill value in October and November. But in December, that route went down to the fifth place in that chart. So it will be useful for the company to look into that.

Also, the company can give these routes with higher sales, the required attention they need, which may include giving higher priority in case of a stock shortage.

5.4. Sales rep profiling

KPI : Identify sales reps with higher target to actual sales ratio.

SalesRepKey	DateKey (groups)	NetValue	Target Month (groups)	Value	Actual/Target
128	Order_Oct	2,476,765.23	Taeget_Oct	1,516,370.78	1.63
126	Order_Nov	3,021,081.78	Target_Nov	2,162,923.82	1.40
130	Order_Dec	2,781,579.27	Target_Dec	2,000,013.95	1.39
131	Order_Nov	2,640,974.48	Target_Nov	2,043,880.15	1.29
124	Order_Dec	2,223,953.10	Target_Dec	1,800,781.40	1.23
123	Order_Oct	2,727,440.72	Taeget_Oct	2,208,807.03	1.23
134	Order_Nov	2,950,777.58	Target_Nov	2,441,718.65	1.21
128	Order_Dec	3,408,834.18	Target_Dec	2,858,769.00	1.19
129	Order_Nov	3,997,542.01	Target_Nov	3,361,770.11	1.19
123	Order_Nov	3,494,678.64	Target_Nov	2,949,955.25	1.18
124	Order_Oct	2,028,816.34	Taeget_Oct	1,740,620.39	1.17
126	Order_Dec	3,155,979.17	Target_Dec	2,710,206.54	1.16
124	Order_Nov	3,131,789.97	Target_Nov	2,702,310.10	1.16
130	Order_Nov	2,766,324.92	Target_Nov	2,391,381.23	1.16
129	Order_Oct	3,630,152.52	Taeget_Oct	3,171,580.68	1.14
127	Order_Oct	2,276,066.55	Taeget_Oct	2,000,583.82	1.14
126	Order_Oct	2,223,164.60	Taeget_Oct	1,959,449.75	1.13
127	Order_Dec	3,087,732.55	Target_Dec	2,751,154.49	1.12
134	Order_Dec	2,654,521.11	Target_Dec	2,420,515.45	1.10
125	Order_Dec	2,136,967.99	Target_Dec	1,950,669.41	1.10
133	Order_Dec	3,384,817.92	Target_Dec	3,127,675.11	1.08

Above part of the table shows the Actual sales(NetValue), order month(DateKey), Target sales(Value), TargetMonth and Actual/Target raitos of sales reps. There were 12 sales reps with salesRepKeys as 122,123,124,125,126,127,128,129,130,131,133 and 134.

