PRODUCT SALES ANALYSIS

Data Analytics with cognos – Phase 5 DOCUMENTATION

Team

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ABSTRACT:

This product sales analysis is a comprehensive study aimed at evaluating the performance and trends of a company's product sales. By leveraging historical sales data, this analysis seeks to provide valuable insights into product performance, customer preferences, and market dynamics. Through the application of data analytics and visualization techniques, the study uncovers patterns, identifies key drivers of sales, and offers actionable recommendations for optimizing product strategies and increasing revenue. The findings from this analysis can be used to make informed decisions, streamline inventory management, enhance marketing efforts, and ultimately drive business growth.

1.OBJECTIVE

The objective for a product sales analysis can include:

- **Performance Evaluation:** Assess how well products are selling to determine which are successful and which might need improvement or discontinuation.
- **Revenue Growth:** Identify opportunities to increase sales and revenue for specific products.
- **Market Trends:** Understand market trends and customer preferences to adapt product offerings accordingly.
- **Inventory Management:** Optimize inventory levels by analyzing sales patterns.
- **Pricing Strategy:** Determine the right pricing strategy for each product to maximize profitability.
- **Sales Channel Effectiveness:** Assess the performance of different sales channels (e.g., online, offline) for each product.
- **Customer Segmentation:** Analyze which customer segments are more likely to purchase certain products.
- **Competitive Analysis:** Evaluate how your product sales compare to competitors in the market.
- **Seasonal Analysis:** Understand seasonal variations in product sales to plan for peak periods.

- **Marketing Effectiveness:** Measure the impact of marketing campaigns on product sales.

2.DESIGN THINKING:

1.Empathize:

- **Understand your customers:** Conduct interviews and surveys to gather insights about your customers' pain points, preferences, and behaviors related to your product.
- **Create customer personas:** Develop profiles of your typical customers to better empathize with their needs and expectations.

2.Define:

- **Identify the problem:** Clearly define the specific challenges or opportunities related to product sales that you want to address.
- **Create a problem statement:** Craft a clear and concise statement that summarizes the problem you're trying to solve.

3.Ideate:

- **Brainstorm solutions:** Gather a cross-functional team and brainstorm ideas for improving product sales. Encourage creativity and diverse perspectives.
- Use techniques like mind mapping, brainstorming sessions, or SWOT analysis to generate ideas.

4.Prototype:

- **Develop a prototype:** Create a tangible representation of your proposed solutions. It could be a sales dashboard, a data visualization tool, or a new sales strategy.
- Keep it simple and low-cost to iterate quickly and gather feedback.

5.Test:

- **Gather feedback:** Share your prototype with a select group of customers or stakeholders and collect their feedback.

- **Iterate:** Based on feedback, refine your prototype or explore alternative solutions. Repeat the testing process as needed.

6.Implement:

- **Implement the best solution:** Once you have a viable solution, roll it out to a larger audience. Monitor its impact on sales and gather data.
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7.Evaluate:

- **Measure success:** Analyze the data collected during the implementation phase to assess the impact of your solution on product sales.
- **Adjust as necessary:** If the solution isn't achieving the desired results, go back to the ideation and prototyping stages to come up with new ideas.

3.DEVELOPEMENT PHASE

1.Define Objectives: Clearly define the objectives and goals of your sales analysis. What are you trying to achieve with this analysis? For example, you might want to understand which products are performing best, identify sales trends, or optimize pricing strategies.

2.Data Collection: Gather relevant data. This includes sales data, product data, customer data, and any other information that can help in your analysis. Ensure the data is accurate and complete.

Dataset Link: https://www.kaggle.com/datasets/ksabishek/product-sales-data

3.Data Cleaning and Preparation: Clean and preprocess the data. This step involves removing duplicates, handling missing values, and structuring the data in a way that's suitable for analysis.

4.LOADING THE DATASET:

1.Importing libraries:

Here, for preprocessing the dataset and manipulate the data, pandas is the library used to frame the data.

Code:

```
import pandas as pd
```

2.Loading the dataset:

In this step, we are framing the data into the table using DataFrame in pandas, and display the head or 5 rows of the dataset.

Code:

```
# Replace with the actual filename

file_path= "C:/Users/91962/Documents/phase3.csv"

df = pd.read_csv(file_path)
```

5.EXPLORING THE DATA SET:

After framing data, the first few or five rows of the data in displayed using the head() function.

