A Quantitative Study to Analyse and Optimise the Inventory and Sales for an Automobile Parts Retailing Shop

A Final Report for the BDM capstone Project

Submitted by

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1 Executive Summary and Title

This capstone project focuses on Kusum Enterprise (KE Henceforth), a Tata Motors Authorised Retailer situated at Chandrakona Road (CKR Henceforth) in West Bengal. Owned by Mr Joy Prakash Loadha. Positioned at the convergence of NH 14 and NH 116B and the Kharagpur-Bankura-Adra railway line, CKR is also a hotspot of timber and potato business on a large scale.

However, there are some major challenges faced by KE. An immediate concern is the problem of less profitability even after the location being, aforementioned, hotspot. Another issue that affects KE is poor inventory management. This has lead to a significant amount of dead stocks and impacts the demand fullfilment. Thus, these issues seem to be intertwined with each other.

It has been found that KE experiences seasonal sales trend, with peak months in April and September, attributed to factors like Benagli New Year.. May sees a sales slump, while June shows slight recovery, followed by a dip in July. August sees moderate stability while September-December sees better profitability due to advent of the festive season as well as agricultural activities. It has been seen that certain product categories are showing consistency in their good performance, indicating their importance. KE should try and capitalise on peak months, offer promotions during festivals and discounts and special offers during vacations and seasonal transition. They also need to enhance their online selling prowess. To understand customer behaviour shifts, KE can carry surveys, and utilise forecasting tools/softwares for better inventory management. Finding cross-selling products and bundling them for sales to utilise interdependencies in a positive manner is also a key factor that can optimise profitability.

2 Detailed Explaination of Analysis Method

The data spreads over April, 2023 to December, 2023 - collected during a series of visits. The dataset was computerised and consists of Product Particulars, Category, Opening Balance (including Quantity, Cost, and Total Value), Inwards (Purchase; including Quantity, Cost, and Total Value), Outwards (Sale; including Quantity, Cost, and Total Value), and Closing Balance (including Quantity, Cost, and Total Value), and Month of Sale.

The final analysis is done using Python Notebooks, and the overview of all the steps involved are as follows:

1) The data was first imported to google sheets, from where it was converted to a csv file in order to use it in Python notebook. Using a Python notebook has ensured the safety and easy accessibility of the code as well as the dataset. It has also helped in better error rectification and optimal modifications.

2) All the blank spaces in each cell of the dataset were carefully replaced with zero so as to quantify those cells/rows/attributes in a smoother manner. Pandas Dataframe utilities have been used for this purpose in the Python notebook.

3) Each attribute has been organised properly and separately, after thorough checking for mistakes. Crosschecking the shape of the dataset has helped in cementing the number of rows and columns in every step of analysis.

4) EDA has been done to check the nature of attributes; to understand the spread purchase and sale, depicting the most frequently occurring price ranges. Matplotlip package has helped in visualising these aspects.

5) Various graphs (line and scatter) have been plotted to understand the relationship between values like Sale, Profit, Price, and Month. Line plots have helped to understand the trend with respect to months better while scatter plots add to the understanding of correlations. Matplotlip package has been the main tool to visualise these relationships. Along with Matplotlib, Seaborn package has also helped at times.

6) Apart from visual representations, numerical/quantitative outputs have also been generated using Python code, which shows results much more objectively. This has been helpful in finding out outliers in terms of price of sales. This has also been helpful in finding turnover ratios and deadstocks from the dataset.

7) Finally the interpretations, inferences, and insights were derived based on the aforementioned steps and probable conclusions were drawn by incorporating the environment around KE with the observations from the analysis.

3 Results and Findings

For Dataset LINK: **Click Here**

In order to check the spread of purchase and sale values, the main dataset was divided into two separate sub-datasets - DS1, where only those rows were kept where the sales (Outwards Value) is not zero, and DS2 where only those rows were kept where the purchase (Inwards Value) is not zero. This has been kept intact for the time of April to December, 2023. Plotting the spread of sales from DS1, we see that it ranges from ₹12.72 to ₹2252756.52 with a mean of ₹21543.36. (Fig 1).
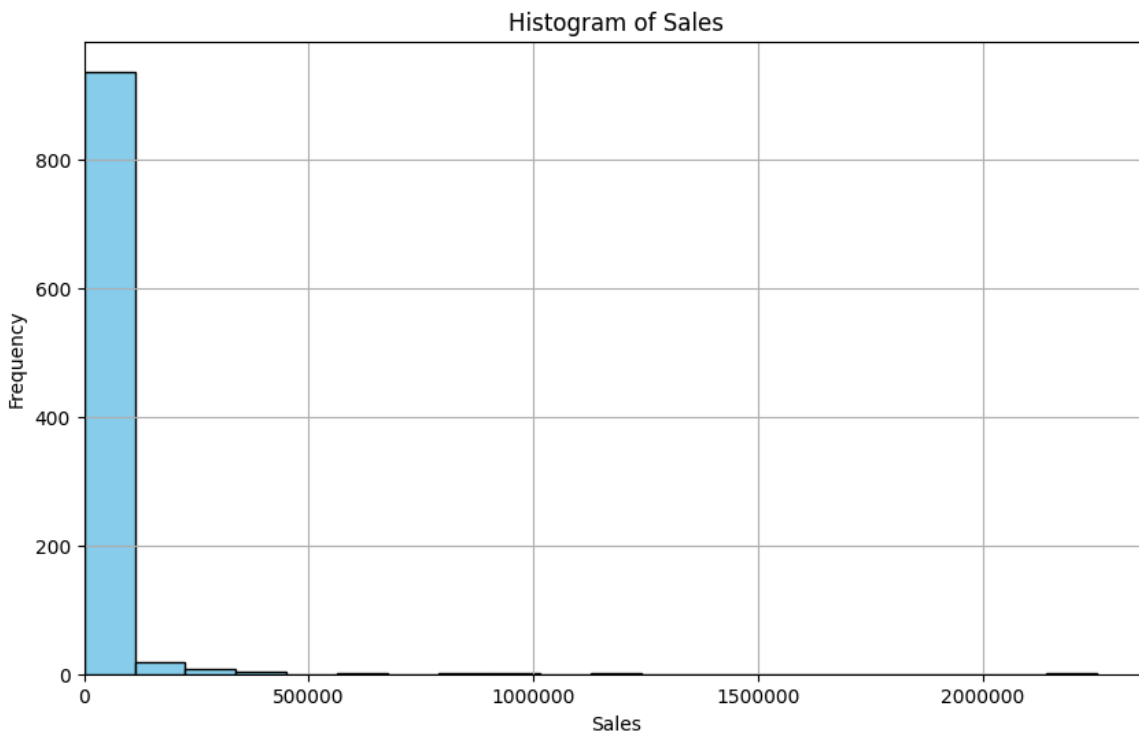

