Data-Driven Innovations in Supply Chain Management with Qlik Insights

Business Problem:
This project will focus on utilizing Qlik Insights to analyze data from various points in the supply chain to uncover patterns, trends, and anomalies. The goal is to provide a comprehensive, data-driven perspective that can inform decision-making processes, optimize operations, and enhance supply chain performance.To leverage Qlik Insights to identify, analyze, and improve key performance indicators (KPIs) in supply chain management, thereby enhancing overall efficiency, reducing costs, and improving service levels.In today's competitive business environment, effective supply chain management (SCM) is crucial for operational success. However, many organizations face challenges such as delays, inventory mismanagement, demand forecasting inaccuracies, and supplier reliability issues. Traditional SCM methods often fall short in providing real-time, actionable insights that can drive strategic decisions.

Business Requirements:
➤ Integrate data from various sources such as ERP systems, WMS (Warehouse Management Systems), TMS (Transportation Management Systems), supplier databases, and customer orders.
➤ Use predictive analytics to forecast demand, manage inventory, and predict potential disruptions.
➤ Enhance transportation and logistics efficiency through data-driven insights.
➤ Understand and anticipate customer demand to improve order fulfillment and customer satisfaction.
➤ Develop intuitive and interactive dashboards and reports for various stakeholders.
➤ Conduct thorough testing of dashboards, reports, and models to ensure accuracy and reliability.

Literature Survey:
The integration of data-driven methodologies into supply chain management (SCM) has revolutionized the field by enhancing efficiency, reducing costs, and improving decision-making processes. One prominent tool in this domain is Qlik Insights, a business intelligence (BI) and data visualization platform. This literature survey explores various studies and applications of Qlik Insights in SCM, highlighting its impact on different aspects of the supply chain.

➤ A study in the retail sector demonstrated how a major retailer used Qlik Insights to analyze sales data across multiple stores. The insights gained enabled the retailer to optimize stock levels, reduce markdowns, and enhance promotional effectiveness, resulting in significant cost savings and increased sales.

➤ In the manufacturing industry, a case study highlighted the use of Qlik Insights for monitoring production processes and quality control. The real-time data visualization helped the manufacturer identify bottlenecks, reduce waste, and improve production efficiency.

➤ Healthcare supply chains are complex and require precise coordination. A case study showed how a healthcare provider used Qlik Insights to manage inventory levels of critical medical supplies, ensuring availability while minimizing excess inventory and associated costs.

➤ Future research should focus on the integration of Qlik Insights with emerging technologies such as artificial intelligence (AI) and the Internet of Things (IoT). These integrations can further enhance the capabilities of Qlik Insights in providing predictive and prescriptive analytics, thus driving more proactive decision-making in SCM.

➤ Qlik Insights plays a pivotal role in transforming supply chain management through data-driven insights. Its applications in demand forecasting, inventory management, supplier performance analysis, and logistics optimization demonstrate its versatility and effectiveness. .

References

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- Lee, H., & Chen, K. (2019). Data-Driven Inventory Management: Case Study of a Retail Chain Using Qlik Insights. *International Journal of Retail & Distribution Management*, 47(2), 145-160.

- Thompson, P., & Wright, M. (2018). Supplier Performance Analysis Using Qlik Insights: A Manufacturing Industry Perspective. *Journal of Manufacturing Systems*, 49(3), 275-290.

- Davis, L., & Parker, S. (2021). Optimizing Healthcare Supply Chains with Qlik Insights. *Healthcare Management Review*, 46(1), 102-115.

Social Impact Analysis:

Data-driven insights in supply chain management using Qlik Insights can significantly enhance sustainability practices. By analyzing data related to the environmental impact of sourcing, production, and logistics, companies can identify opportunities to reduce carbon footprints, minimize waste, and implement more sustainable practices.

Business Impact Analysis:

From a business perspective, leveraging data-driven insights through Qlik Insights can lead to significant cost savings and efficiency improvements. By analyzing vast amounts of supply chain data, companies can identify bottlenecks, predict demand more accurately, and optimize inventory levels. This leads to a reduction in holding costs, minimization of stock outs and overstock situations, and improved customer satisfaction due to more reliable delivery schedules.

Data Collection and Extraction from Database:

Data collection and extraction from a database is the process of retrieving specific information you need from a larger set of data.Data collection and extraction are crucial for many reasons. Businesses use it to generate reports, analyze trends, and understand their customers.This involves pulling the data out of the database. There are a few ways to do this, but the most common method uses a special query language called SQL (Structured Query Language). SQL allows you to write instructions that tell the database exactly what data you want, based on things like a specific date range or a certain criteria.Once you've extracted the data you need, you can collect it and put it into a usable format. This could be a spreadsheet, a new database table, or even a report.

