

Phase - 5

Project Title: Product Sales Analysis

Problem Defenition:

The primary objective of our project is to leverage data analytics to gain in-depth insights and make informed decisions based on the sales data of our company's products. Through data-driven analysis, we aim to evaluate the sales performance, market dynamics, and customer behavior patterns. Specifically, we will utilize data analytics to assess and quantify trends, growth, or decline in sales, segment the market to identify high-demand products and key market segments, and profile customer buying behavior to understand their preferences and purchase patterns. Our project will also focus on optimizing inventory management through data-driven demand forecasting, implementing dynamic pricing strategies, and identifying underperforming products for improvement or discontinuation. Furthermore, we will use data analytics to predict seasonal variations and trends, conduct competitive analysis, segment customers, optimize sales channels, and develop advanced sales forecasting models. Additionally, we intend to analyze production and marketing costs, identify untapped sales opportunities, and enhance customer retention strategies, all driven by data analytics. Ultimately, our goal is to foster a data-driven decision-making culture within the organization, where insights from data analytics serve as the foundation for strategic sales and marketing initiatives.

DESIGN THINKING:

1. Identify Top Selling Products:

Analyze sales data to determine which products have consistently generated the highest revenue.

Calculate key performance indicators (KPIs) such as total sales, units sold, and revenue per product.

Objective: To provide a list of top-selling products and their contribution to overall sales.

2. Analyze Peak Sales Periods:

Examine historical sales data to identify seasonal patterns, trends, and peak sales periods.

Determine if there are specific months, weeks, or days when sales consistently spike.

Objective: To pinpoint peak sales periods for effective inventory management and marketing campaign planning.

3. Customer Preferences and Behavior:

Segment customers based on purchasing behavior, such as high-value customers, frequent buyers, or occasional shoppers.

Analyze customer demographics and preferences to understand who buys what and when.

Objective: To gain insights into customer segments and tailor marketing strategies accordingly.

4. Inventory Management Optimization:

Forecast future demand for products to assist in inventory planning.

Identify slow-moving or obsolete products that may require adjustments in stock levels.

Objective: To help businesses maintain optimal inventory levels and minimize carrying costs.

5. Marketing Strategy Improvement:

Analyze the effectiveness of past marketing campaigns and promotions.

Identify which marketing channels and tactics have the highest ROI.

Objective: To guide marketing efforts by focusing on strategies that yield the best results.

6. Visualize Insights in IBM Cognos:

Design relevant visualizations and reports within IBM Cognos to present key findings.

Create interactive dashboards for stakeholders to explore sales data intuitively.

Objective: To provide an accessible and user-friendly interface for decision-makers to interact with the data.

7. Derive Actionable Insights:

Summarize the analysis findings into actionable insights and recommendations.

Provide clear and data-backed recommendations for inventory adjustments and marketing strategy refinements.

Objective: To empower businesses with actionable insights for informed decision-making.

8. Data Quality Assurance:

Ensure the accuracy and integrity of the sales data used for analysis.

Implement data validation and cleaning processes to address any data quality issues.

Objective: To maintain data reliability throughout the analysis process.

9. Documentation and Knowledge Transfer:

Document the analysis methodology, data sources, and transformation processes.

Provide training and knowledge transfer to enable stakeholders to utilize IBM Cognos for ongoing analysis.

Objective: To ensure the sustainability of the analysis capabilities within the organization.

Development Phase

The development phase of a product sales analysis project using data analytics is a critical stage where you transform your project objectives into actionable steps and implement the necessary tools and methodologies to analyze the sales data effectively. Below are the key steps and components of the development phase for product sales analysis by data analytics:

1. Data Collection and Integration:

- Gather and compile relevant sales data from various sources, such as transaction records, CRM systems, e-commerce platforms, and marketing databases.
- Integrate data from multiple sources into a unified dataset for analysis.

2. Data Cleaning and Preprocessing:

- Identify and address data quality issues, such as missing values, duplicates, and outliers.
- Standardize and format the data for consistency and accuracy.

3. Data Transformation:

- Create new features or variables that may be useful for analysis, such as calculating total revenue, profit margins, or customer segments.
- Normalize or scale data if necessary.

4. Exploratory Data Analysis (EDA):

- Conduct EDA to understand the basic characteristics of the data, including summary statistics, data distribution, and initial visualizations.
- Identify potential patterns or anomalies in the data.

5. Hypothesis Formulation:

- Based on the project objectives, formulate specific hypotheses or questions that you aim to answer through data analytics. For example, you might hypothesize that a particular product's sales are influenced by pricing changes.

6. Model Selection and Methodology:

- Choose appropriate data analytics techniques and models to address your hypotheses and objectives. This could include regression analysis, time series analysis, clustering, or machine learning algorithms.
- Define the methodology for each analysis, including parameters and assumptions.

7. Feature Engineering:

- Select relevant features or variables that will be used as input for the analysis.
- Consider feature selection or dimensionality reduction techniques to improve model performance and interpretability.

8. Model Building:

- Implement the chosen data analytics models, applying them to the cleaned and transformed data.
- Train and fine-tune the models as necessary, and validate their performance using suitable metrics.

9. Data Visualization:

- Create visualizations to communicate findings effectively. This can include charts, graphs, and dashboards to present insights to stakeholders.

10. Sales Forecasting:

- If applicable, develop sales forecasting models based on historical data and use them to predict future sales trends.

11. Customer Segmentation:

- Apply segmentation techniques to categorize customers into distinct groups based on their behavior and characteristics.

12. Market Analysis:

- Analyze market trends, competitive performance, and market share using data analytics tools.

13. Reporting and Documentation:

- Document the entire data analytics process, including data sources, preprocessing steps, analysis methodologies, and results.
- Create a comprehensive report or presentation for stakeholders with clear, actionable insights.

14. Validation and Testing:

- Validate the accuracy and reliability of your models and findings through testing and validation against new data or holdout samples.

15. Implementation and Integration:

- Integrate the insights and recommendations from the analysis into the company's sales and marketing strategies.

16. Continuous Monitoring:

- Establish a system for ongoing data monitoring and analysis to ensure that sales performance is continuously tracked and evaluated.

17. Feedback and Iteration:

- Gather feedback from stakeholders and users of the analysis results and incorporate improvements or updates as needed.

The development phase is iterative and may require collaboration with various teams, such as data engineers, data scientists, business analysts, and domain experts. Successful execution of this phase will provide the foundation for data-driven decision-making and ultimately improve the company's sales and marketing strategies.