Fig 1: Histogram depicting spread of Sales (Outwards Value) from DS1

We can see that the frequency past ₹500000 are very low while most prominent frequency is below ₹30000. Considering the second plot derived from DS2 (Fig 2), we cansee that the minimum purchase is ₹32 while the maximum value is ₹2086043.02. The average value of purchase is ₹21983.23. The frequencies past ₹250000 is are low.
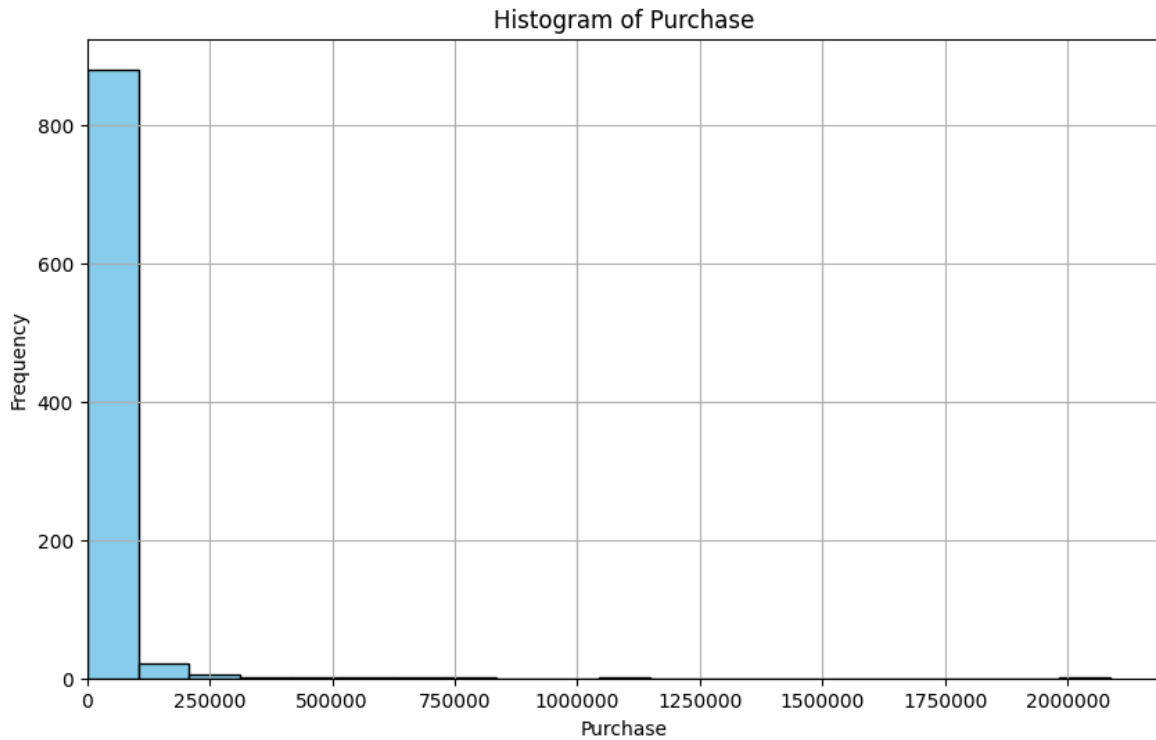
Fig 2: Histogram depicting spread of Purchase (Intwards Value) from DS2

From the main dataset stored in a variable "data", it was found that the top ten categories that add to the sale are Lubricant/Grease (₹2660733.35), Brake Components (₹2530279.11), Fluids (₹2300247.56), Suspension System (₹2127647.80), Engine Oil (₹1876276.81), Bearings and Bushings (₹1261027.05), Clutch Components (₹957716.44), Transmission Components (₹925686.85), Sensors (₹736111.93), and Miscellaneous (₹678572.32). (Fig 3).

```
category_sales=data.groupby('Category')['Outwards Value'].sum()
top_ten_categories=category_sales.nlargest(10)
print(top_ten_categories)

Category
Lubricants/Grease          2660733.35
Brake Components           2530279.11
Fluids                     2300247.56
Suspension System          2127647.80
Engine Oil                 1876267.81
Bearings and Bushings      1261027.05
Clutch Components           957716.44
Transmission Components     925686.85
Sensors                     736111.93
Miscellaneous               678572.32
Name: Outwards Value, dtype: float64
```

Figure 3: Code Snippet for Top 10 Categories adding to Sales (Outwards Value)

Now, we can also see (from Fig 4) that the top ten categories that add to tha purchase are Suspension System (₹2594128.95), Brake Components (₹2321475.10), Fluids (₹2127343.08) Lubricants/Grease (₹1904282.18), Engine Oil (₹1540386.02), Bearings and Bushings (₹1305513.73), Clutch Components (₹880509.38), Miscellaneous (₹879937.19), Transmission Components (₹760809.60), and Filters (₹695695.49).

```
category_purchase=data.groupby('Category')['Inwards Value'].sum()
top_ten_categories_pur=category_purchase.nlargest(10)
print(top_ten_categories_pur)

Category
Suspension System          2594128.95
Brake Components            2321475.10
Fluids                      2127343.08
Lubricants/Grease           1904282.18
Engine Oil                  1540386.02
Bearings and Bushings       1305513.73
Clutch Components            880509.38
Miscellaneous                879937.19
Transmission Components      760809.60
Filters                      695695.49
Name: Inwards Value, dtype: float64
```