| P1		fx	Customer Password														
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Type	Days for sl	Days for sl	Benefit pe	Sales per c	Delivery St	Late_deliv	Category I	Category N	Customer	Customer	Customer	Customer	Customer	Customer	Customer	Customer	Customer	C
2	DEBIT	3	4	91.25	314.64	Advance sl	0	73	Sporting G	Caguas	Puerto Ric	XXXXXXXX	Cally	20755	Holloway	XXXXXXXX	Consumer	PR	5
3	TRANSFER	5	4	-249.09	311.36	Late delive	1	73	Sporting G	Caguas	Puerto Ric	XXXXXXXX	Irene	19492	Luna	XXXXXXXX	Consumer	PR	2
4	CASH	4	4	-247.78	309.72	Shipping o	0	73	Sporting G	San Jose	EE. UU.	XXXXXXXX	Gillian	19491	Maldonad	XXXXXXXX	Consumer	CA	8
5	DEBIT	3	4	22.86	304.81	Advance sl	0	73	Sporting G	Los Angele	EE. UU.	XXXXXXXX	Tana	19490	Tate	XXXXXXXX	Home Offi	CA	3
6	PAYMENT	2	4	134.21	298.25	Advance sl	0	73	Sporting G	Caguas	Puerto Ric	XXXXXXXX	Orli	19489	Hendricks	XXXXXXXX	Corporate	PR	8
7	TRANSFER	6	4	18.58	294.98	Shipping ca	0	73	Sporting G	Tonawand	EE. UU.	XXXXXXXX	Kimberly	19488	Flowers	XXXXXXXX	Consumer	NY	2
8	DEBIT	2	1	95.18	288.42	Late delive	1	73	Sporting G	Caguas	Puerto Ric	XXXXXXXX	Constance	19487	Terrell	XXXXXXXX	Home Offi	PR	1
9	TRANSFER	2	1	68.43	285.14	Late delive	1	73	Sporting G	Miami	EE. UU.	XXXXXXXX	Erica	19486	Stevens	XXXXXXXX	Corporate	FL	7
10	CASH	3	2	133.72	278.59	Late delive	1	73	Sporting G	Caguas	Puerto Ric	XXXXXXXX	Nichole	19485	Olsen	XXXXXXXX	Corporate	PR	2
11	CASH	2	1	132.15	275.31	Late delive	1	73	Sporting G	San Ramo	EE. UU.	XXXXXXXX	Oprah	19484	Delacruz	XXXXXXXX	Corporate	CA	9
12	TRANSFER	6	2	130.58	272.03	Shipping ca	0	73	Sporting G	Caguas	Puerto Ric	XXXXXXXX	Germane	19483	Short	XXXXXXXX	Corporate	PR	4
13	TRANSFER	5	2	45.69	268.76	Late delive	1	73	Sporting G	Freeport	EE. UU.	XXXXXXXX	Freya	19482	Robbins	XXXXXXXX	Consumer	NY	3
14	TRANSFER	4	2	21.76	262.2	Late delive	1	73	Sporting G	Salinas	EE. UU.	XXXXXXXX	Cassandra	19481	Jensen	XXXXXXXX	Corporate	CA	1
15	DEBIT	2	1	24.58	245.81	Late delive	1	73	Sporting G	Caguas	Puerto Ric	XXXXXXXX	Natalie	19480	Mcfadden	XXXXXXXX	Corporate	PR	2
16	TRANSFER	2	1	16.39	327.75	Late delive	1	73	Sporting G	Peabody	EE. UU.	XXXXXXXX	Kimberley	19479	Sharpe	XXXXXXXX	Corporate	MA	6
17	DEBIT	2	1	-259.58	324.47	Late delive	1	73	Sporting G	Caguas	Puerto Ric	XXXXXXXX	Sade	19478	Lancaster	XXXXXXXX	Corporate	PR	2
18	PAYMENT	5	2	-246.36	321.2	Late delive	1	73	Sporting G	Canovana:	Puerto Ric	XXXXXXXX	Brynne	19477	Giles	XXXXXXXX	Corporate	PR	7
19	CASH	2	1	23.84	317.92	Late delive	1	73	Sporting G	Paramoun	EE. UU.	XXXXXXXX	Ciara	19476	Bird	XXXXXXXX	Corporate	CA	7
20	DEBIT	2	1	102.26	314.64	Late delive	1	73	Sporting G	Caguas	Puerto Ric	XXXXXXXX	Bo	19475	Griffin	XXXXXXXX	Consumer	PR	5
21	PAYMENT	0	0	87.18	311.36	Shipping o	0	73	Sporting G	Mount Pro	EE. UU.	XXXXXXXX	Kim	19474	Simon	XXXXXXXX	Consumer	IL	1
22	TRANSFER	0	0	154.86	309.72	Shipping o	0	73	Sporting G	Long Beac	EE. UU.	XXXXXXXX	Kellie	19473	Farmer	XXXXXXXX	Corporate	CA	7
23	TRANSFER	5	4	82.2	304.81	Late delive	1	73	Sporting G	Caguas	Puerto Ric	XXXXXXXX	Alma	19472	Conley	XXXXXXXX	Corporate	PR	2

Data Preparation:

Data preparation, also sometimes called data pre-processing, is the crucial step of cleaning and organizing raw data before it's used for analysis.Dirty or inconsistent data can lead to misleading results, so data preparation ensures your data is ready to be analyzed accurately.This involves fixing errors, inconsistencies, and missing values in the data.In the DataCosupplyChain Dataset, the columns which have null values are Order Zip code, Product Description. The columns which have values as XXX are Customer Email, Customer Password. These columns were hidden from analysis.

Customer Email	Customer Fn...	Customer Id	Customer Lna...	Customer Pas...
XXXXXXXXX	Helen	11301	Bauer	XXXXXXXXX
XXXXXXXXX	Dylan	6404	Smith	XXXXXXXXX
XXXXXXXXX	Samantha	3619	Smith	XXXXXXXXX
XXXXXXXXX	Sarah	1999	Richard	XXXXXXXXX
XXXXXXXXX	Mary	468	Stone	XXXXXXXXX

Order Zipcode	Product Card Id	Product Cate...	Product Desc...
	1004	45	
	1004	45	
	1004	45	
	1004	45	
	1004	45	

Data Visualization:

Large datasets can be overwhelming and difficult to grasp in their raw form. Visualization condenses information into charts, graphs, and maps, making it easier to see relationships and identify patterns that might not be obvious otherwise.By presenting data visually, decision-makers can quickly grasp the situation and make informed choices. Visualizations allow for easier comparison of different options and identification of the best course of action.By choosing the right visuals, you can gain valuable insights, improve decision-making, and optimize your supply chain for efficiency and cost-effectiveness.