Analysis Objective:

The analysis objective in a product sales analysis using data analytics is the specific goal or purpose of conducting the analysis. It defines what you aim to achieve through the data analytics process and guides the entire analysis project. The analysis objective should be clear, measurable, and aligned with the broader business goals. Here's a more detailed description of the analysis objective:

Definition: The analysis objective sets the focus and direction of the product sales analysis by data analytics. It serves as a well-defined statement of what the analysis seeks to accomplish.

Specificity: The objective should be highly specific, leaving no room for ambiguity. It should state precisely what aspect of product sales you intend to explore or understand through data analytics.

Measurability: The analysis objective should be measurable, meaning that it should be possible to evaluate the success or achievement of the objective based on quantifiable metrics and criteria.

Relevance: The objective should be directly relevant to the broader business goals and decision-making needs of the organization. It should address a specific business challenge or opportunity.

Scope: The objective should define the scope of the analysis, including the time frame, the data sources to be used, and any particular segments or products under investigation.

Examples of Analysis Objectives: Depending on the project's context, the analysis objective can vary. Here are some examples:

1. Objective: "To identify the top-performing products in terms of revenue and growth over the last year."

- Specific: Identifying specific products.
- Measurable: Comparing revenue and growth.
- Relevant: Relevant to optimizing product offerings.

2. Objective: "To analyze the impact of pricing changes on sales volume and profitability."

- Specific: Analyzing pricing changes.
- Measurable: Measuring changes in sales volume and profitability.
- Relevant: Relevant to pricing strategy.

3. Objective: "To forecast sales for the next quarter and identify seasonal trends."

- Specific: Sales forecasting and identifying trends.
- Measurable: Accuracy of sales forecasts and seasonal patterns.
- Relevant: Relevant for demand planning.

4. Objective: "To segment customers based on their purchase history and behavior."

- Specific: Customer segmentation.
- Measurable: Number of customer segments and their characteristics.
- Relevant: Relevant to personalized marketing.

5. Objective: "To optimize inventory levels based on historical sales data and demand fluctuations."

- Specific: Inventory optimization.
- Measurable: Reduction in overstock and stockouts, cost savings.
- Relevant: Relevant to inventory management.

Significance: The analysis objective is significant as it guides the entire data analytics process. It ensures that the analysis is purpose-driven and that the results are actionable, ultimately leading to data-informed decision-making and improvements in product sales strategies.

DATA COLLECTION:

1. Data Assessment:

Review the provided dataset to understand its structure, contents, and data quality. Check for missing values, outliers, and any data anomalies that need to be addressed.

2. Data Integration:

If the dataset is fragmented or stored in different files, consolidate it into a single dataset. Ensure that data from different sources (e.g., transaction records, product information, customer demographics) are properly linked using common keys (e.g., product IDs, customer IDs).

3. Data Cleaning and Preprocessing:

Handle missing data by imputing values or removing incomplete records as appropriate.

Address outliers by determining whether they are legitimate data points or errors, and take appropriate action.

Standardize data formats and units (e.g., currency, date formats) for consistency.

Perform any necessary data transformations, such as aggregations or calculations, to prepare the data for analysis.

4. Data Privacy and Security:

Ensure that any sensitive or personally identifiable information in the dataset is handled in compliance with data privacy regulations.

Anonymize or pseudonymize data if required.

5. Data Validation:

Validate the accuracy and integrity of the dataset to ensure it aligns with the analysis objectives.

6. Data Documentation:

Maintain comprehensive documentation that describes the dataset, its sources, any transformations applied, and any cleaning processes performed.

7. Data Storage:

If the dataset is not already in a suitable format, consider storing it in a database or data warehouse that can be easily accessed by IBM Cognos for analysis.

8. Data Retrieval Automation:

If the dataset needs periodic updates, set up automated processes for retrieving and updating the data.

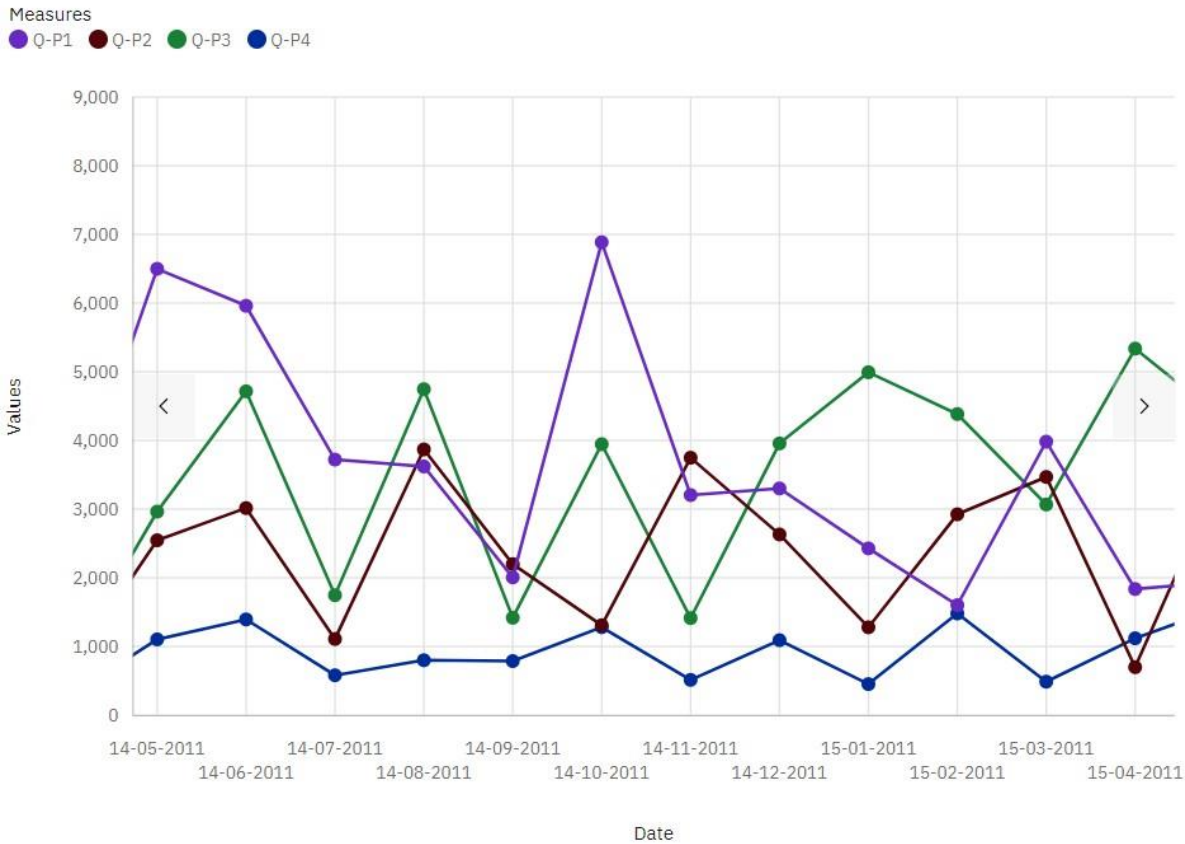
9. Data Exploration:

Before moving on to analysis in IBM Cognos, conduct exploratory data analysis (EDA) to gain a deeper understanding of the dataset's characteristics and relationships between variables.