Figure 4: Code Snippet for Top 10 Categories adding to Purchase (Outwards Value)

3.1 Sales

Now, when we plot the total sale over the months, we see that the highest sale amongs months is in April, nearing ₹4500000. From there, in May, it goes down to between ₹1500000 and ₹2000000. From May, it goes up in June, just crossing ₹2000000, only to go down again in July, below ₹1500000. In August it reaches up to almost ₹2000000, and going up between ₹2500000 and ₹3000000 in September. In October, the value is between ₹2500000 and ₹3000000 again but higher than September. In November, the value reaches ₹1500000 and whereas in December it goes up, crossing ₹2000000 but staying way below ₹2500000. (Fig 5).
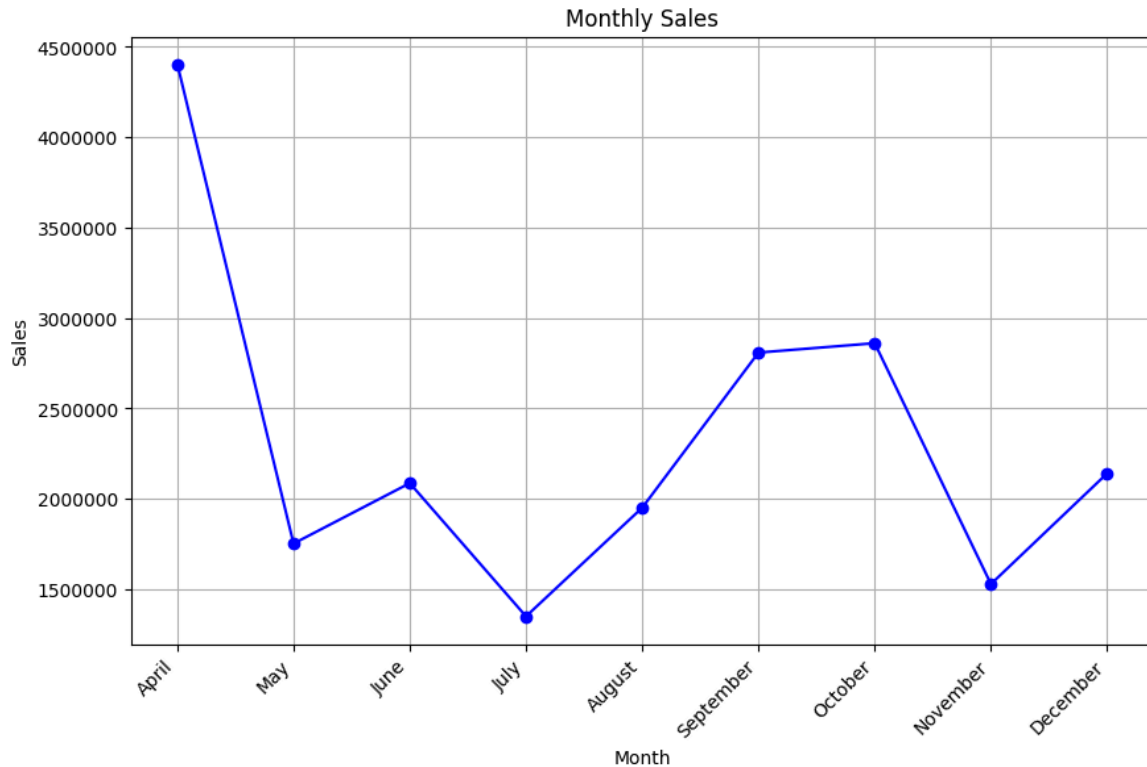
Figure 5: Change of Total Sale over Months

Now, on a monthly basis we will see which are the top 10 categories that add to the Sales. (Fig 6).

Top 10 Categories with Highest Sales in April:		Top 10 Categories with Highest Sales in July:		Top 10 Categories with Highest Sales in October:	
Category		Category		Category	
Fluids	2252756.52	Suspension System	382002.51	Brake Components	1314826.40
Lubricants/Grease	1000788.94	Bearings and Bushings	198978.45	Lubricants/Grease	636012.38
Engine Oil	417869.02	Transmission Components	165303.59	Engine Oil	207457.37
Clutch Components	208781.35	Electrical Components	75328.52	Suspension System	124209.73
Suspension System	133682.41	Engine Oil	70893.17	Clutch Components	117968.72
Bearings and Bushings	122681.37	Engine Components	66840.90	Oil Filter	77427.16
Electrical Components	36560.20	Lubricants/Grease	49194.90	Bearings and Bushings	59331.91
Transmission Components	26669.88	Rubber Components	43632.90	Miscellaneous	56239.12
Radiator Valve	25390.64	Fasteners	41913.57	Fuel System	53249.92
Belt Tensioner	24576.24	Tools and Accessories	41008.60	Counter Shaft	42968.75
Name: April, dtype: float64		Name: July, dtype: float64		Name: October, dtype: float64	
Top 10 Categories with Highest Sales in May:		Top 10 Categories with Highest Sales in August:		Top 10 Categories with Highest Sales in November:	
Category		Category		Category	
Filters	269169.54	Engine Oil	514209.29	Miscellaneous	453740.92
Engine Oil	230513.79	Suspension System	277784.83	Suspension System	361568.91
Air Filters	225483.29	Bearings and Bushings	264328.73	Bearings and Bushings	116615.17
Seals	184462.58	Filters	238701.09	Fuel System	82245.66
Automotive Tools	180279.96	Clutch Components	150828.50	Engine Components	73142.81
Bearings and Bushings	129457.00	Sensors	147896.71	Lubricants/Grease	70254.23
Suspension System	120529.88	Engine Components	70333.51	Clutch Components	61228.26
Brake Components	87428.92	Brake Components	56632.21	Brake Components	60630.42
Fasteners	54138.84	Fasteners	35566.67	Engine Oil	43587.96
Drivetrain	51562.50	Mirrors	30028.49	Synchronization Cone Assembly	28619.92
Name: May, dtype: float64		Name: August, dtype: float64		Name: November, dtype: float64	
Top 10 Categories with Highest Sales in June:		Top 10 Categories with Highest Sales in September:		Top 10 Categories with Highest Sales in December:	
Category		Category		Category	
Sensors	582877.19	Lubricants/Grease	896008.40	Engine Oil	367177.87
Suspension System	306599.36	Brake Components	483369.66	Brake Components	359415.52
Fuel System	243814.83	Transmission Components	318078.46	Transmission Components	316825.92
Bearings and Bushings	240756.16	Clutch Components	212550.02	Seals	251170.85
AdBlue	157364.09	Suspension System	197380.43	Suspension System	223889.74
Brake Components	136700.52	Steering System	141247.70	Bearings and Bushings	92221.06
Clutch Components	71424.66	Filters	100406.71	Miscellaneous	87299.01
Coolant	47479.72	Fluids	46219.88	Clutch Components	71460.81
Transmission Components	39375.05	Gaskets	42457.68	Fuel System	58691.46
Belts	38025.38	Cooling System	38281.32	Filters	32314.25