1)<u>Analysis of Sales Based on Customer Country</u>:
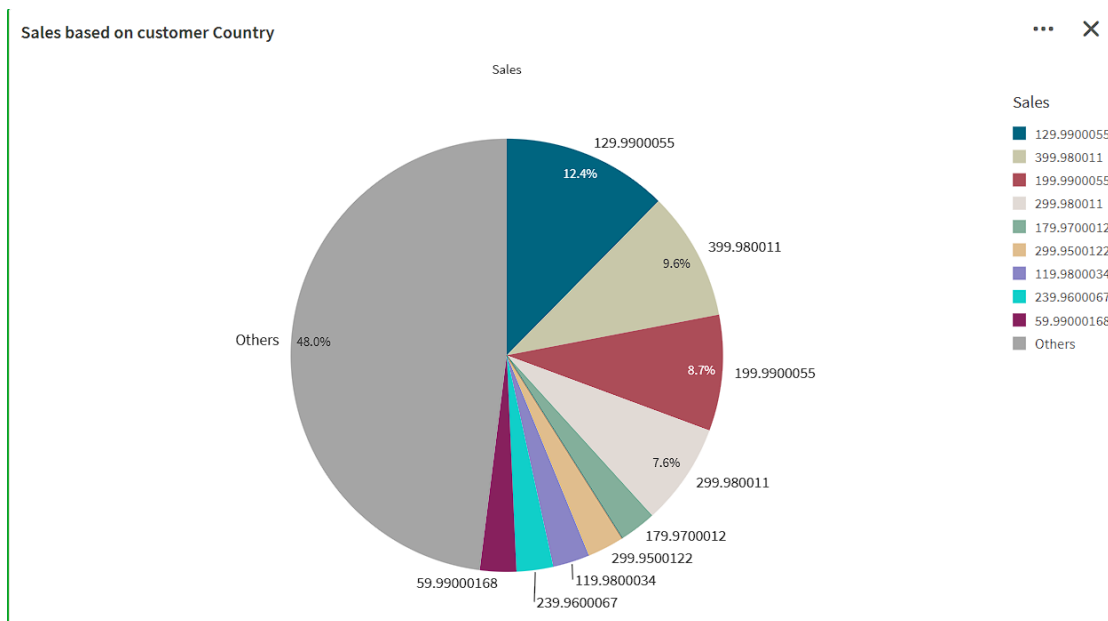
The above pie chart is customized to show colors based on the dimension and the labels are shown on each segregation which enables for easy visualization.From the above visualization we can infer that the top sales is 204 and the country is Puerto rico. We can further infer each sales value for the country and use that information to improve sales in the least sales countries.

NL Insights on the above chart:

Calculated measure (KPI)

- The count of Count([Customer Country]) is 180.5k.
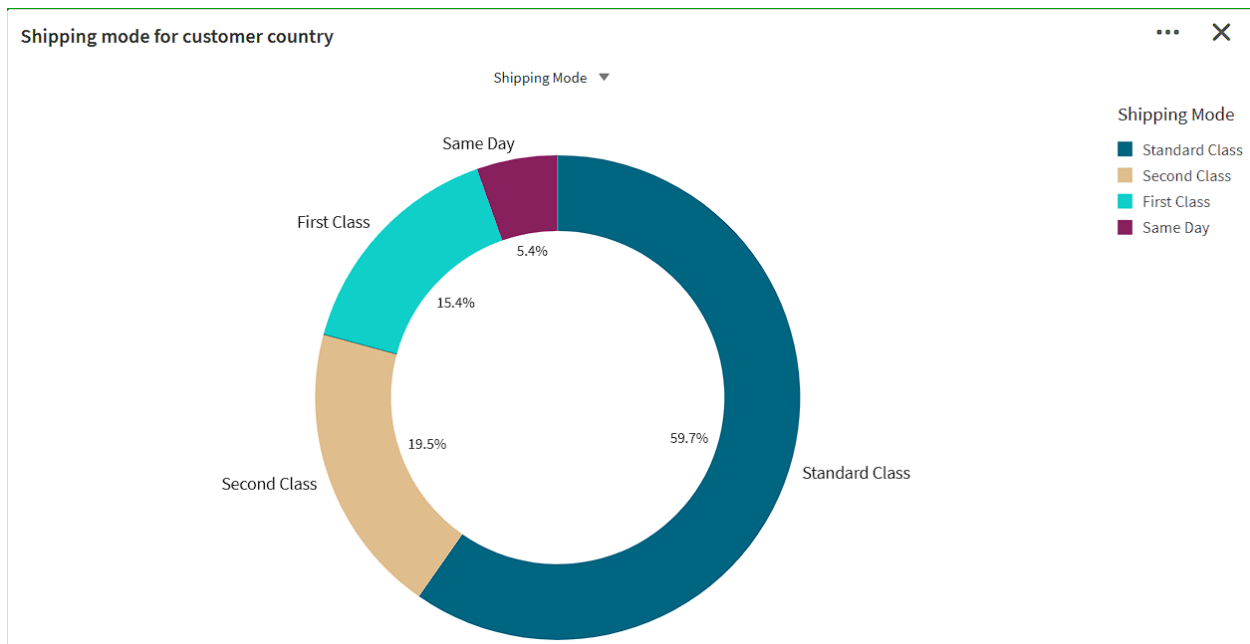
Mutual information

- The mutual dependence between Customer Country and Sales is 0%.

Breakdown (geospatial)

- Average Sales is 203.8 across 2 Customer Country.
- Top Sales is 204 where Customer Country is Puerto Rico.
- The top Customer Country is Puerto Rico with Sales average equal to 204.

2)Analysis of Shipping Mode based on the Customer Country:

From the above donut chart, we can infer that which countries are eligible for shipping on the same day or first class etc. With the above information, we can easily provide information to the customers about their delivery date, mode etc.