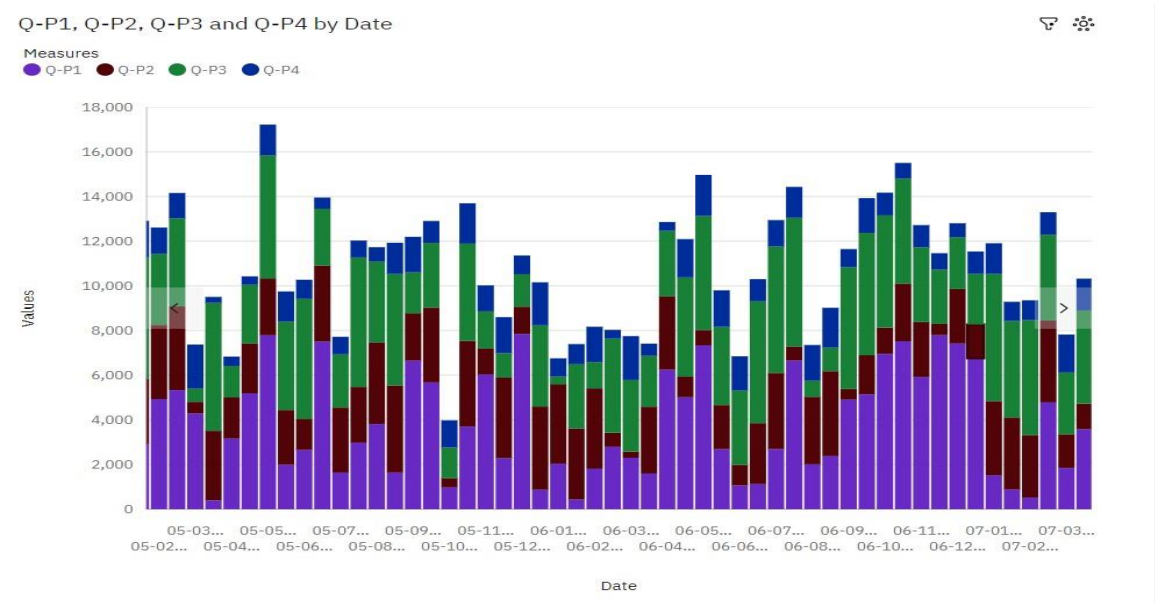
Once you have completed these steps, your prepared dataset will be ready for analysis in IBM Cognos to extract insights related to top-selling products, peak sales periods, and customer preferences, as outlined in the project objectives.

DATA Visualisation using IBM COGNOS:

Q-P1, Q-P2, Q-P3 and Q-P4 by Date

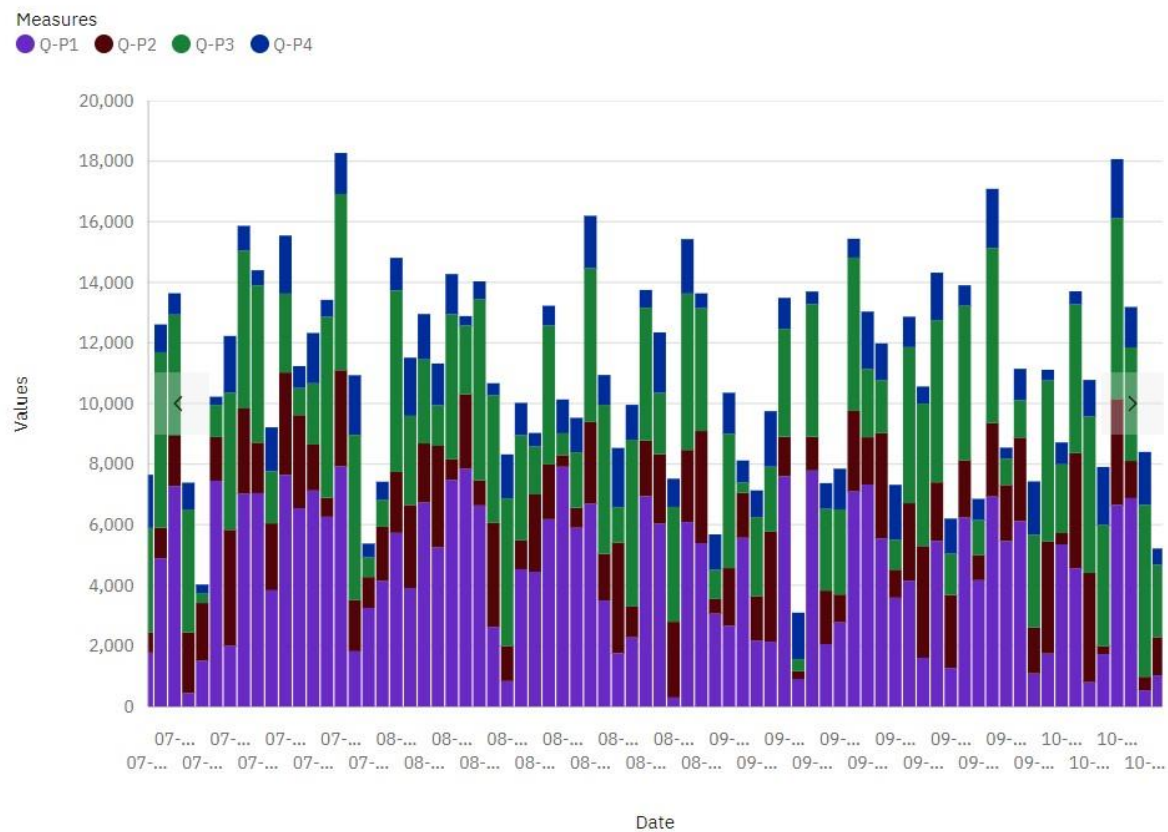


Line Chart for Dates.