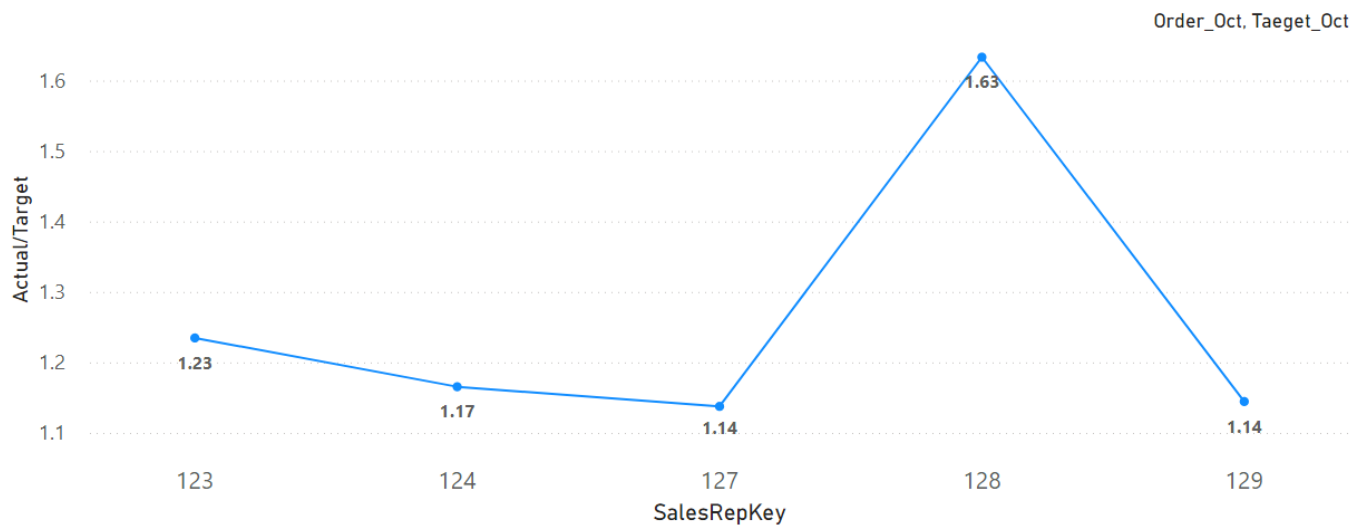


Figure 5-15 Top 5 sales reps with highest target to actual sales ratio in October

According to the above line chart 123, 124, 127, 128 and 129 sales reps have the highest actual/target ratios in month of October. Among them, the sales rep 128 has the highest ratio 1.63 indicating that in October, sales rep 128 has had the best performance.

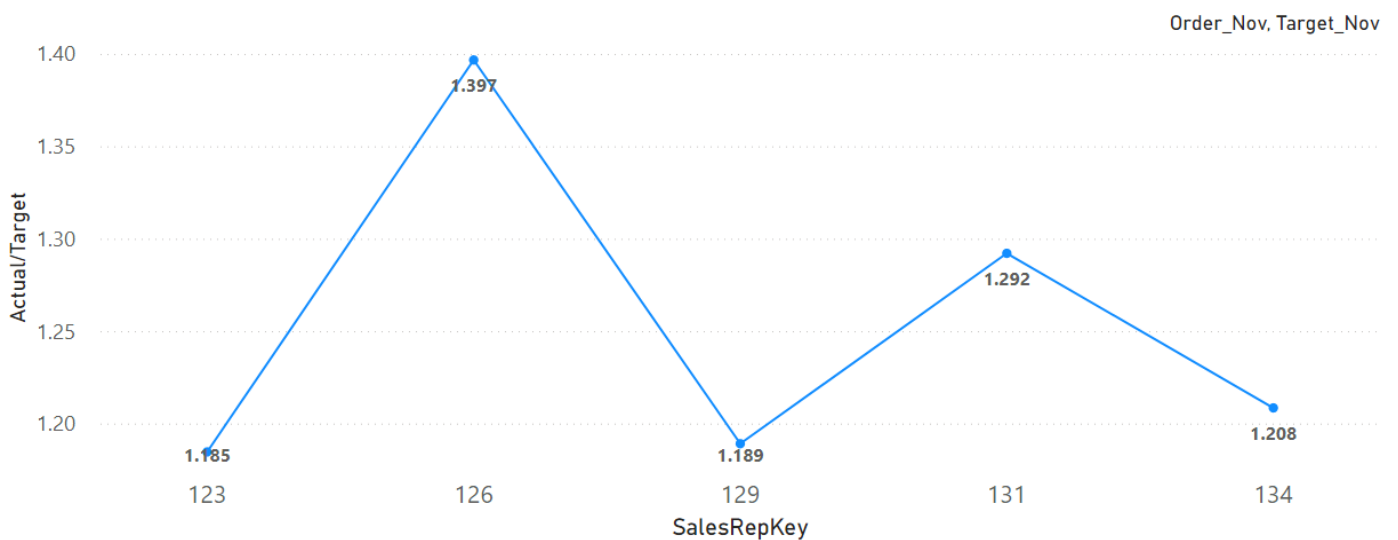


Figure 5-16 Top 5 sales reps with highest target to actual sales ratio in November

According to the above line chart, 123, 126, 129, 131 and 134 sales reps have the highest actual/target ratios in month of October. Among them 126 sales rep has the highest ratio 1.397 indicating that in November sales rep 126 has the best performance.

Among the top 5 sales reps in October and November, only sales reps 123 and 129 remain in top through both of the months.