Figure 6: Top 10 Categories adding to the sale per month

1) Starting with April, we can see that Fluids add ₹2252756.52, Lubricant/Grease adds ₹1000788.94. Engine Oil, Clutch Compnents, and Suspension System add ₹417869.02, ₹208781.35, and ₹133682.41 respectively. Bearings and Bushings add ₹122681.37. Electrical Components, Transmission Components, Radiator Valve, and Belt Tensioner add ₹36560.20, ₹26669.88, ₹25390.64, and ₹24576.24 respectively.

2) For the month of May, Filters add ₹269169.54, Engine Oil add ₹230523.79, Air Filters and Seals add ₹225483.29 and ₹184462.58 respectively. Automotive Tools add ₹180279.96, Bearings and Bushings add ₹129457, Suspension System adds ₹120529.88. Brake Components, Fasteners, and Drivetrain add ₹87428.92, ₹54138.84, and ₹51562.50 respectively.

3) For June, Sensors add ₹582877.19, Suspension System add ₹306599.36, Fuel System add ₹243814.83, Bearings and Bushings add ₹240756.16, ADBlue add ₹157364.09, Brake Components add ₹136700.52. Clutch Components, Coolant, Transmission Components, and Belts add ₹71424.66, ₹47479.72, ₹39375.05, and ₹38025.38 respectively.

4) Coming to the month of July, Suspension System add ₹382002.51, Bearings and Bushings add ₹198978.45, Transmission Components add ₹165303.59, Electrical Components add ₹75328.52, Engine Oil, Engine Components, Lubricants/Grease and Rubber Components add ₹70893.17, ₹66840.90, ₹49194.90, and ₹43632.90 respectively. Fasteners add ₹41913.57 while Tools and Accessories add ₹41008.60.

5) In the month of August, Engine Oil add ₹514209.29, Suspension System add ₹277784.83, Bearings and Bushings add ₹264328.73, Filters add ₹238701.09, Clutch Components add ₹150828.50. Sensors, Engine Components, Brake Components, and Fasteners add ₹147896.71, ₹70333.51, ₹56632.21, and ₹35566.67 respectively while Mirrors add ₹30028.49.

6) September sees Lubricants/Grease, Brake Components, and Transmission Components adding ₹896008.40, ₹483369.66, and ₹318078.46 respectively. Clutch Components add ₹212550.02, Suspension System add ₹197380.43, Steering System add ₹141247.70, Filters add ₹100406.71, while Fluids, Gaskets, and Cooling System add ₹46219.88, ₹42457.68, and ₹38281.32 respectively.

7) Coming to October, Brake Components add ₹1314826.40, Lubricants/Grease add ₹636012.38, Engine Oil add ₹207457.37, Suspension System add ₹124209.73, Clutch Components add ₹117968.72. Oil Filter, Bearings and Bushings, Miscellaneous, Fuel System and Counter Shaft add ₹42968.75.

8) November has Miscellaneous add ₹453740.92, Suspension System add ₹361568.91, Bearings and Bushings add ₹116615.17, Fuel System add ₹82245.66, Engine Components add ₹73142.81, while Lubricants/Grease add ₹70254.23. Clutch Components, Brake Components, Engine Oil, and Synchronization Cone Assembly add ₹61228.26, ₹60630.42, ₹43587.96, and ₹28619.92 respectively.

9) Finally, in December, Engine Oil add ₹367177.87, Brake Components add ₹359415.52, Transmission Components add ₹316825.92, Seals add ₹251170.85, Suspension System add ₹223889.74, Bearings and Bushings add ₹92221.06, Miscellaneous adds ₹87299.01, Clutch Components add ₹71460.81, while Fuel System and Filters add ₹58691.46 and ₹32314.25 respectively.

3.2 Profitability

As far as Profitibiity is concerned, over the months, Fig 7 tells us that September sees the highest profitability, crossing ₹600000, followed by April, just crossing ₹600000.
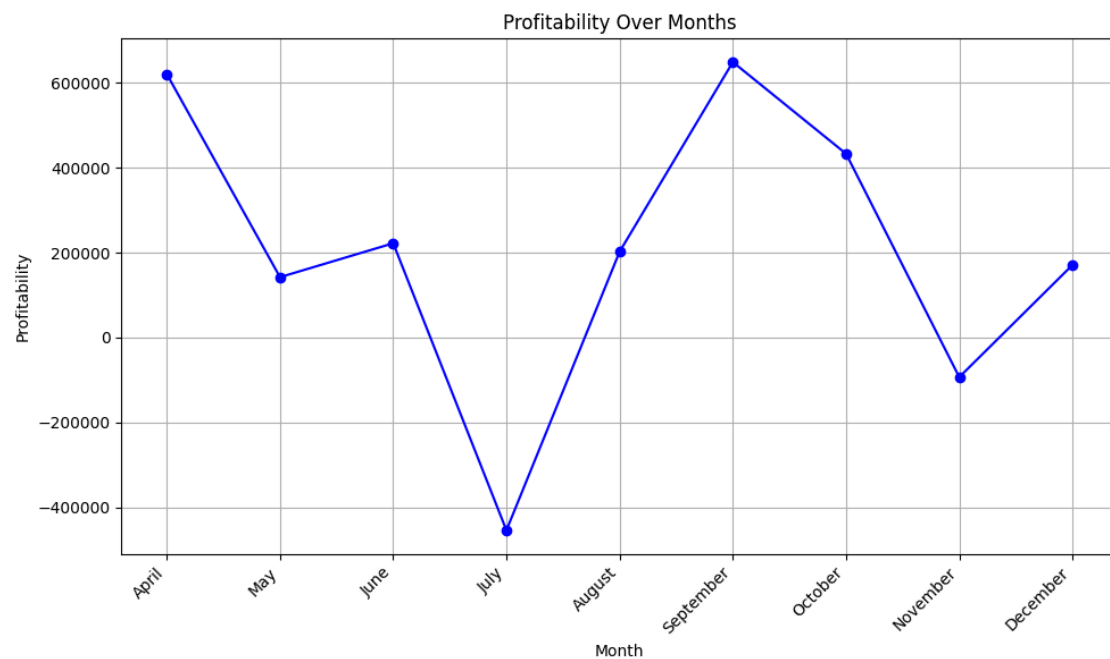