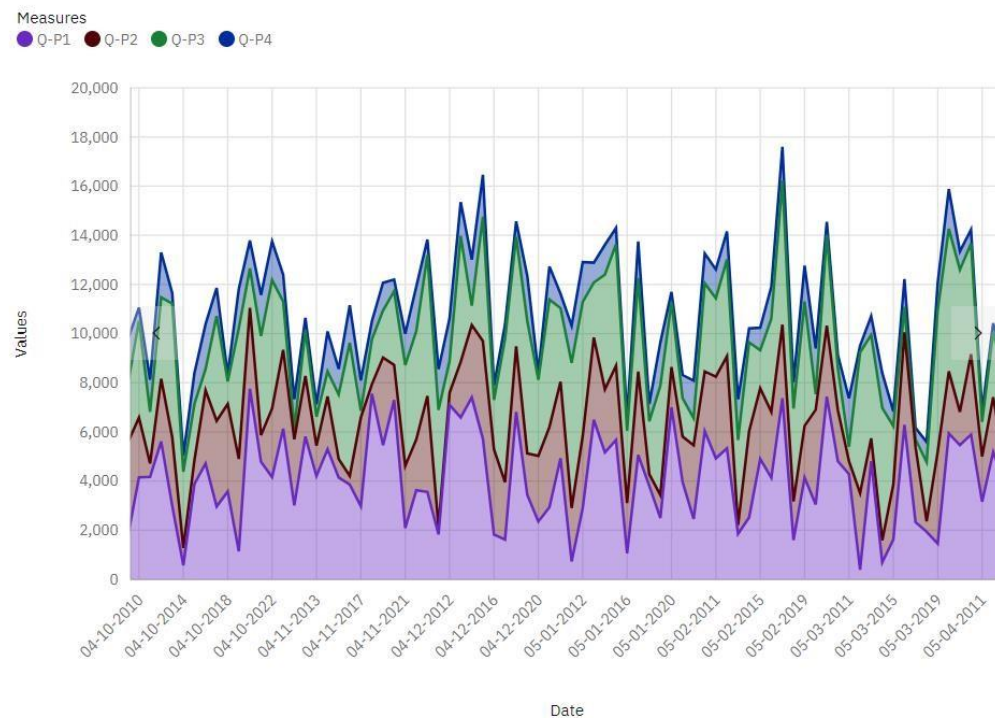
Bar Chart for Product vs Dates in 2011

Q-P1, Q-P2, Q-P3 and Q-P4 by Date



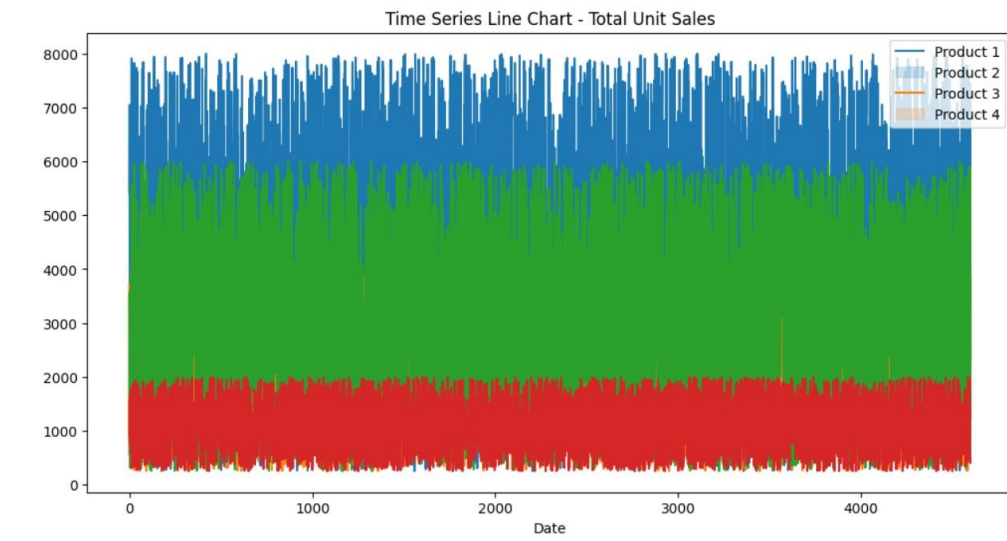
Bar Chart for Product vs Date in 2012

Q-P1, Q-P2, Q-P3 and Q-P4 by Date

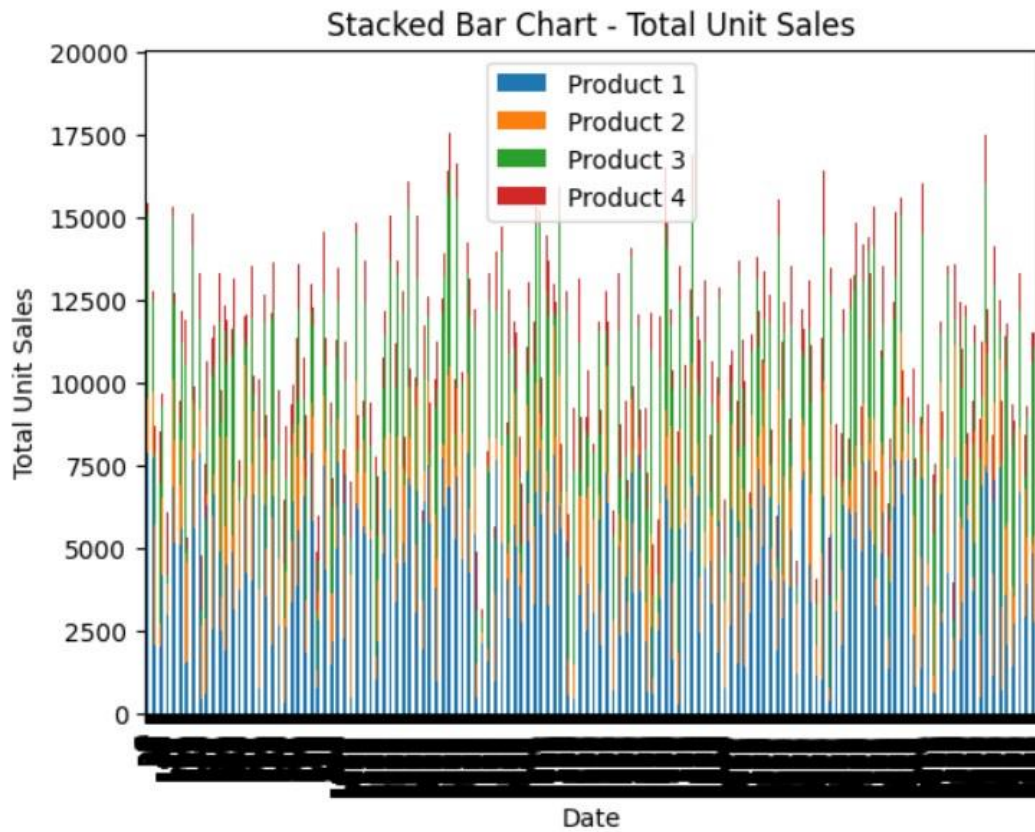


Area Chart for Dates vs Product in 2011

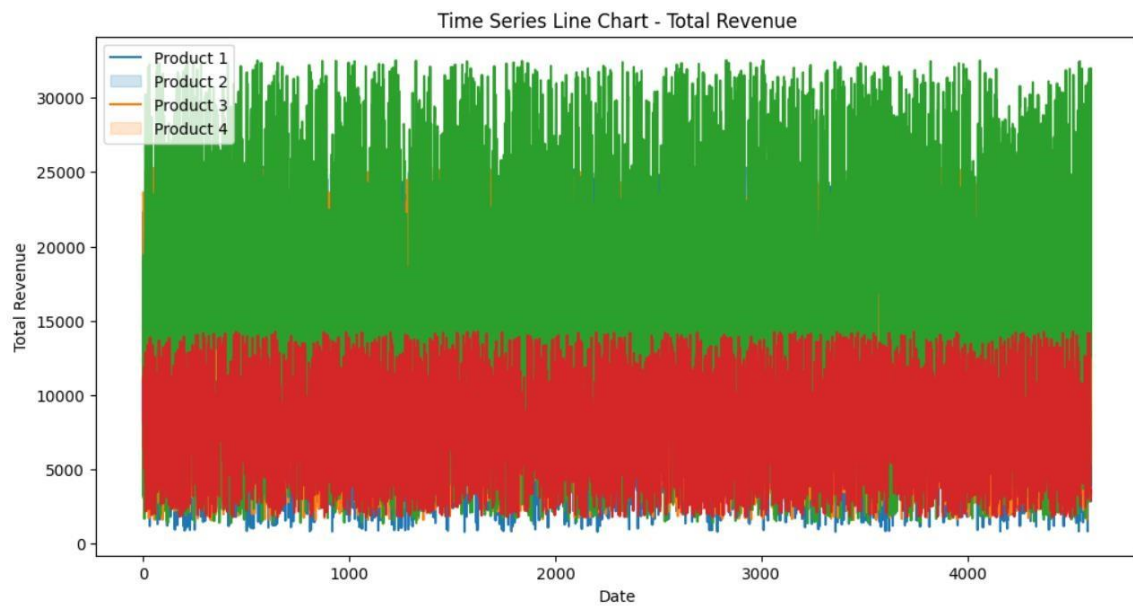
Data Visualisation by Python:



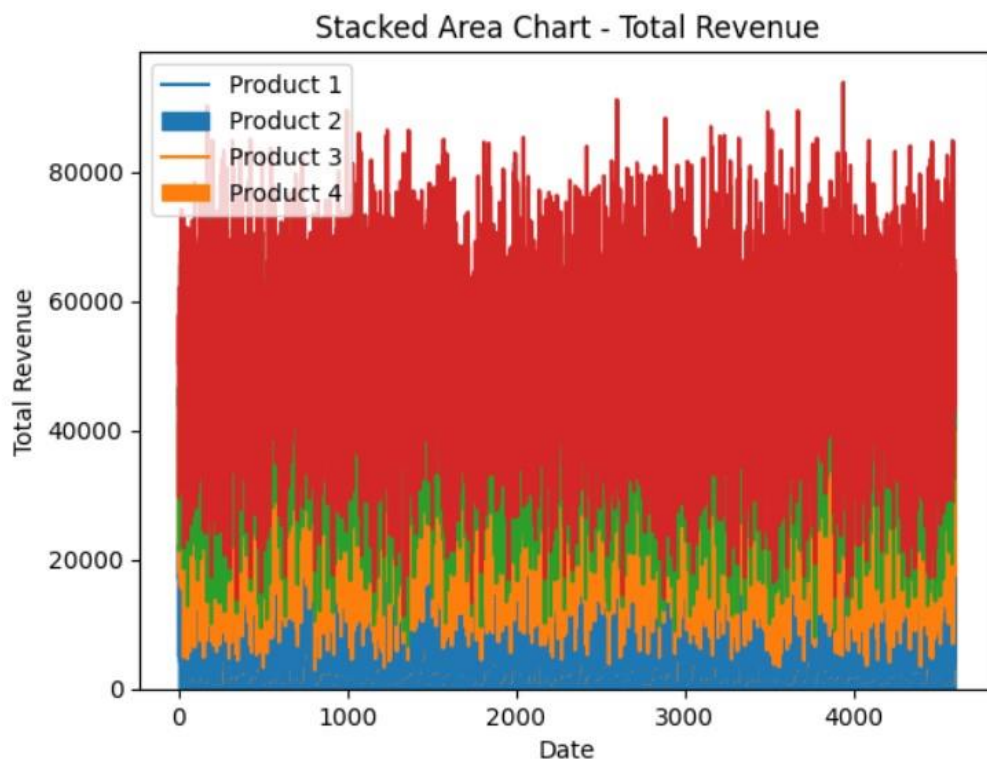
Line Chart



Stacked Bar Chart

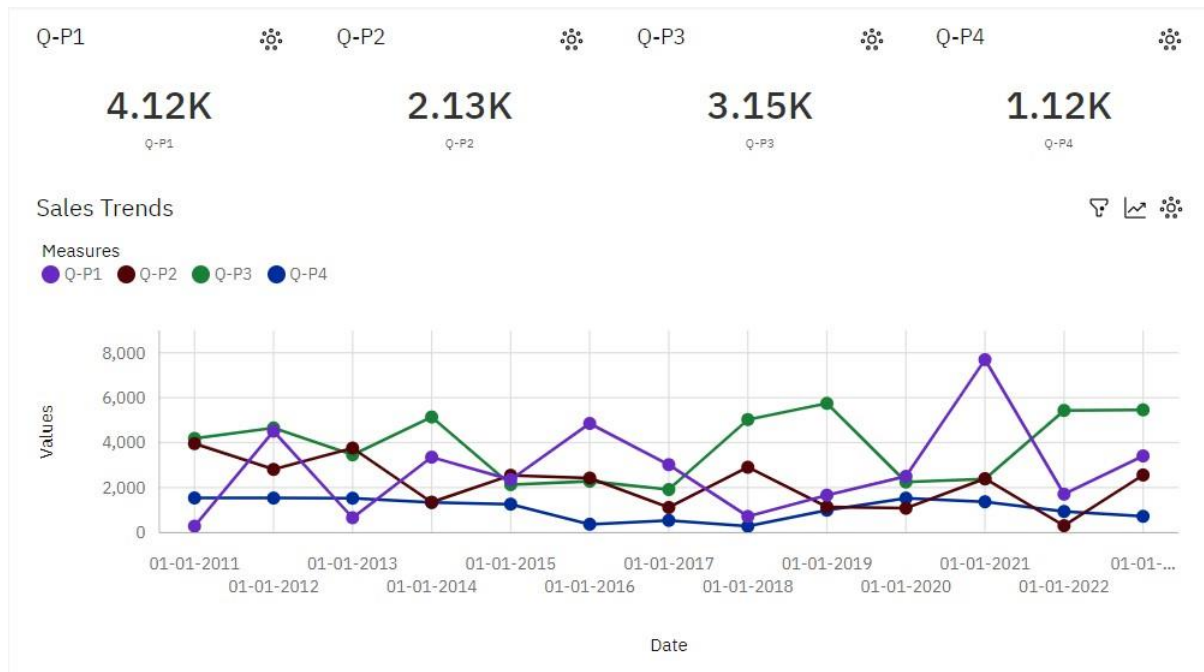


Line Chart



Stacked Area Chart

Actionable insights:



Insights:

Over all dates, the average of Q-P1 is nearly three thousand.

Across all dates, the average of Q-P2 is over two thousand.

Over all dates, the average of Q-P3 is nearly four thousand.

Across all dates, the average of Q-P4 is over a thousand.