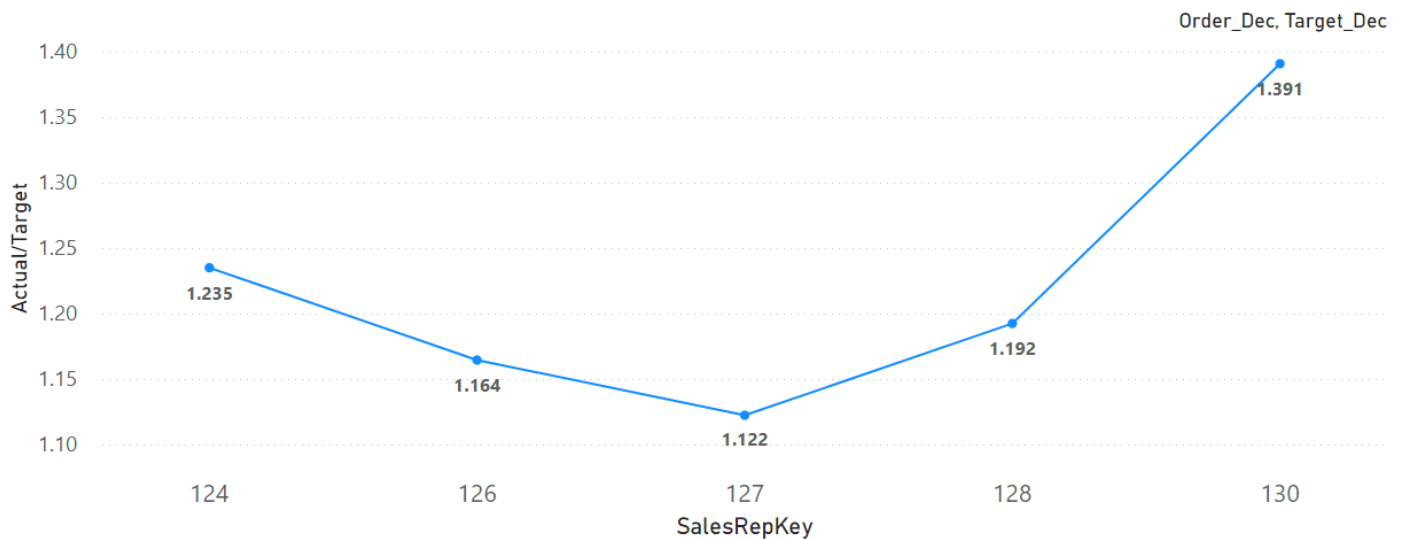


Figure 5-17 Top 5 sales reps with highest target to actual sales ratio in December

According to the above line chart 124, 126, 127, 128 and 130 sales reps have the highest actual/target ratios in month of October. Among them 130 sales rep has the highest ratio 1.391 indicating that in December sales rep 130 has the best performance.

When comparing above three line charts sales none of them have not remain in top 5 for all three months. Sales rep 130 is in top 5 of December even though he has not performed well in October and November. Sales reps 131 and 134 have performed well only in November.

KPI : Identify sales reps with higher order to return quantity ratio.

SalesRepKey	OrderUnitQty	DateKey (groups)	ReturnUnitQty	ReturnDateKey (groups)	Return/Order
133	52177	Order_Oct	14963	Return_Nov	28.68
131	38979	Order_Oct	9870	Return_Nov	25.32
133	67368	Order_Nov	15354	Return_Dec	22.79
124	41258	Order_Oct	6848	Return_Nov	16.60
131	43856	Order_Nov	6870	Return_Dec	15.66
126	44311	Order_Oct	6579	Return_Nov	14.85
126	61409	Order_Nov	8441	Return_Dec	13.75
129	64944	Order_Nov	8151	Return_Dec	12.55
122	41637	Order_Oct	5214	Return_Nov	12.52
128	41006	Order_Oct	4769	Return_Nov	11.63
129	59368	Order_Oct	6786	Return_Nov	11.43
125	38767	Order_Oct	4106	Return_Nov	10.59
124	48700	Order_Nov	4971	Return_Dec	10.21
128	50160	Order_Nov	5001	Return_Dec	9.97
130	47284	Order_Nov	4537	Return_Dec	9.60
122	45841	Order_Nov	4319	Return_Dec	9.42
127	47408	Order_Oct	3589	Return_Nov	7.57
123	43335	Order_Oct	2910	Return_Nov	6.72
127	63621	Order_Nov	4023	Return_Dec	6.32
130	39226	Order_Oct	2198	Return_Nov	5.60
125	45960	Order_Nov	2566	Return_Dec	5.58

Above part of the Power BI table shows the order unit quantity(OrderUnitQty), order month(DateKey), return unit quantity(ReturnUnitQty), return month(ReturnDateKey) and Return/Order ratios of each sales rep. A new measure is created by applying a query to get the ratio of order to return sales. There were 12 sales reps with SalesRepKeys as 122,123,124,125,126,127,128,129,130,131,133 and 134.