Figure 7: Profitability over Months

From April, it goes down between ₹0 and ₹200000 in May, while in June, it crosses ₹200000. From there, in July we see a loss crossing ₹400000, and then rise up to ₹200000 in August. From there, it gets its highest value in September and falls down in October, just crossing ₹400000. Again, it sees a loss while dipping below zero, half-way to ₹200000, only to rise up again above zero and reaching ₹200000 on the positive side. The Top 10 most profitable

categories overall are Lubricants/Grease (₹756451.17), Engine Oil (₹335881.79), Brake Components (₹208804.01), Fluids (₹172904.48), Transmission Components (₹164877.25), Sensors (₹113692.71), Clutch Components (₹77207.06), Coolants (₹61789.49), Gaskets (₹53820.88), and Electrical Components (₹39969.01). (Fig 8).

Figure 8: Top 10 Most Profitable Categories

From Fig 9., we can see that amongst the aforementioned categories, Transmission Components, Clutch Components, Engine Oil, Electrical Components, and Break Components form a cluster near the origin while Fluids have an outlier.
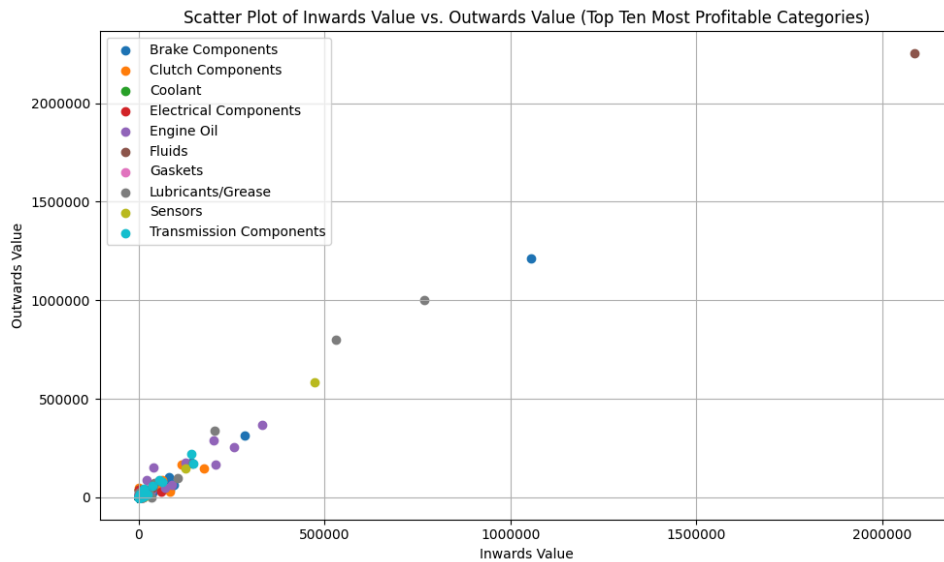

Figure 9: Scatter Plot of Top 10 Most Profitable Catgories

Rest of the categories also add to the cluster but the majority comprises of the aforementioned ones. Now, in order to check the ten most profitable categories in each month, we will be following the code snippets provided in Fig 10:

```
Top 10 Profitable Categories in April:   Top 10 Profitable Categories in July:      Top 10 Profitable Categories in October:
Category                                 Category                                   Category
Lubricants/Grease       233836.84        Electrical Components    65397.37           Lubricants/Grease         179558.04
Fluids                  166713.50        Transmission Components  39956.24           Brake Components          175324.72
Engine Oil              153475.13        Lubricants/Grease        28479.33           Miscellaneous              33102.52
Bearings and Bushings    42017.29        Fasteners                13415.44           Fans                       30000.32
Clutch Components        16220.13        Axle Components           9859.61           Oil Filter                 27992.37
Brake Components          9353.24        Clutch Components         9416.93           Counter Shaft              25446.55
Repair Kits               8593.80        Body and Frame            7797.65           Bearings and Bushings      14445.22
Axle                      7812.50        Fuel System               5897.78           Fasteners                   9090.37
Clutch                    7400.00        Bumpers                   3708.24           Power Steering Components    6308.59
Radiator Valve            5199.87        Diaphragm                 3600.75           Coolant                     5873.99
Name: April, dtype: float64            Name: July, dtype: float64                 Name: October, dtype: float64

Top 10 Profitable Categories in May:     Top 10 Profitable Categories in August:    Top 10 Profitable Categories in November:
Category                                 Category                                   Category
Engine Oil               89345.54        Engine Oil               74641.75           Bearings and Bushings      63045.76
Seals                    44525.59        Clutch Components        58711.12           Clutch Components          29287.00
Brake Components         31779.37        Sensors                  20762.71           Lubricants/Grease          26875.27
Electrical Components    26105.58        Assembly                 19125.01           Engine Oil                 15585.24
Suspension System        17768.63        Bearings and Bushings    17291.66           Fuel System                12306.14
Gaskets                  16922.87        Gaskets                  16661.70           Suspension System           9663.96
Automotive Tools         16464.68        Filters                  13265.30           Valve Components            6368.58
Gear Oil                 13254.27        Lubricants/Grease         8474.50           Cooling System              5859.38
Air Filters              10623.75        Mirrors                   6428.44           Transmission Components      5473.72
Filters                   8292.51        Miscellaneous             5655.38           Fasteners                   5209.76
Name: May, dtype: float64              Name: August, dtype: float64               Name: November, dtype: float64

Top 10 Profitable Categories in June:    Top 10 Profitable Categories in September:  Top 10 Profitable Categories in December:
Category                                 Category                                   Category
Sensors                 109521.23        Lubricants/Grease       314569.35           Transmission Components    91755.84
Brake Components         46742.71        Transmission Components  77470.31           Engine Oil                 32026.18
Bearings and Bushings    30880.17        Clutch Components        61563.38           Miscellaneous              28529.18
AdBlue                   25033.62        Suspension System        36120.82           Brake Components           22345.96
Gear Oil                 18439.04        Coolant                  36093.44           Coolant                    12086.82
Miscellaneous            13631.39        Steering System          26456.88           Clutch Components          11996.66
Coolant                  11855.22        Instrument Cluster       17895.08           Suspension System          11493.80
Belts                    11283.88        Brake Components         17827.18           Power Steering Components  10387.84
Transmission Components   8803.67        Tools and Accessories    17711.95           Gaskets                     8557.83
Engine Oil                8016.91        Gaskets                  14697.40           Fasteners                   7944.51
```