The total number of results for Q-P1, across all dates, is 13.

The total number of results for Q-P2, across all dates, is 13.

The total number of results for Q-P3, across all dates, is 13.

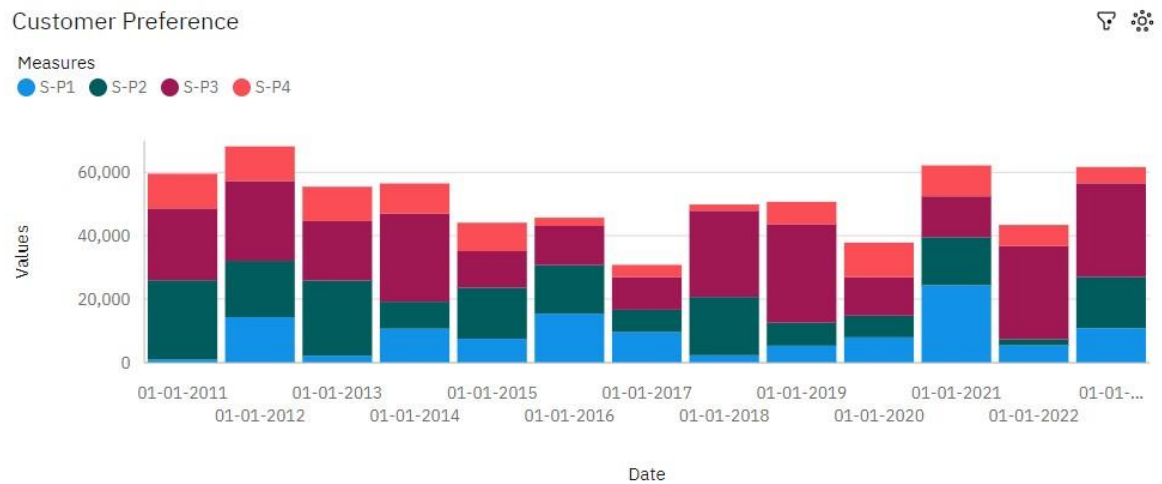
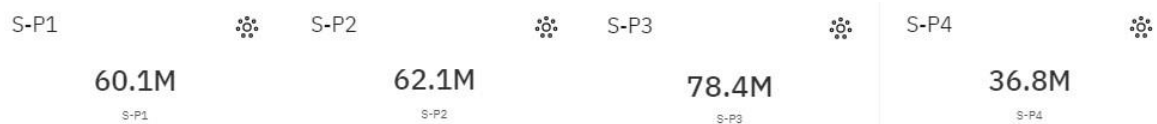
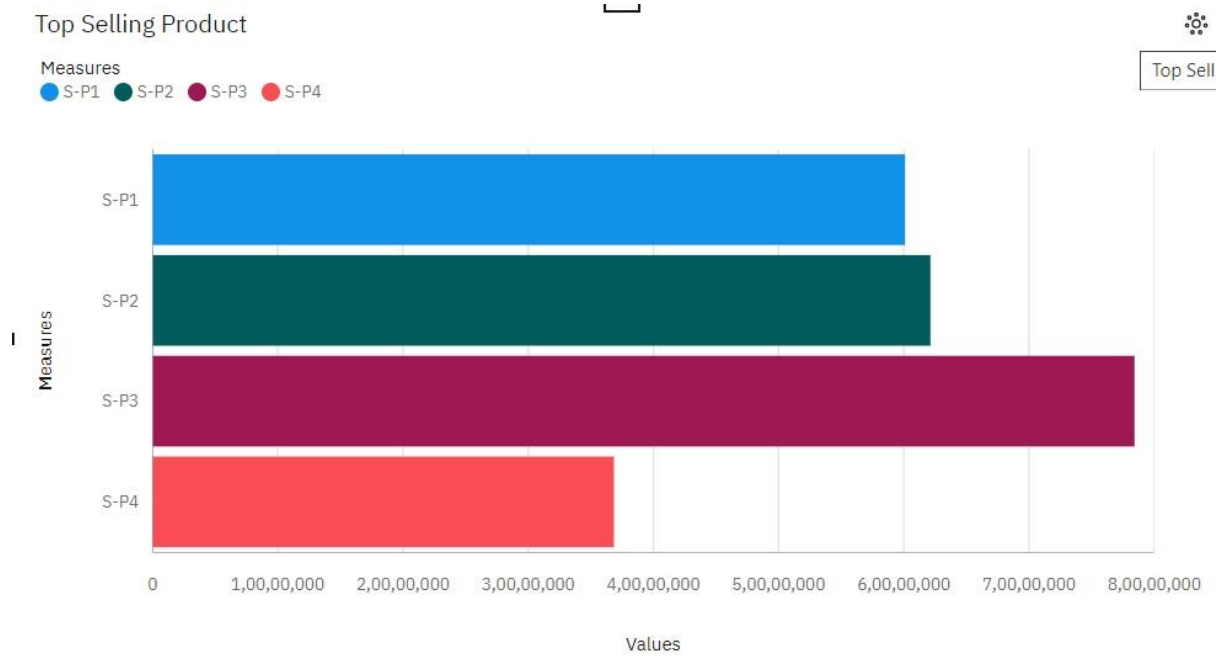
The total number of results for Q-P4, across all dates, is 13.