Code:

```
print(df.head())
```

OUTPUT:

```
   Unnamed: 0        Date  Q-P1  Q-P2  Q-P3  Q-P4      S-P1      S-P2  \
0           0  13-06-2010  5422  3725   576   907  17187.74  23616.50
1           1  14-06-2010  7047   779  3578  1574  22338.99   4938.86
2           2  15-06-2010  1572  2082   595  1145   4983.24  13199.88
3           3  16-06-2010  5657  2399  3140  1672  17932.69  15209.66
4           4  17-06-2010  3668  3207  2184   708  11627.56  20332.38

       S-P3      S-P4
0   3121.92   6466.91
1  19392.76  11222.62
2   3224.90   8163.85
3  17018.80  11921.36
4  11837.28   5048.04
                                                          In [ ]:
```

6.DATA VISUALIZATION:

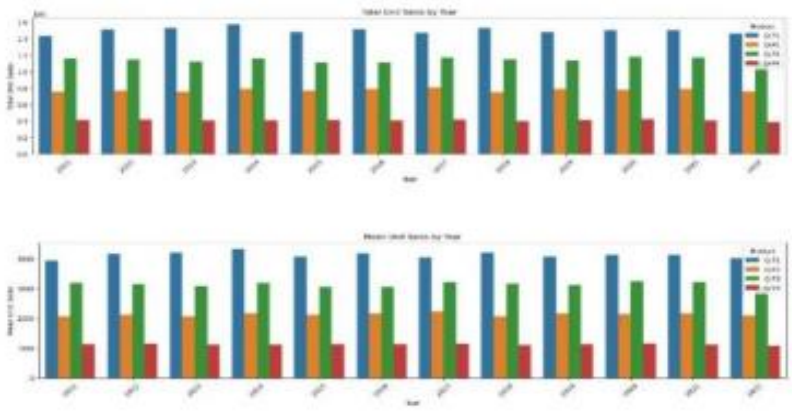
HISTOGRAM:

Graph our TOTAL & MEAN unit sold for each product using a histogram:

Create a function that allows us to plot a bar chart for the 4 products

```
Def plot_bar_chart(df, columns, stri, str1, val):

 # Aggregate sales for each product by year, by sum or mean

If val == 'sum':

Sales_by_year = df.groupby('Year')[columns].sum().reset_index()

 Elif val == 'mean':

Sales_by_year = df.groupby('Year')[columns].mean().reset_index()

# Melt the data to make it easier to plot

 Sales_by_year_melted = pd.melt(sales_by_year, id_vars='Year', value_vars=columns, var
_name='Product', value_name='Sales')

# Create a bar chart

Plt.figure(figsize=(20,4))

Sns.barplot(data=sales_by_year_melted, x='Year', y='Sales', hue='Product') #,palette="ci
vidis")

 Plt.xlabel('Year')

Plt.ylabel(stri)

Plt.title(f'{stri} by {str1}')

 Plt.xticks(rotation=45)

 Plt.show()

Plot_bar_chart(data_reduced, ['Q-P1', 'Q-P2', 'Q-P3', 'Q-P4'],'Total Unit Sales', 'Year', 'su
m')

 Plot_bar_chart(data_reduced, ['Q-P1', 'Q-P2', 'Q-P3', 'Q-P4'],'Mean Unit Sales', 'Year', '
mean')
```

OUTPUT:

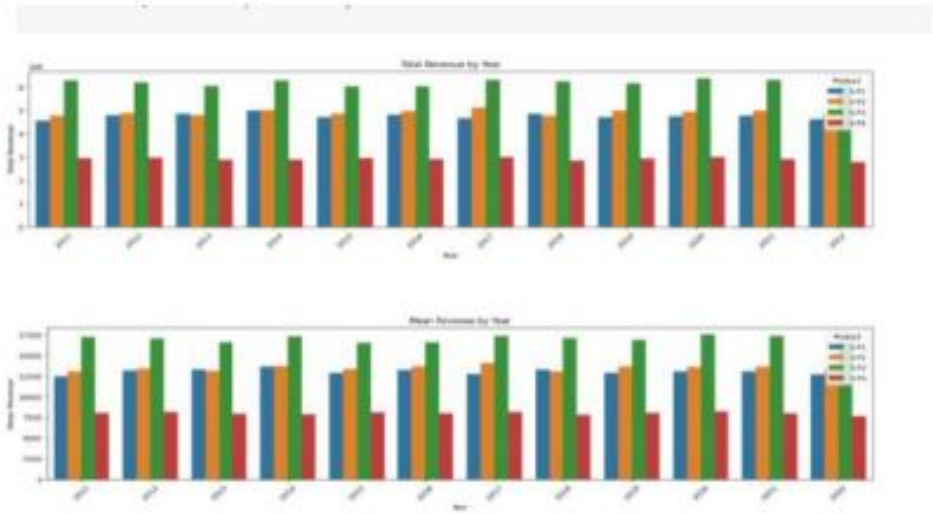


Graph our TOTAL & MEAN revenue of sales for each product u sing a historgram:

Plot_bar_chart(data_reduced, [‘S-P1’, ‘S-P2’, ‘S-P3’, ‘S-P4’], ‘Total Revenue’, ‘Year’, ‘sum ’)

Plot_bar_chart(data_reduced, [‘S-P1’, ‘S-P2’, ‘S-P3’, ‘S-P4’], ‘Mean Revenue’, ‘Year’, ‘mean’)

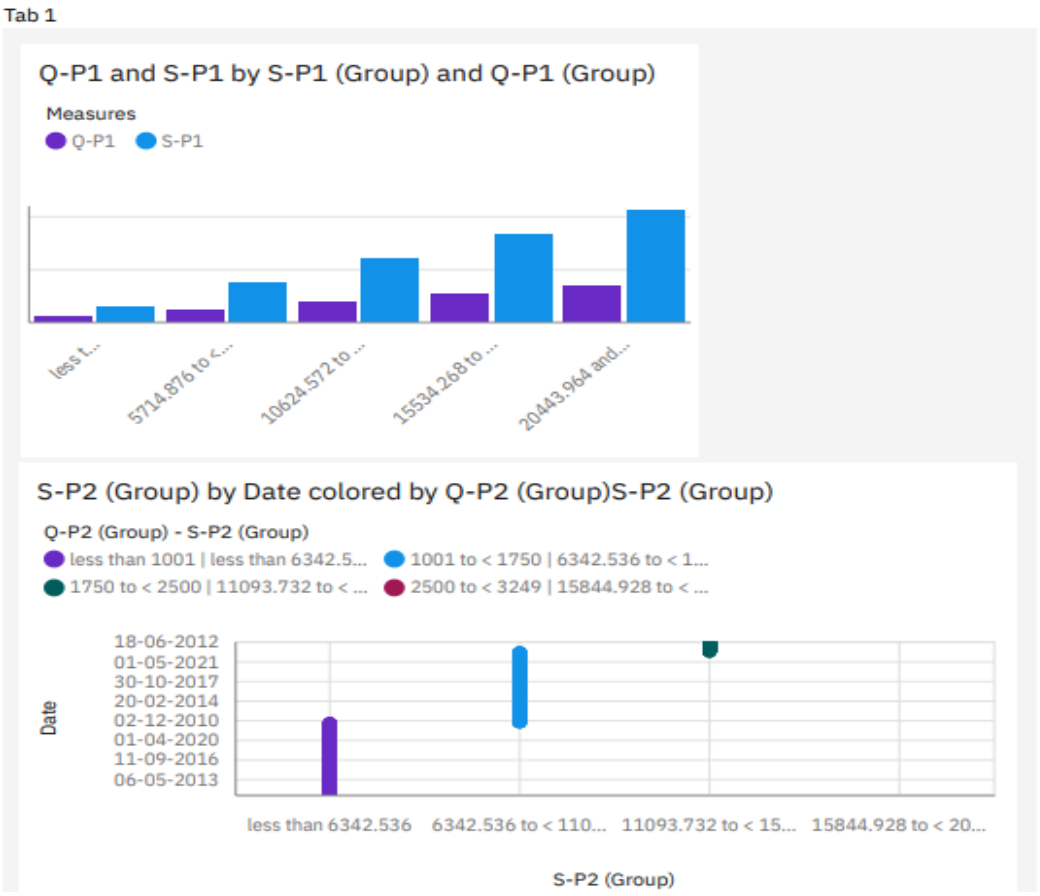
OUTPUT:



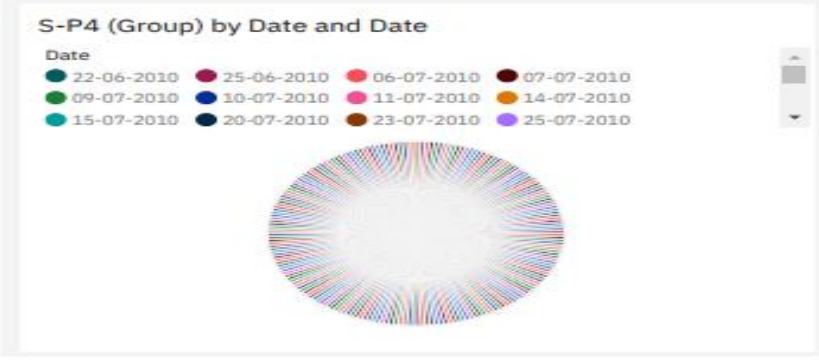
7. DATA VISUALIZATION

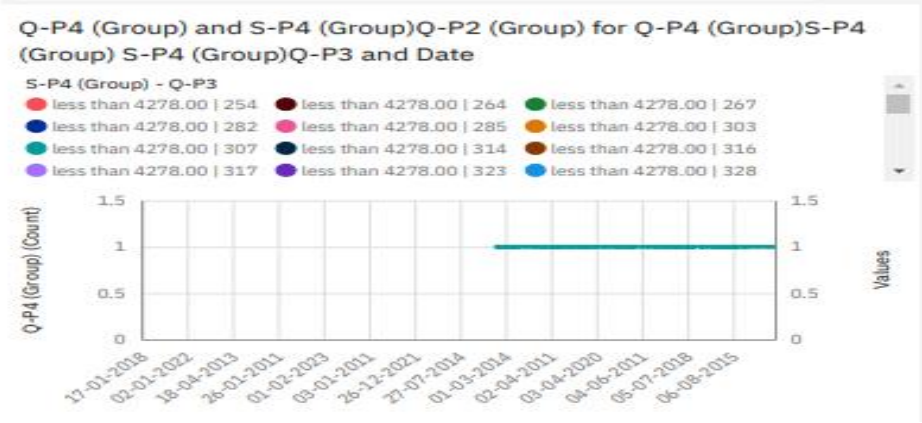
7.1 DATA ANALYTICS WITH IBM COGNOS

- IBM Cognos Introduction
  - Introduce IBM Cognos as a tool for data analytics.
- Data Exploration
  - Showcase how IBM Cognos aids in exploring and understanding the dataset.
- Visualization
  - Demonstrate the creation of visualizations in IBM Cognos.