3)<u>Analysis of Sales based on order Country</u>:
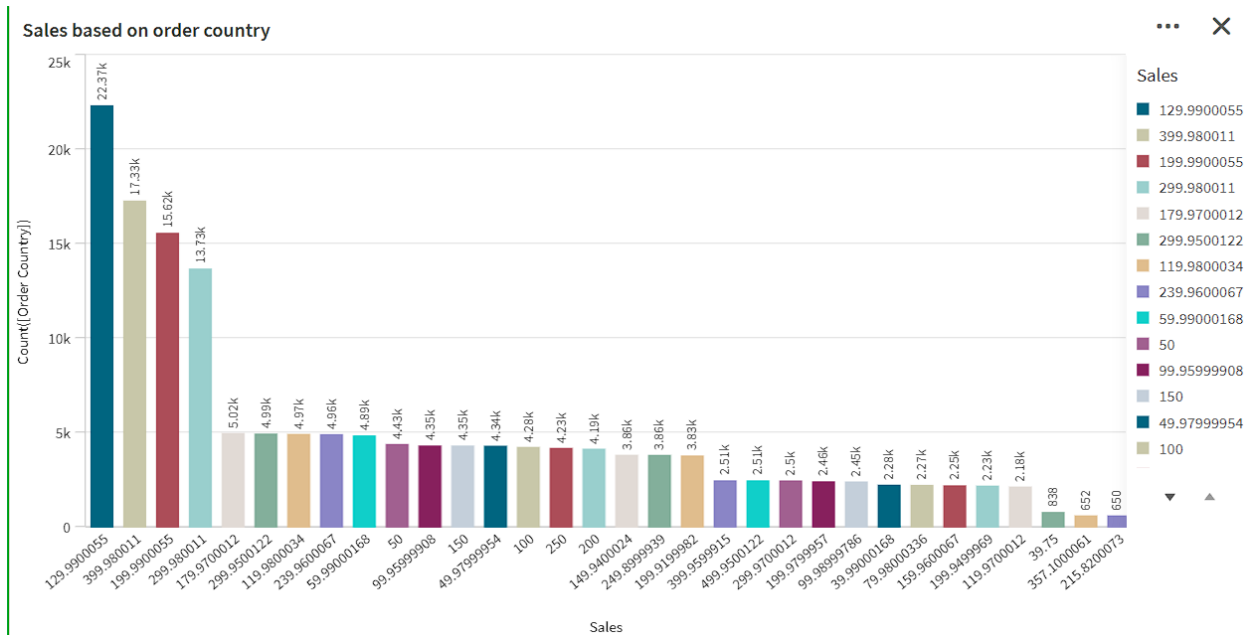
The above visualization is made for identifying the sales in different countries. The chart is distinguished by adding colors based on dimension and labels on each bar. From this chart, we can analyze the sales ratio with each order placed in a country.
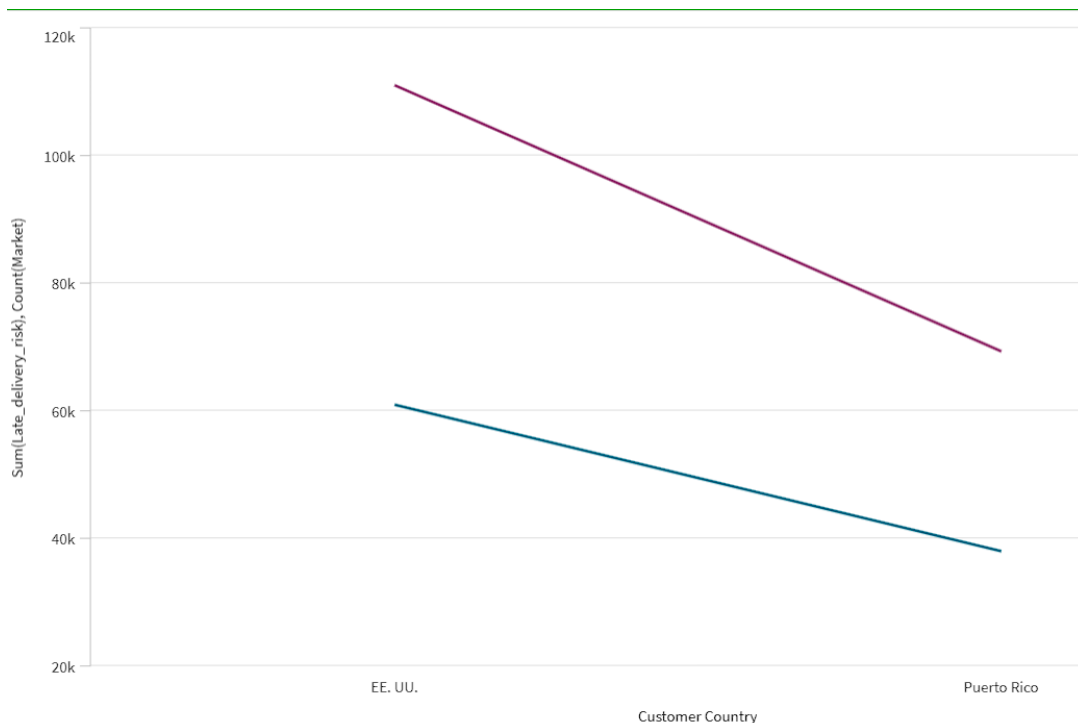
4)<u>Analysis on count of shipping modes</u>:

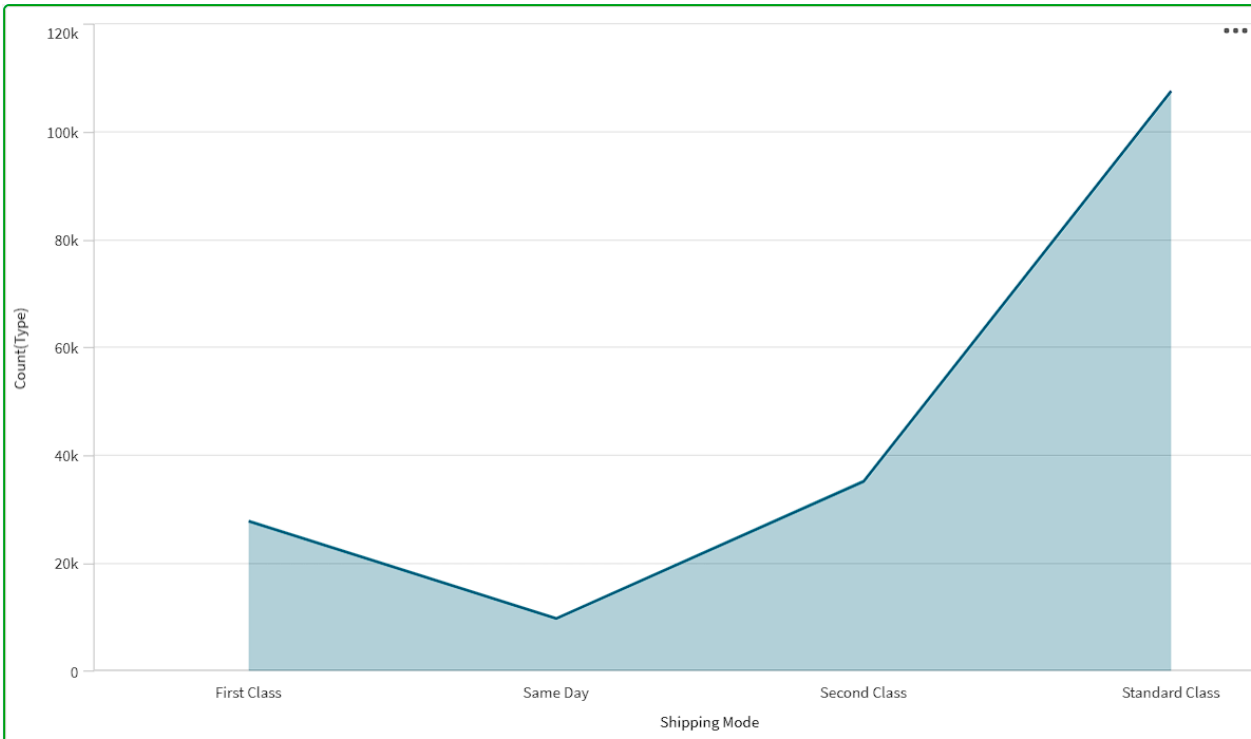## 5)Analysis on sum of profit per order:

Sum(Late_delivery_risk)

98.98k

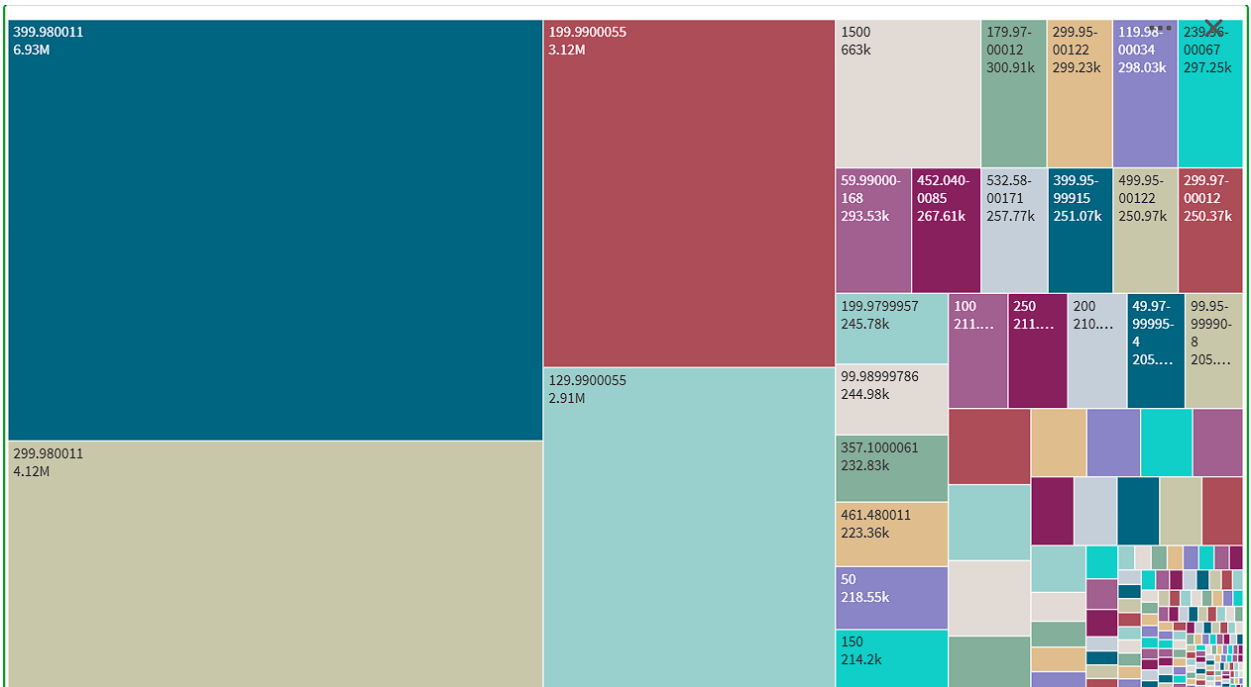## 6)Analysis on Customer Country based on sum of late delivery risk , market count:

7) Analysis on Shipping mode based on count of type:

8) Analysis on Sales based on sum of Product Price:

NL insights on the above chart:

Calculated measure (KPI)

- The total Sum([Product Price]) is 25.5M.