For Order_Oct, Return_Nov ratio = Returns in November/Orders in October

For Order_Nov, Return_Dec ratio = Returns in December/Orders in November

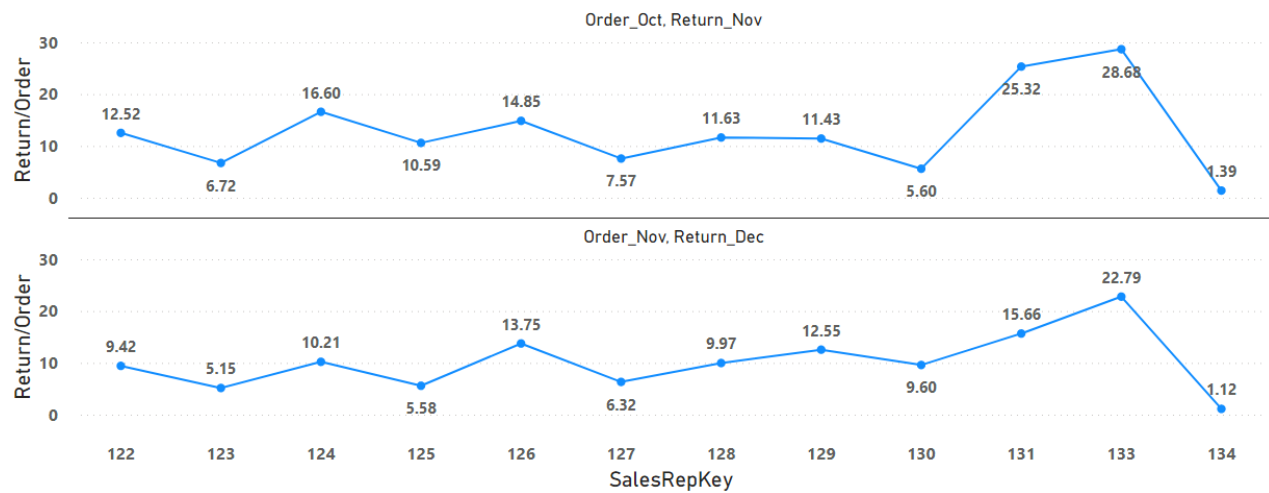


Figure 5-18 Order to Return quantity with respect to Sales Rep

According to above line chart, sales rep 133 has the highest Return/Order ratio in both charts. It indicates even though sales rep 133 has a higher order quantity in previous month, in the next month there is a higher return quantity. It is same for sales rep 131.

So, this might be a case of Cheating.

6. Conclusion

- The project was carried out mainly using Power BI and Python to find any prevailing drawbacks and potential opportunities to increase the overall effectiveness of the business operation.
- In terms of sales rep profiling, the sales reps with the highest sales in each month were found. The sales reps; 123, 124, 127, 128, and 129 are some of them. This is useful because it can be used to increase the sales efficiency by identifying sales reps with higher potential.
- And possible cases of cheating were found (sales reps 131 and 134). These potential cases of cheating can be taken care of, to further increase the efficiency.
- In product profiling, the highest selling products (such as sanitary napkins and nivarana) (October, November and December) and the Return-to-order ratios (October and November) were found.
- And also, a set of frequently bought products were found. (Mainly Wings and cough syrup)
- Under route profiling, the route with the highest number of shops was "Mahiyanganaya town" and the one with the highest bill amounts were "Nagala-Dodangoda" and "Mt. Lavinia II".
- And, under shop profiling, The outlets with the highest net value were COL93-A, COL93-C and KUR93-C. This information can be used by the company to develop the productivity in the process.