Figure 10: Top 10 Categories adding to the profit per month

1) In the month of April, Lubricants/Grease add ₹233836.84, Fluids add ₹166713.50, Engine Oil adds ₹153475.13, Bearings and Bushing add ₹42017.29. Clutch Components, Brake Components, Repair Kits, and Axle add ₹16220.13, ₹9353.24, ₹8593.80, and ₹7812.50 respectively. At the same time, Clutch and Radiator Valve add ₹7400 and ₹5199.87 respectively.

2) In May, Engine Oil add ₹89345.54, Seals add ₹44525.59, Brake Components add ₹31779.37, Electrical Components add ₹26105.58, and Suspension System add ₹17768.63. Gaskets, Automotive Tools, Gear Oil, Air Filters, and Filters add ₹16922.87, ₹16464.68, ₹13254.27, ₹10623.75, and ₹8292.51 respectively.

3) Coming to June, we see that Sensors add ₹109521.23, Brake Components add ₹46742.71, Bearings and Bushings add ₹30880.17, AdBlue add ₹25033.62, and Gear Oil add ₹18439.04. On the other hand, Miscellaneous, Coolant, Belts, Transmission Components, and Engine Oil add ₹13631.39, ₹11855.22, ₹11283.88, ₹8803.67, and ₹8016.91

4) July sees Electrical Components adding ₹65397.37, Transmission Components adding ₹39956.24, Lubricants/Grease adding ₹28479.33, and Fasteners adding ₹13415.44. At the same time, Axle Components add ₹9859.61, Clutch Components add ₹9416.93, Body and Frame add ₹7797.65, Fuel System add ₹5897.78, Bumpers and Diaphragm add ₹3708.24 and ₹3600.75 respectively.

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5) Coming to August, Engine Oil add ₹74641.75, Clutch Components add ₹58711.12, Sensors add ₹20762.71, Assembly add ₹19125.01, Bearings and Bushings add ₹17291.66, and Gaskets add ₹16661.70. On the other hand, Filters, Lubricants/Grease, Mirrors, and Miscellaneous add ₹13265.30, ₹8474.50, ₹6428.44, and ₹5655.38.

6) In September, Lubricants/Grease add ₹314569.35, Transmission Components add ₹77470.31, Clutch Components add ₹61563.38, Suspension System add ₹36120.82, Coolant add ₹36093.44, while Steering System, Instrument Cluster, and Brake Components add ₹26456.88, ₹17895.08, and ₹17827.18 respectively. On the other hand, Tools and Accessories and Gaskets add ₹17711.95 and ₹14697.40 respectively.

7) Coming to October, we see Lubricants/Grease add ₹179558.04, Brake Components add ₹175324.72, Miscellaneous adds ₹33102, Fans add ₹30000.32, Oil Filter add ₹27992.37, and Counter Shaft add ₹25446.55. Bearings and Bushings, Fasteners, Power Steering Components, and Coolant add ₹14445.22, ₹9090.37, ₹6308.59, and ₹5873.99 respectively.

8) In November, Bearings and Bushings add ₹63045.76, Clutch Components add ₹29287, Lubricants/Grease add ₹26875.27, Engine Oil add ₹15585.24, Fuel System add 12306.14, Suspension System and Valve Components add ₹9663.96 and ₹6368.58 respectively, while Cooling System, Transmission Components, and Fasteners add ₹5859.38, ₹5473.72, and ₹5209.76 respectively.

9) Finally in December, Transmission Components add ₹91755.84, Engine Oil add ₹32026.18, Miscellaneous add ₹28529.18, Brake Components add ₹22345.96, Coolant add ₹12086.82, Clutch Components add ₹11996.66, Suspension System add ₹11493.80, Power Steering Components add ₹10387.84, while Gaskets and Fasteners add ₹8557.83 and ₹7944.51.

3.3 Turnover Ratio and Deadstocks

Turnover Ratio will give us the an idea about the KE's inventory management, approximating how quickly particulars/categories are being sold. The formula that is being used is as follows:

$$Turnover\ Ratio\ =\ \frac{Cost\ of\ Goods\ Sold}{Average\ Inventory}$$

Where Cost of Goods Sold is the amount associated to the purchasing of goods whereas Average Inventory is the mean of the inventory at KE. Using this formula we found out that the top ten categories with the highest turnover ratio are Tank (19947.254), Differential (13003.313), Electronic Components (12130.168), Engine Set (9921.880), Axle (9729.787), Radiator Core (9200.460), Crown Wheel and Pinion (8393.507), Intercooler (8220), Alternator (7900), and Nut (7015.520).