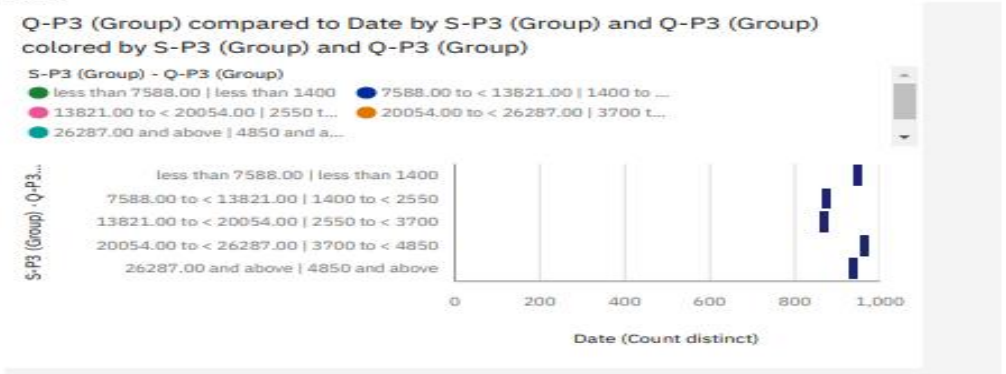


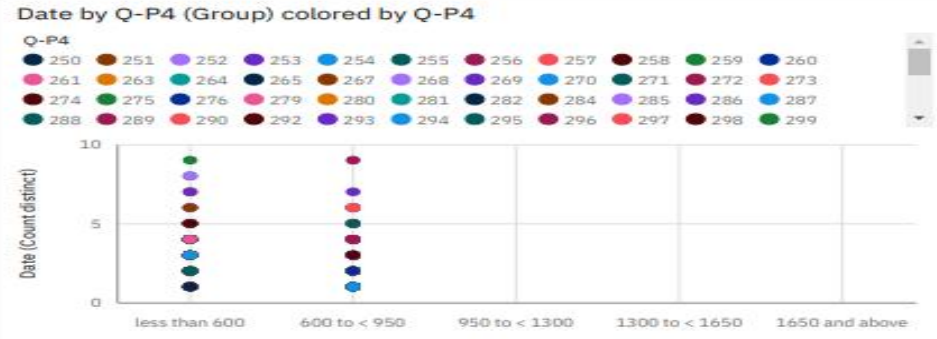
Tab 2

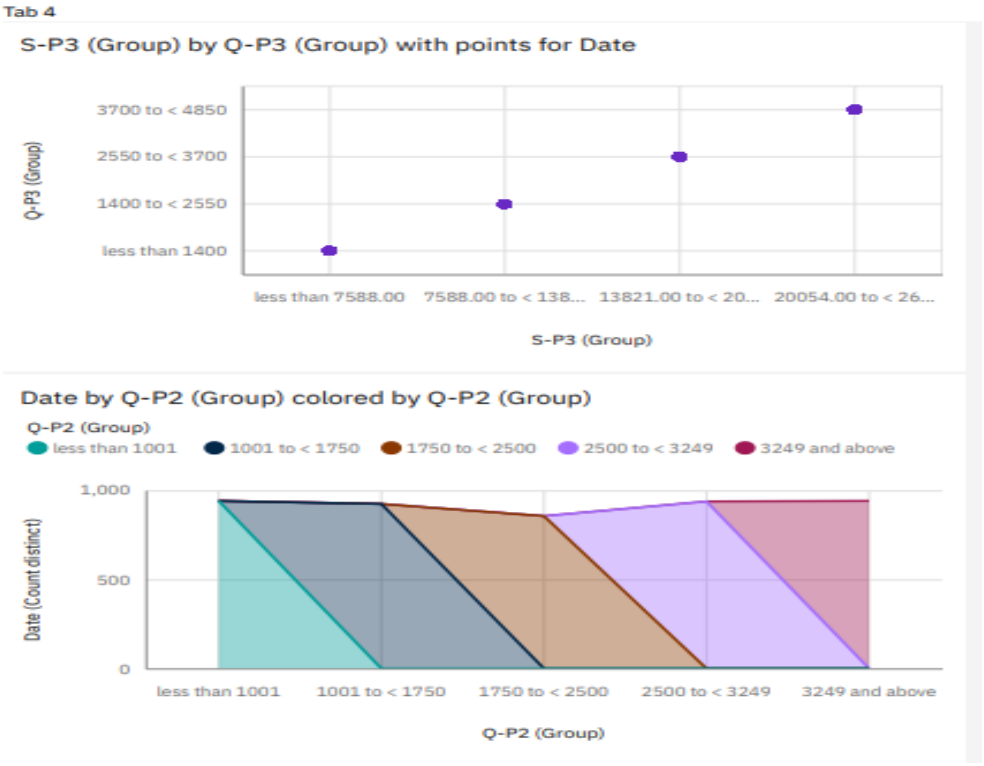

S-P4 (Group) by Date and Date
Date
22-06-2010
25-06-2010
06-07-2010
07-07-2010
09-07-2010
10-07-2010
11-07-2010
14-07-2010
15-07-2010
20-07-2010
23-07-2010
25-07-2010


Q-P4 (Group) and S-P4 (Group)Q-P2 (Group) for Q-P4 (Group)S-P4 (Group) S-P4 (Group)Q-P3 and Date
S-P4 (Group) - Q-P3
less than 4278.00 | 254
less than 4278.00 | 264
less than 4278.00 | 267
less than 4278.00 | 282
less than 4278.00 | 285
less than 4278.00 | 303
less than 4278.00 | 307
less than 4278.00 | 314
less than 4278.00 | 316
less than 4278.00 | 317
less than 4278.00 | 323
less than 4278.00 | 328
Q-P4 (Group) (Count)
Values
1.5
1
0.5
0
17-01-2018
02-01-2022
18-04-2013
26-01-2011
01-02-2023
03-01-2011
26-12-2021
27-07-2014
01-03-2014
02-04-2011
03-04-2020
04-06-2011
05-07-2018
06-08-2015