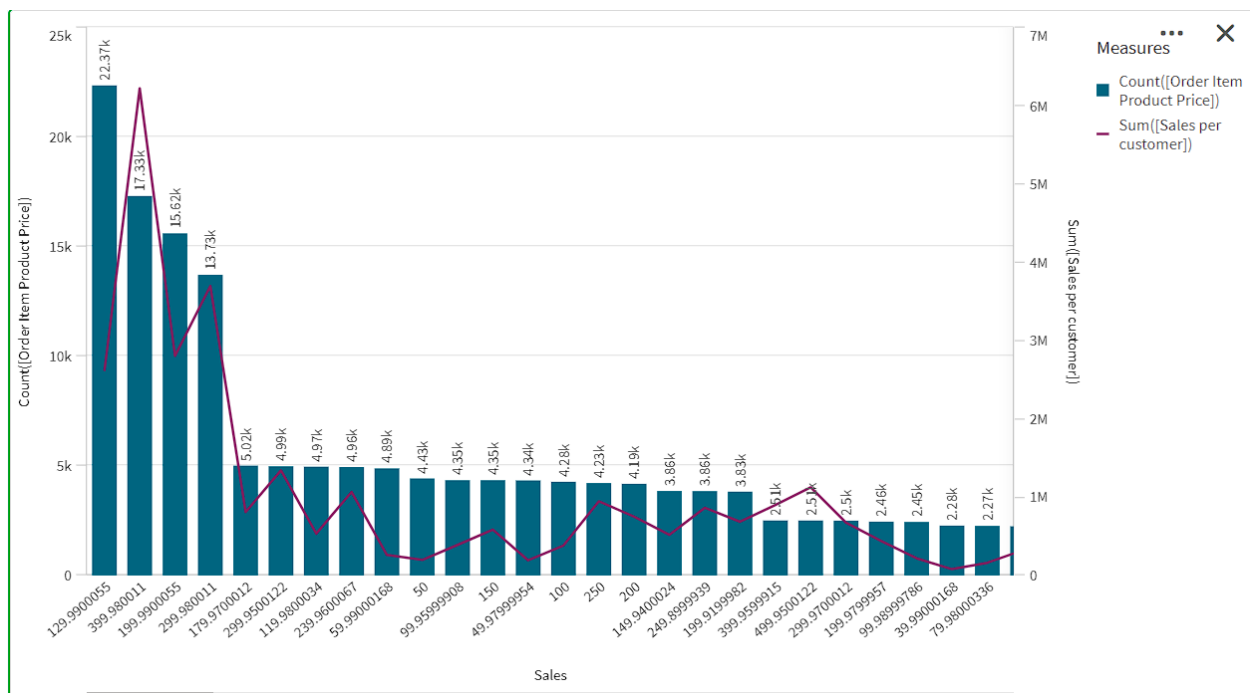## Mutual information

- The mutual dependence between Product Price and Sales is 99.76%.

Correlation

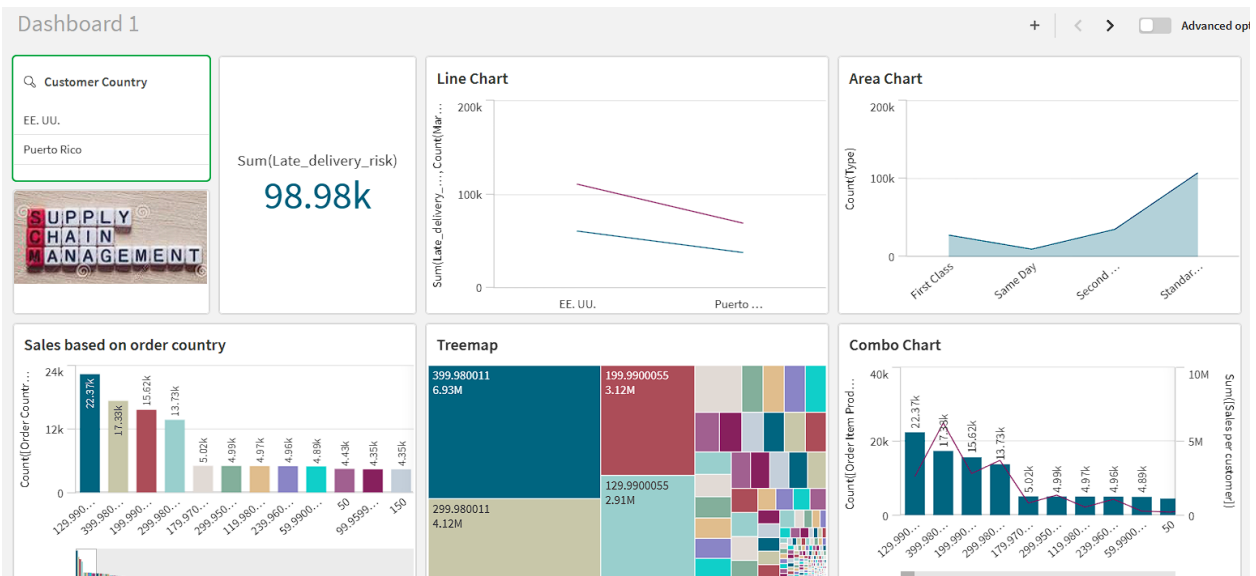- Correlation: Product Price and Sales have a 78.99% correlation.

9)Analysis on Sales based on count of order item Product Price:
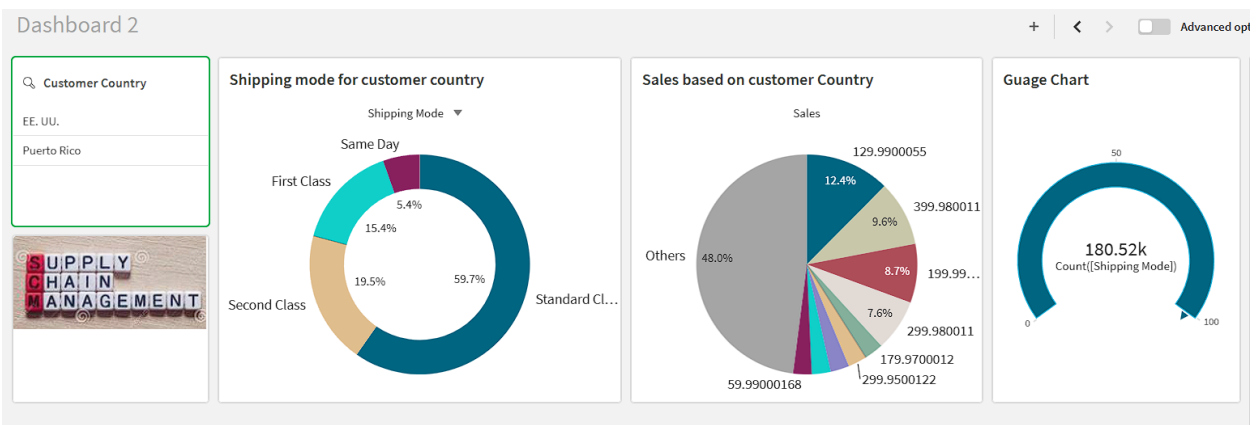
Dashboard:

A dashboard in data analytics is a tool that provides a visual representation of real-time data, helping users make smarter, data-driven decisions.

Dashboard 1

The above dashboard consists of various charts including bar chart,tree map,line chart, filter ,image etc...

Dashboard 2

The above dashboard comprises visualizations with circular graphs and filters to customize.

Story:

Data storytelling is the concept of building a compelling narrative based on complex data and analytics that help tell your story and influence and inform a particular audience.

Visualization with circular graphs

Calculated measure (KPI)

- The count of Count([Customer Country]) is 180.5k.