At the same time, we also find that amongst the products (particulars) which are not even sold ones (deadstocks), the top ten categories which dominate these products are Suspension System (465 products), Electrical Components (218 products), Transmission Components (206 products), Bearings and Bushings (177 products), Clutch Components (148 products), Engine Components (148 products), Fasteners (144 products), Brake Components (125 products), Miscellaneous (95 products), and Engine Oil (65 products).

It was also found that out of 4085 products in the dataset, total products that did not get sold at all are 3101. This gives us a huge percentage of items not sold even once - 75.9%.

3.4 Outliers

When we plot the change of sale (Outwards Value) with respect to change in price (Outwards Rate), we also come across outliers. We have here considered three kinds of outliers - in terms of price, in terms of sale, and in terms of both. We found that:

1) In case of Outliers based on Price, there 22 products with categories being Clutch Components (7 products), Electrical Components (3 products), Sensors (2 products), Gear Components (1 product), Cooling System (1 product), Miscellaneous (1 product), Air Filters (1 product), Fuel System (2 products), Engine Components (2 products), Gaskets (1 product), and Axle Components (1 product).

2) In case of Outliers based on Sale, there are 8 products with categories being Brake Components (1 product), Miscellaneous (1 product), Fluids (1 product), Lubricants/Grease (3 products), Engine Oil (1 product), and Sensors (1 product).

3) In case of Outliers based on both Price and Sale, we have 1 product with the category being Sensors.

The total Outwards Value (Sale) contributed by the outliers is ₹8985683.37, which constitutes 43.044% of the Total Sale. These Outliers can be visualised by using Fig 11 which also shows the change of Sale with respect to Price.
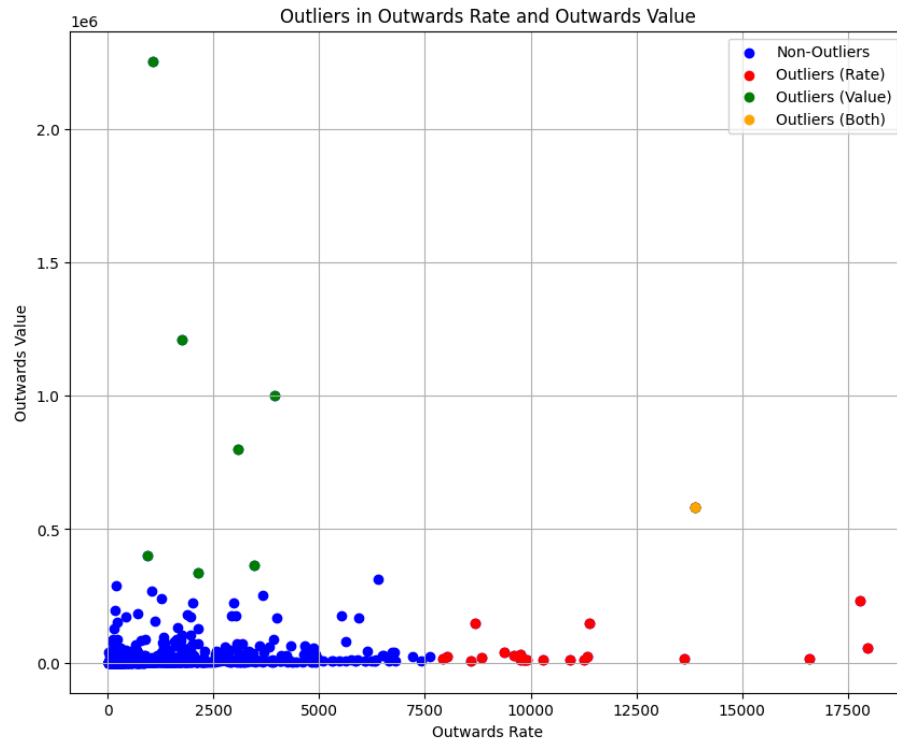
Figure 11: Scatter Plot of Change in Sale with respect to Price;Outliers based on Price/Rate in Red, based on Sale/Value in Green, based on both in Yelllow

Based on the dataset, the outliers across months are 5 in November, June, and July; 3 in October, April, May, and December; 2 in August and September. From Fig 12, we can see the average sale of Outliers over Months.
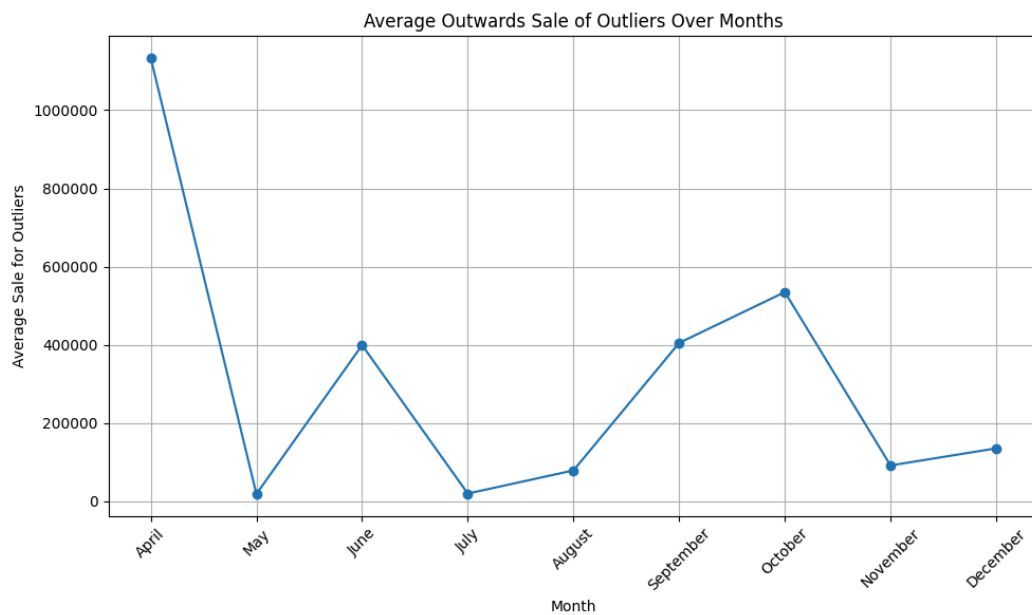

Figure 12: Average Sale of Outliers over Months

From Fig 12, we can see that Outliers add highest to the total sale in the month of April, well above ₹1000000, this goes down in May to near zero, from where it moves up to ₹400000. It again dips in July to near zero, moving back up in August between zero and ₹200000. In September it moves to ₹400000 from where it moves between ₹400000 and ₹600000 in October. It again comes back between ₹200000 and zero in November with moving a bit up but still staying between zero and ₹200000 in December.