Tab 3

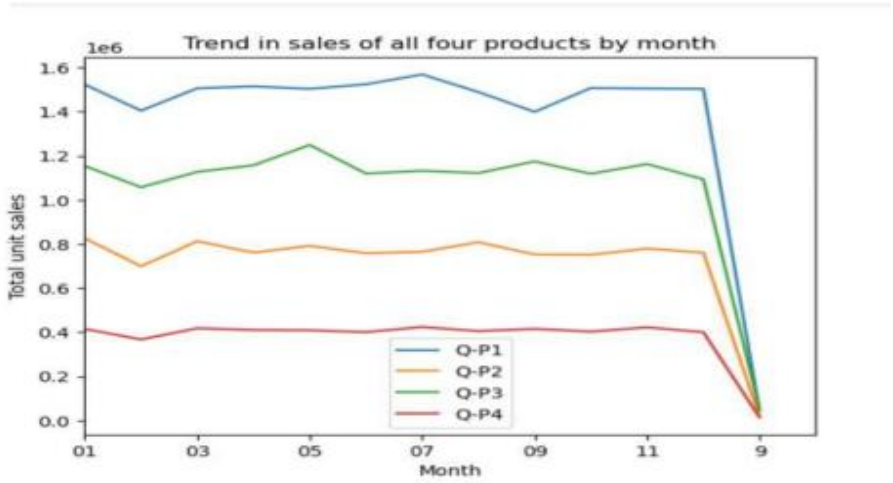

Q-P3 (Group) compared to Date by S-P3 (Group) and Q-P3 (Group) colored by S-P3 (Group) and Q-P3 (Group)
S-P3 (Group) - Q-P3 (Group)
less than 7588.00 | less than 1400
7588.00 to < 13821.00 | 1400 to ...
13821.00 to < 20054.00 | 2550 t...
20054.00 to < 26287.00 | 3700 t...
26287.00 and above | 4850 and a...
S-P3 (Group) - Q-P3...
less than 7588.00 | less than 1400
7588.00 to < 13821.00 | 1400 to < 2550
13821.00 to < 20054.00 | 2550 to < 3700
20054.00 to < 26287.00 | 3700 to < 4850
26287.00 and above | 4850 and above
0
200
400
600
800
1,000
Date (Count distinct)


Date by Q-P4 (Group) colored by Q-P4
Q-P4
250
251
252
253
254
255
256
257
258
259
260
261
263
264
265
267
268
269
270
271
272
273
274
275
276
279
280
281
282
284
285
286
287
288
289
290
292
293
294
295
296
297
298
299
Date (Count distinct)
10
5
0
less than 600
600 to < 950
950 to < 1300
1300 to < 1650
1650 and above



7.2 DATA VISUALIZATION WITH JUPYTER NOTEBOOK

```
Month_plot():
Fig, ax = plt.subplots()
 # Plot the sales data for each product by month
Data_reduced.groupby('Month')[['Q-P1', 'Q-P2', 'Q-P3', 'Q-
P4']].sum().plot(ax=ax)
# Set the x-axis limits to only show up to December
 Ax.set_xlim(left=0, right=13)
# Set the axis labels and title
 Ax.set_xlabel('Month')
 Ax.set_ylabel('Total unit sales')
 Ax.set_title('Trend in sales of all four products by month')
 # Show the plot
 Plt.show()
Month_plot()
Data_reduced['Month'] = data['Month'].replace('9', '09')
 Month_plot()
```



8.PREDICTIVE MODELLING:

Predictive modeling for product sales analysis involves using statistical and machine learning techniques to forecast future sales based on historical data. Here are the key steps to create such a model:

- **Data Collection:** Gather historical sales data, including information about the product, time, and any relevant factors that may influence sales, such as marketing campaigns, pricing, and seasonality.

- **Data Preprocessing:** Clean and prepare the data by handling missing values, outliers, and transforming features as needed. This may also involve creating new features, like lagged sales or seasonality indicators.