Q-P1 ranges from 281, when Date is 01-01-2011, to over 7500, when Date is 01-01-2021.

Q-P2 ranges from 302, when Date is 01-01-2022, to nearly four thousand, when Date is 01-01-2011.

Q-P3 ranges from nearly two thousand, when Date is 01-01-2017, to over 5500, when Date is 01-01-2019.

Q-P4 ranges from 276, when Date is 01-01-2018, to over 1500, when Date is 01-01-2011.



Insights:

Over all dates, the average of S-P1 is nearly nine thousand.

Over all dates, the average of S-P2 is nearly fourteen thousand.

Over all dates, the average of S-P3 is almost 21 thousand.

Across all dates, the average of S-P4 is over 7500.

The total number of results for S-P1, across all dates, is 13.

The total number of results for S-P2, across all dates, is 13.

The total number of results for S-P3, across all dates, is 13.

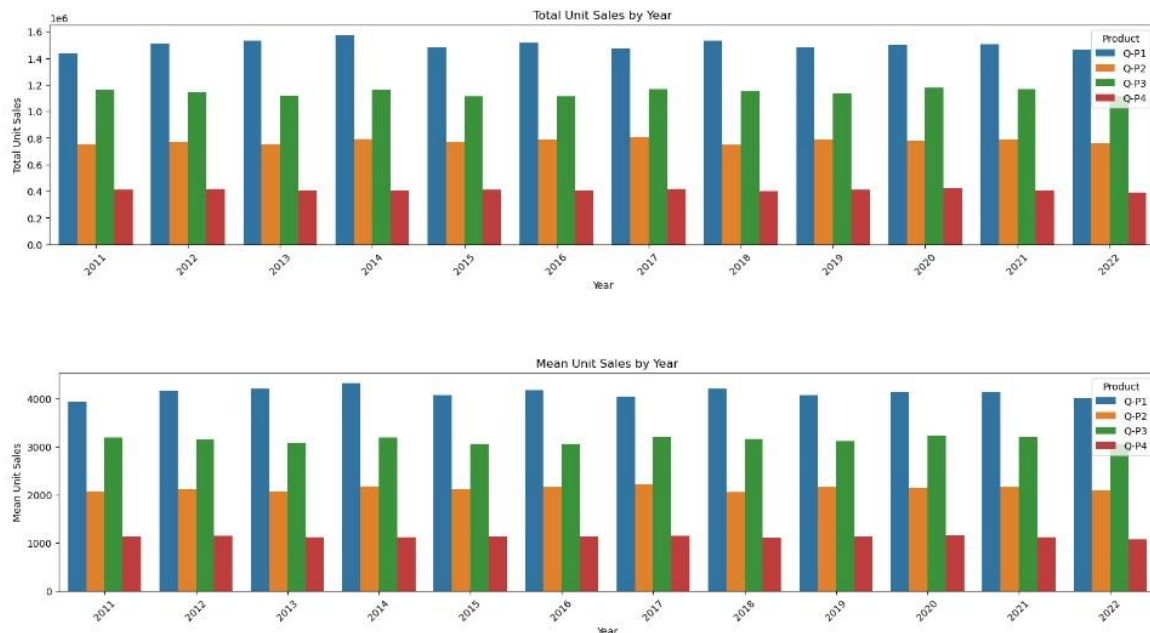
The total number of results for S-P4, across all dates, is 13.

S-P1 ranges from 890.8, when Date is 01-01-2011, to over 24 thousand, when Date is 01-01-2021.

S-P2 ranges from nearly two thousand, when Date is 01-01-2022, to over 25 thousand, when Date is 01-01-2011.

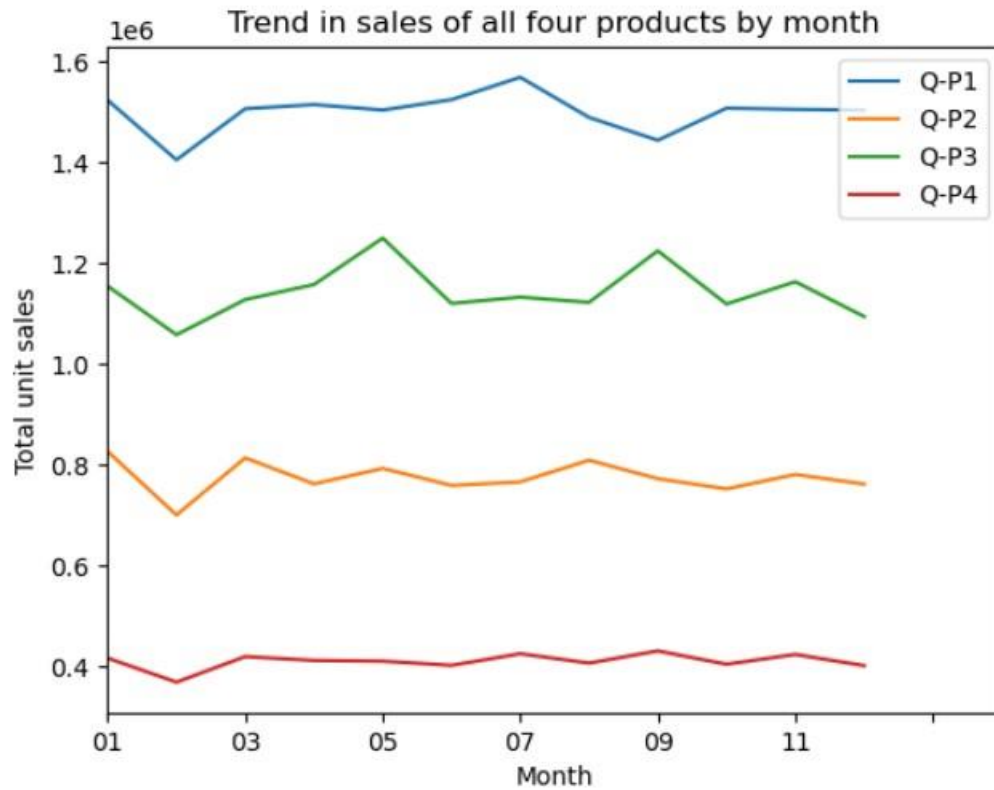
S-P3 ranges from over 10 thousand, when Date is 01-01-2017, to over 31 thousand, when Date is 01-01-2019.

S-P4 ranges from nearly two thousand, when Date is 01-01-2018, to nearly eleven thousand, when Date is 01-01-2011.



Observation

- We can observe that P1 has the highest unit sales for each year. And it's highest is in year 2014.
- We can observe taht P4 has the lowest unit sales of all the products.



Observation

- We have merged the sales for months 9 and 09.
- We can observe that Feb and Dec have the lowest sales for each product
- For P1 We can observe Mar - Jul having the highest unit sales
- For P2 We can observe Jan, Mar - Aug having the highest unit sales
- For P3 We can observe May & Sep having the highest unit sales
- For P4 We can observe uniform sales from Jan - Dec

Marketing strategy and inventory Management:

Marketing Strategy:

Leverage Product A (Q-P1): Product A, represented by Q-P1, shows a consistent average value of nearly three thousand across all dates, and it has a relatively wide range. To capitalize on this product's performance, consider promoting it as a core offering. Marketing strategies could include targeted campaigns, bundle deals, or loyalty programs to encourage customer engagement and increase sales.

Highlight Seasonal Trends (Q-P2 and Q-P3): Q-P2 and Q-P3 show fluctuations in average values across different dates. Leverage these seasonal trends to plan marketing campaigns. For instance, focus on Q-P2 during periods when its value is over two thousand and concentrate on Q-P3 during times when it's nearly four thousand. Seasonal promotions, discounts, and content marketing can be tailored accordingly.

Increase Visibility for Product B (Q-P4): Although the average for Product B (Q-P4) is over a thousand, it doesn't show as high a value as other products. Consider investing in marketing efforts to increase its visibility and market presence. Promotions, improved product descriptions, and targeted advertising could help boost its sales.

Customer Segmentation: Use customer segmentation based on their preferences and behavior regarding the different products (Q-P1, Q-P2, Q-P3, and Q-P4). This can help create personalized marketing campaigns for specific customer groups, increasing the chances of sales and customer retention.

Cross-Selling and Upselling: Identify opportunities to cross-sell or upsell complementary products based on customer purchase history. This can enhance the average transaction value.

Inventory Management:

Demand Forecasting: Implement demand forecasting models for each product category (Q-P1, Q-P2, Q-P3, and Q-P4) to ensure that inventory levels are aligned with expected sales trends. Adjust inventory levels as per seasonal fluctuations and demand patterns.

Safety Stock for High-Performing Products: Maintain a safety stock for high-performing products, such as Q-P1 and Q-P3, to prevent stockouts during peak demand periods. The ranges in sales values indicate potential fluctuations in demand.

Inventory Turnover: Monitor inventory turnover ratios for all products to ensure efficient use of capital. High-performing products should have faster turnover, whereas slower-moving items may require less frequent restocking.

Just-in-Time Inventory: Implement a just-in-time inventory strategy for Product B (Q-P4) to reduce carrying costs. Given its lower range and lower average value, a leaner inventory approach may be appropriate.

Supplier Relationships: Strengthen relationships with suppliers and consider negotiating flexible terms for faster restocking during periods of increased demand.

Safety Stock for Seasonal Products: For products with significant seasonal variations (Q-P2 and Q-P3), maintain higher safety stock levels during peak seasons to avoid stockouts.

Inventory Optimization Software: Consider implementing inventory optimization software that uses historical data and analytics to help automate inventory management decisions and maintain optimal levels.

INSTRUCTION TO ANALYSIS:

Step 1: Data Preparation and Connection:

Data Source Connection: Ensure that you have a connection to the data source (your sales data) set up in IBM Cognos. This may involve configuring a database connection, uploading data files, or connecting to an existing data source.

Data Import: Import your sales data into IBM Cognos in a structured format. This may include Date, Product ID, Sales Quantity (Q-P1, Q-P2, Q-P3, Q-P4), and Sales Price (S-P1, S-P2, S-P3, S-P4).

Data Cleaning: Perform any necessary data cleaning and preprocessing within Cognos, such as handling missing values and duplicates. Ensure the data is clean and ready for analysis.

Step 2: Data Analysis:

4. **Create Data Modules:** Use IBM Cognos Data Modules to organize and prepare the data for analysis. Data Modules provide a visual and intuitive interface for data preparation.

Calculate Aggregates: Create calculated fields to calculate the averages and ranges mentioned in the insights. For example, you can create calculated fields for average Q-P1, Q-P2, etc., and for range calculations.

Filtering: Apply filters to the data to focus on specific date ranges or product categories for analysis. For instance, you can create filters for specific date ranges and product types.

Step 3: Visualization Creation:

7. **Dashboard Creation:** Start by creating a new dashboard in Cognos. Dashboards allow you to combine multiple visualizations into a single view.

Visualizations: Add visualizations to your dashboard. Based on your insights, you can use different types of visualizations:

For showing averages, use bar charts, line charts, or tables.

For displaying ranges, consider using stacked bar charts or area charts.

Use slicers and filters to allow users to interactively select date ranges or product categories.

Customization: Customize the appearance of your visualizations, including labels, colors, and titles. Make sure the visualizations are easy to understand and visually appealing.

Interactivity: Add interactivity to your dashboard by setting up filter controls that allow users to interact with the data dynamically. Users should be able to filter data by date or product.

Performance Optimization: Ensure that your dashboard and visualizations are optimized for performance. Large datasets may require aggregation or summarization to improve dashboard load times.

Step 4: Sharing and Distribution:

12. Sharing: Publish your dashboard to the Cognos environment. You can share it with authorized users and teams within your organization.

Scheduling: Set up automated scheduling to refresh data and update visualizations at regular intervals. This ensures that users always have access to up-to-date information.

Step 5: Continuous Monitoring and Improvement:

14. Monitoring: Continuously monitor the performance and usage of your dashboard. Pay attention to user feedback and data trends.

Iterative Improvement: Based on feedback and changing business needs, make iterative improvements to your dashboard. This may involve adding new visualizations, updating filters, or refining the data model.

Documentation: Document the dashboard's purpose, data sources, and assumptions to maintain clarity for users and future analysts.

IBM Cognos provides a robust platform for data analysis and visualization. By following these steps, you can create interactive and informative dashboards that enable your organization to make data-driven decisions and implement the marketing and inventory management strategies derived from the insights.