4 Insights

Based on the aforementioned analysis, the following insights were made:

1) There exists a seasonal trend in sales as well as profitability over months. April and September consistently appear as peak months, with the former being at top in both the trends. This could point towards factors driving higher consumer demand and business performance.

2) The rise in sale and profit and April could also be linked with *Haal Khata*, a festival marking the celebration of New Year in terms of Benagli Calender (KE being situated in West Bengal). This marks the traders and business men closing old ledgers and open a new ledger for the new business season. At the same time, customers are invited to settle old debts and start afresh.

3) May has consistently shown a slump in both sales and profitibiliy. This could point at changes in consumer behaviour. At the same time, May sees the advent of Summer Vacations which could lead to shift in spending priorities as people might allocate their budgets towards travel, accommodation, and leisure activities. Individuals might also postpone repairs and upgrades to their vehicle until after the vacation period.

4) June sees slight recovery in both sales and profitability which could point at the business adapting to the seasonal shift and improved strategies. July appears to be a volatile month with sales and profitability both dipping down, while the latter shows some fluctuation. This could indicate unexpected expenses or hurdles in managing costs.

5) August has a relatively stable performance with sales and profitability maintaining a moderate level. This could point towards a period of consolidation or optimisation within the business operation.

6) The season of September-December sees better profitability and sales. Being the festive season, the region celebrates Vishwakarma Puja, Durga Puja, and Diwali

during this period, which often lead to increased consumer spending. Especially in the period of Vishwakarma Puja, people spend a lot on vehicle upgradations and repair. The region's involvement in the potato business suggest a strong agricultural presence, with the sowing period starting from mid-September to November while the harvesting starts from December. The whole procedure would require robust transportation facilities which would contribute to the higher demand of automotive parts and services. The dip in November could be due to it marking the transition period between sowing and harvesting.

7) Categories like Lubricants/Grease, Brake Components, Engine Oil, Suspension System, Bearings and Bushings, and Clutch Components consistently appear in both the overall top ten sales and monthly ones, indicating their importance throughout the year in driving sales.

8) Categories like Fluids might see higher sales in months of April and September, usually the seasonal maintenance months.

9) Categories like Sensor see significant spikes in certain months compared to overall performance, which might point to a demand trend.

10) There are instances of complementary sales as well, suggesting those categories being often brought together.

11) Suspension System, Bearings and Bushings, and Transmission Components appear often across multiple months. These categories might point towards their interdependence suggesting that sales in one category may positively influence the other.

12) Categories like Lubricants/Grease, Engine Oil, Brake Components, and Transmission Components appear consistently in overall and monthly top ten list of profitability, indicating a stable profitability throughout the season.

13) We see that Lubricants/Grease show significant spikes in profitability in April and September, indicating a potential seasonal demand.

14) Categories like Sensors and Bearings and Bushings are in top ten in specific months, indicating an increment in demand in those periods.

15) Engine Oil and Trasmission Components appear frequently together, suggesting a potential correlation.

16) The overlap of certain categories in lists of those adding to the most sales, most profitable, and deadstocks add to the fact that certain products in these categories are

struggling to attract customers, indicating inefficient product assortment and marketing.

17) KE might have overextended their product offerings which have added to failure in attracting customer interest.

18) KE may have misjudged customer preferences or might have come across unexpected consumer behaviour, leading to mismatch in supply and demand. 75.9% usold products is a sign of poor inventory management and lack of product assortment strategy.

19) Outliers in terms of price point that certain products within specific categories may have usually high or low prices compared to their counterparts. Those in terms of sales indicate products that deviate significantly from the average sales within their respective categories. Outliers based on both price and sale indicate potential areas of market volatility or niche demand.

5 Recommendations

Based on the above insights, we recommend the following steps to KE in order to increase profitability and enhance inventory management:

1) KE needs to capitalise and align marketing efforts in the peak months of April and September. They also need to promote during festive seasons of Haal Khata, Vishwakarma Puja, and Durga Puja. Offering special discounts and promotions on products related to upgrades and repairs during such times to maximise sales.

2) In times of long vacations and holidays, some offer and discount could be provided. Enhancing online sale channels and marketing efforts to reach out to customers who may be less inclined to visit the store physically.

3) Building partnerships with complementary businesses or industries to create synergies and and tap into new customer segments.

4) Investigating the slump in May and the dip in July by the means of survey and market research to understand shifts in consumer behaviour during these periods. This would help them organise the inventory levels.

5) They need to utilise better forecasting tools/softwares to recognise demand fluctuations and ensure optimal stock levels to minimise deadstock. This would result in a much better dynamic inventory management system based on seasonal trends and consumer demand pattern.

6) By focusing on high-demand categories, like Lubricants/Grease, Brake Components, and Engine Oil, streamlining of products can be done. Eliminating or reducing inventory for low-performing products to make space for more profitable items.

7) KE can promote bundled deals to encourage customers to purchase related/cross-sellable items (especially items that frequently purchased together), which will lead to increment in average transaction value.

8) KE needs to ensure the availability of various products like Suspension System, Bearings and Bruhsings, and Transmission Components with the aim of recognising the interdependence of various product categories and cross-selling opportunities.

9) With the aim of optimising profitability and to align with customer needs, KE is required to identify the bottlenecks which directly affect the market volatility or niche demand. Various product categories need to be evaluated for the same.

10) KE needs to immediately resort to research on market conditions and various business performance metrics and regular review and analysis of sales data for ensuring areas of opportunities and improvement.

11) In general, it is also suggested that KE could cement its presence on the internet with a better and much furnished website, along with active presence on social media platforms. This would attract the young vehicle owners adding a new demographic to KE's customer base.