- **Feature Selection:** Identify the most important features that impact sales and select them for modeling.

- **Model Selection:** Choose an appropriate predictive modeling technique, such as linear regression, decision trees, random forests, or time series models like ARIMA or Prophet.

- **Model Training:** Split the data into training and validation sets, and train the chosen model on the training data.

- **Model Evaluation:** Evaluate the model's performance on the validation data using appropriate metrics, such as mean squared error (MSE) or mean absolute error (MAE).

- **Hyper parameter Tuning:** Fine-tune the model's hyper parameters to improve its performance.

- **Deployment:** Once the model performs well, deploy it to make predictions on new data.

- **Monitoring and Updating:** Continuously monitor the model's performance in the real world, and retrain or update it as needed to adapt to changing sales patterns.

- **Interpretability:** Understand the factors contributing to the predictions, as this can provide insights for decision-making and strategy adjustments.

9.INSIGHTS OF PRODUCT SALES ANALYSIS:

Product sales analysis provides valuable insights into the performance of your products and can guide decision-making. Here are some key insights that can be gained through product sales analysis:

- **Sales Trends:** Identify sales trends over time, including seasonality and long-term growth or decline.

- **Top-Selling Products:** Determine which products are the best sellers and contribute the most to revenue.

- **Sales Channels:** Understand where most sales are coming from, such as online, offline, or specific distribution channels.

- **Customer Segmentation:** Analyze customer demographics and preferences to tailor marketing and product offerings.

- **Pricing Strategies:** Evaluate the impact of pricing changes on sales and profit margins.

- **Inventory Management:** Optimize inventory levels by analyzing product turnover rates and identifying slow-moving items.

- **Sales Forecasting:** Use historical data to predict future sales, helping with inventory planning and resource allocation.

- **Promotion Effectiveness:** Measure the success of marketing campaigns and promotional efforts in driving sales.

- **Product Performance Over Time:** Track how product sales evolve as they age and become part of your product portfolio.

- **Competitor Analysis:** Compare your product sales to those of competitors to identify areas for improvement.
- **Customer Behavior:** Understand customer buying patterns, such as repeat purchases, cross-selling opportunities, and product bundling.
- **Geographic Insights:** Analyze regional variations in product sales to tailor marketing and distribution strategies.
- **Profitability Analysis:** Assess the profitability of each product by considering not just revenue but also costs and margins.
- **Outliers and Anomalies:** Identify unusual sales patterns that may require further investigation, such as unexpected spikes or drops in sales.
- **Customer Feedback:** Incorporate customer feedback and reviews to understand how it impacts sales and product quality.

10.CONCLUSION:

Product sales analysis is a critical aspect of business strategy and decision-making. It involves gathering and analyzing historical sales data to gain insights into product performance, customer behavior, and market trends.

In today's data-driven business environment, sales analysis plays a vital role in helping companies gain a competitive edge and adapt to evolving market dynamics. It's not just about looking at past performance but using historical data to shape the future of your products and business strategies.

LINK FOR JUPYTER NOTEBOOK (ipynb):

https://github.com/ELAKIYALOGANATHAN/Elakiya/blob/main/psa%20phase_4

https://github.com/ELAKIYALOGANATHAN/Elakiya/blob/main/PSA%20.ipynb

LINK FOR JUPYTER NOTEBOOK (pdf):

https://github.com/ELAKIYALOGANATHAN/Elakiya/blob/main/DAC_phase3-1.pdf

LINK FOR IBM COGNOS VISUALIZATION (pdf):

https://github.com/ELAKIYALOGANATHAN/Elakiya/blob/main/DAC%20_%20phase4(part2).pdf

GITHUB LINK:

PHASE 1:
https://github.com/ELAKIYALOGANATHAN/Elakiya/blob/main/DAC_Phase%201.pdf

PHASE 2:
https://github.com/ELAKIYALOGANATHAN/Elakiya/blob/main/DAC_Phase2.pdf

PHASE 3:
https://github.com/ELAKIYALOGANATHAN/Elakiya/blob/main/DAC_phase3-1.pdf

PHASE 4:
https://github.com/ELAKIYALOGANATHAN/Elakiya/blob/main/DAC%20_%20phase4(part2).pdf