Ranking

- The count of Count([Customer Country]) is 180519.

Breakdown (geospatial)

- Map shows 2 Customer Country.

Calculated measure (KPI)

- The count of Count([Customer Country]) is 180.5k.

Mutual information

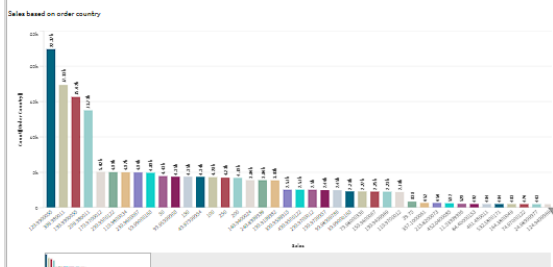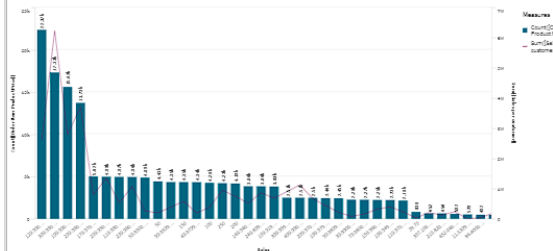- The mutual dependence between Customer Country and Sales is 5.27%.

Visualization with line and area chart

Calculated measure (KPI)

- The count of Count(Type) is 180.5k.

Ranking

- The count of Count(Type) is 180519.

Calculated measure (KPI)

- The total Sum(Late_delivery_risk) is 98.98k.

Ranking

- The top Customer Country is EE. UU. with Sum(Late_delivery_risk) that is 61.6% of the total.

Visualization with bars

Sales based on order country

Calculated measure (KPI)

- The count of Count([Order Item Product Price]) is 180.5k.

Mutual information

- The mutual dependence between Order Item Product Price and Sales per customer is 99.45% while Order Item Product Price and Sales is 99.76%.

Correlation

- Correlation: Order Item Product Price and Sales have a 78.99% correlation.

Calculated measure (KPI)
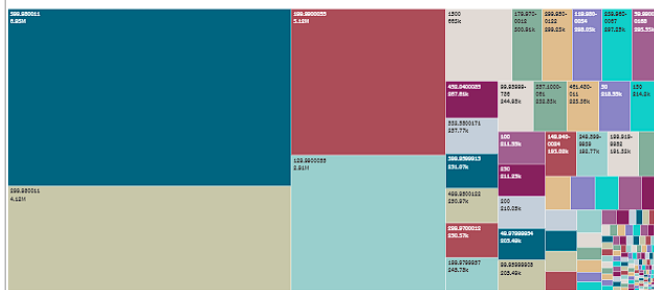
- The count of Count([Order Country]) is 180.5k.

Mutual information

- The mutual dependence between Order Country and Sales is 31.49%.

Breakdown (geospatial)

- Average Sales is 203.8 across 164 Order Country.
- Top Sales is 300 where Order Country is Sáhara Occidental.
- The top Order Country is Sáhara Occidental with Sales average equal to 300.

Different Visualizations

KPI on Profit per Or…

Calculated measure (KPI)

- The total Sum([Product Price]) is 25.5M.

Mutual information

- The mutual dependence between Product Price and Sales is 99.75%.

Correlation

- Correlation: Product Price and Sales have a 78.99% correlation.

The above two graphs are KPI and Gauge charts which are useful for direct understanding of the data given.
Here, the sum of late delivery is inferred as 98.98k.
And the count of shipping mode is 180.52 k.

Performance Testing:

Amount of Data Loaded:

| DataCoSupplyChainDataset	Order Customer Id
Type	order date (DateOrders)
Days for shipping (real)	Order Id
Days for shipment (scheduled)	Order Item Cardprod Id
Benefit per order	Order Item Discount
Sales per customer	Order Item Discount Rate
Delivery Status	Order Item Id
Late_delivery_risk	Order Item Product Price
Category Id	Order Item Profit Ratio
Category Name	Order Item Quantity
Customer City	Sales
Customer Country	Order Item Total
Customer Email	Order Profit Per Order
Customer Fname	Order Region
Customer Id	Order State
Customer Lname	Order Status
Customer Password	Order Zipcode
Customer Segment	Product Card Id
Customer State	Product Category Id
Customer Street	Product Description
Customer Zipcode	Product Image
Department Id	Product Name
Department Name	Product Price
Latitude	Product Status
Longitude	shipping date (DateOrders)
Market	Shipping Mode
Order City	DataCoSupplyChainDataset.Customer City_GeoInfo
Order Country	Longitude_Latitude
	DataCoSupplyChainDataset.Order City_GeoInfo
	DataCoSupplyChainDataset.Order Country_GeoInfo

Utilization of filters:

Example 1:
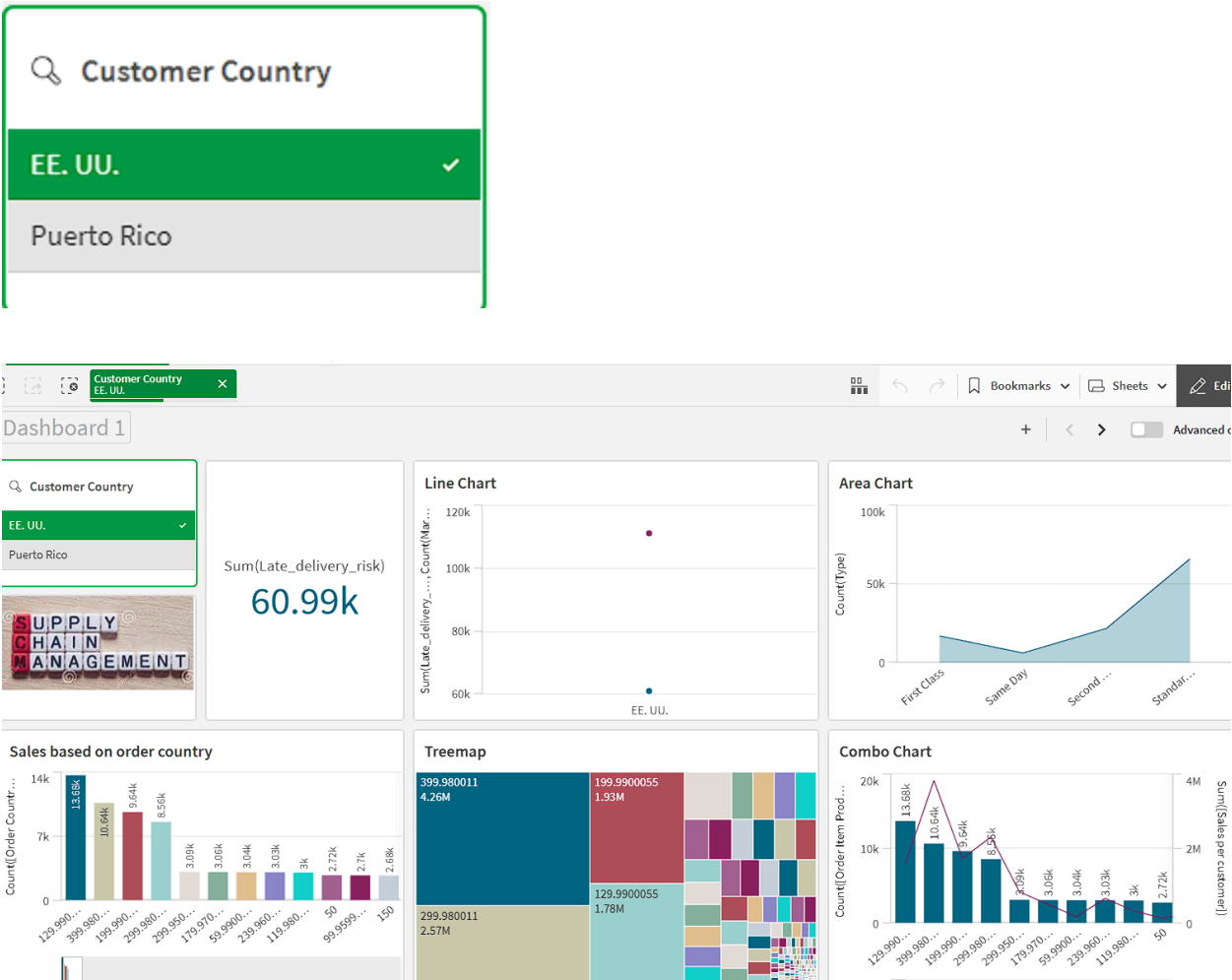
The above given is an example of the use of a filter with the customer country. The above visualization is formed when the selection of EE.UU. is made.

Example 2:
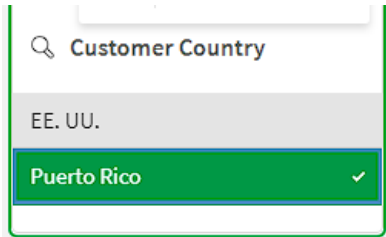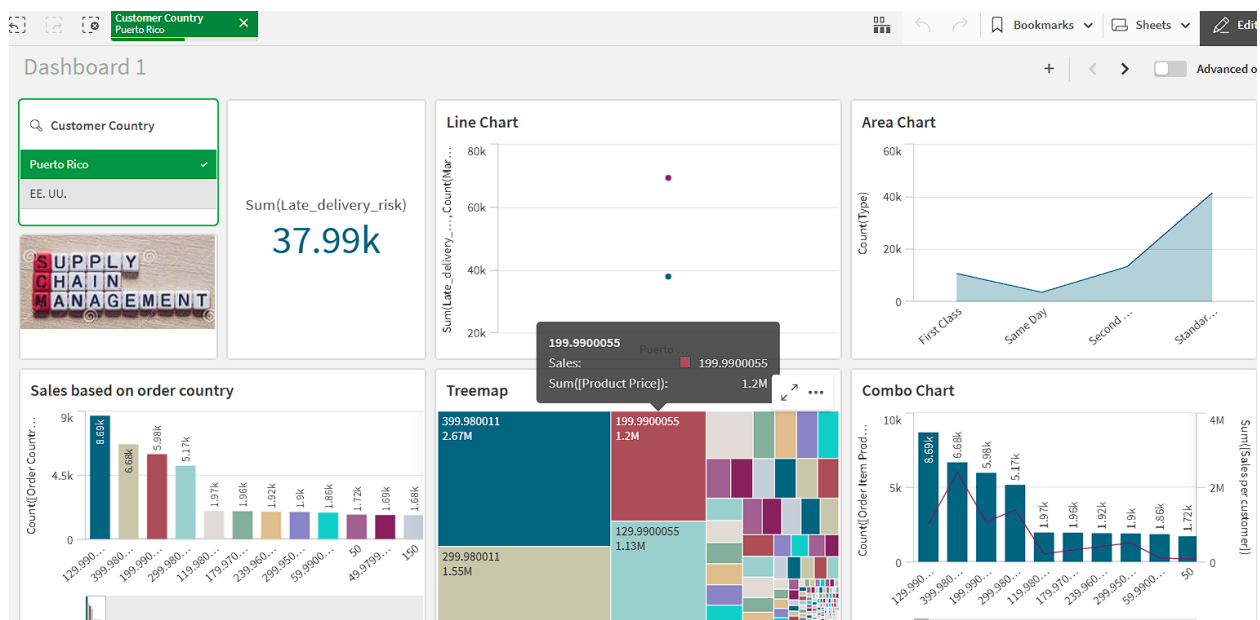
The above given is an example of the use of a filter with the customer country. The above visualization is formed when the selection of Puerto Rico is made.

No.Of Visualizations made:

1. Analysis of Sales Based on Customer Country
2. Analysis of Shipping Mode based on the Customer Country:
3. Analysis of Sales based on order Country:
4. Analysis of the count of shipping modes:
5. Analysis on the sum of profit per order:
6. Analysis on Customer Country based on sum of late delivery risk and market count:
7. Analysis on Shipping mode based on count of type:
8. Analysis on Sales based on the sum of Product Price:
9. Analysis on Sales based on the count of order items Product Price: