Sustainability Analysis

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Problem Statement

Analyze IKEA's sustainability initiatives to understand the relationships between environmental, social, and economic impacts, and identify key factors driving effective outcomes. Use data-driven insights to recommend strategies for improving sustainability performance.

Objectives

•Evaluate the effectiveness of sustainability initiatives of IKEA.
•Recognizing the essential factors for expected results.
•Find correlations among cost, CO2 emission reduction, and revenue.
•Recommendations for Improvements.

Dataset Overview(Optional)

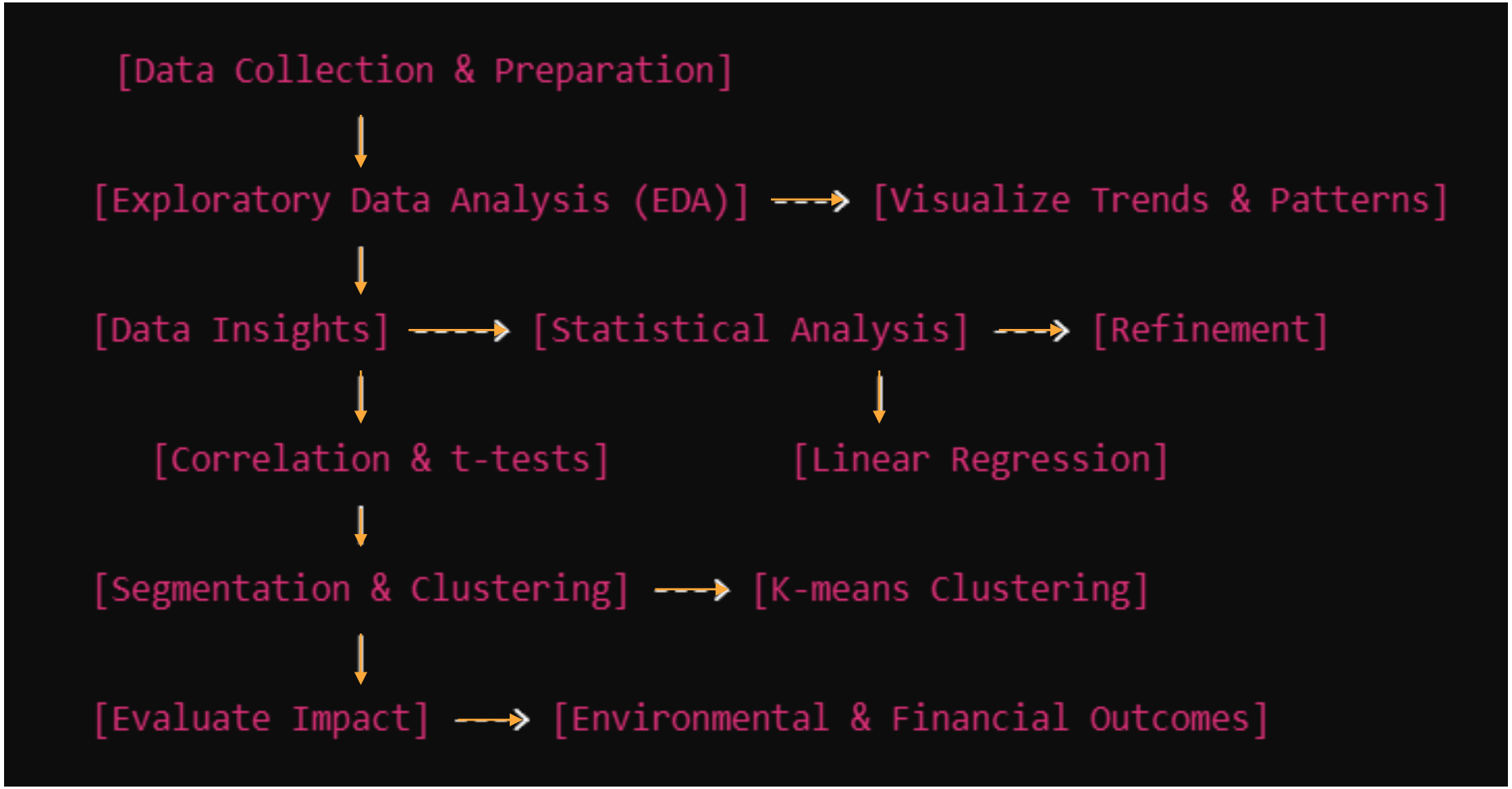
The dataset contains sustainability initiatives at IKEA, focusing on both environmental and financial aspects. It provides insights into the performance and impact of various sustainability programs.

Key Columns:

1. **Initiative_ID**: Unique identifier for each sustainability initiative (e.g., 'IKEA_40').
2. **Category**: The type or category of sustainability initiative (e.g., 'Energy Efficiency', 'Waste Management').
3. **Cost**: The cost associated with each initiative (numeric).
4. **Revenue_Impact**: The financial revenue generated or saved due to the initiative (numeric).
5. **CO2_Reduction**: The amount of CO2 emissions reduced as a result of the initiative (numeric).
6. **Waste_Reduction**: The amount of waste reduced through the initiative (numeric).
7. **Renewable_Energy_Usage**: Percentage of energy used from renewable sources in the initiative (numeric).
8. **Customer_Engagement**: The level of customer engagement or awareness raised by the initiative (numeric).
9. **Employee_Engagement**: The level of employee involvement in sustainability initiatives (numeric).

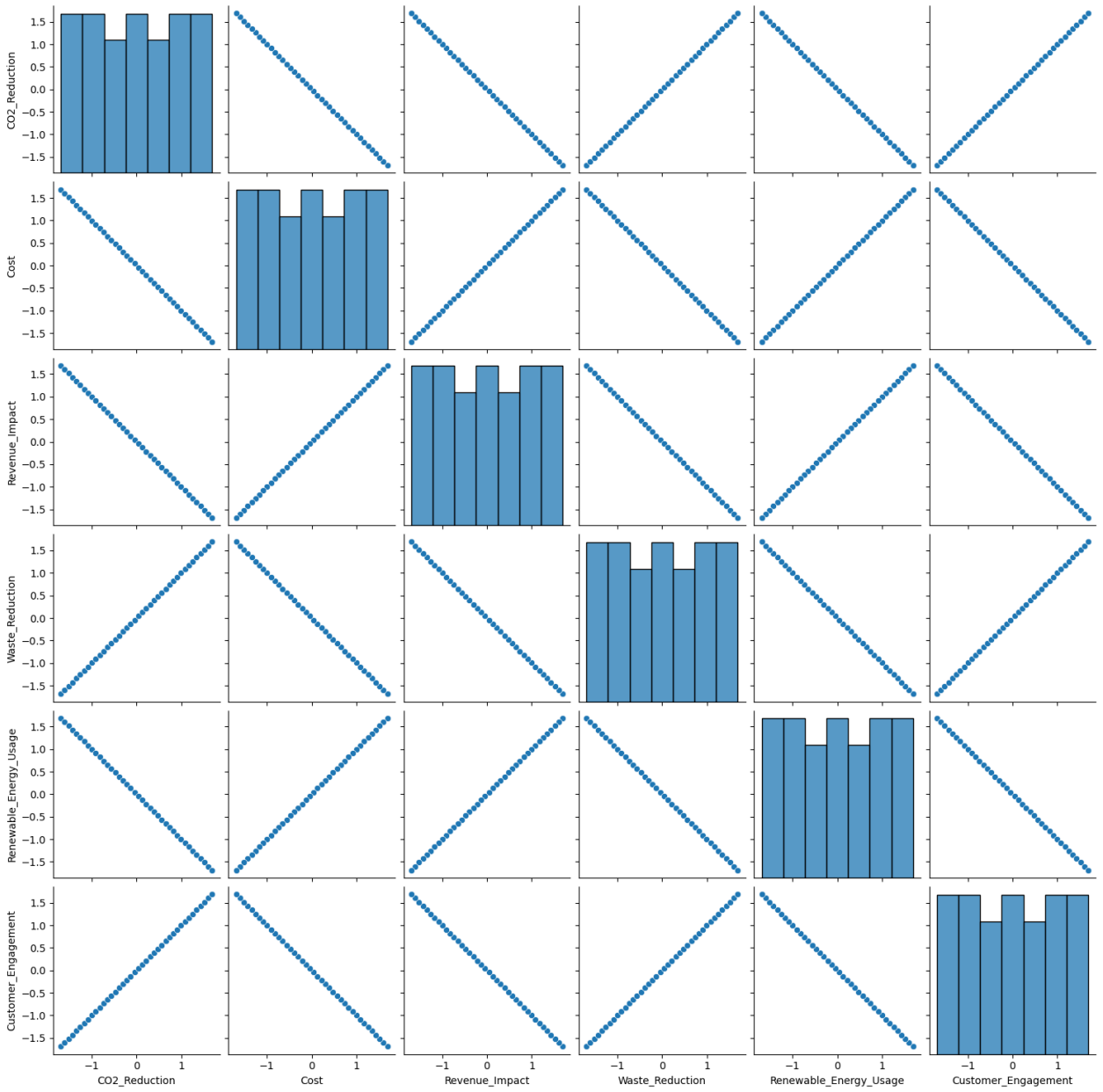
Methodology

Data-Driven Decision Process:

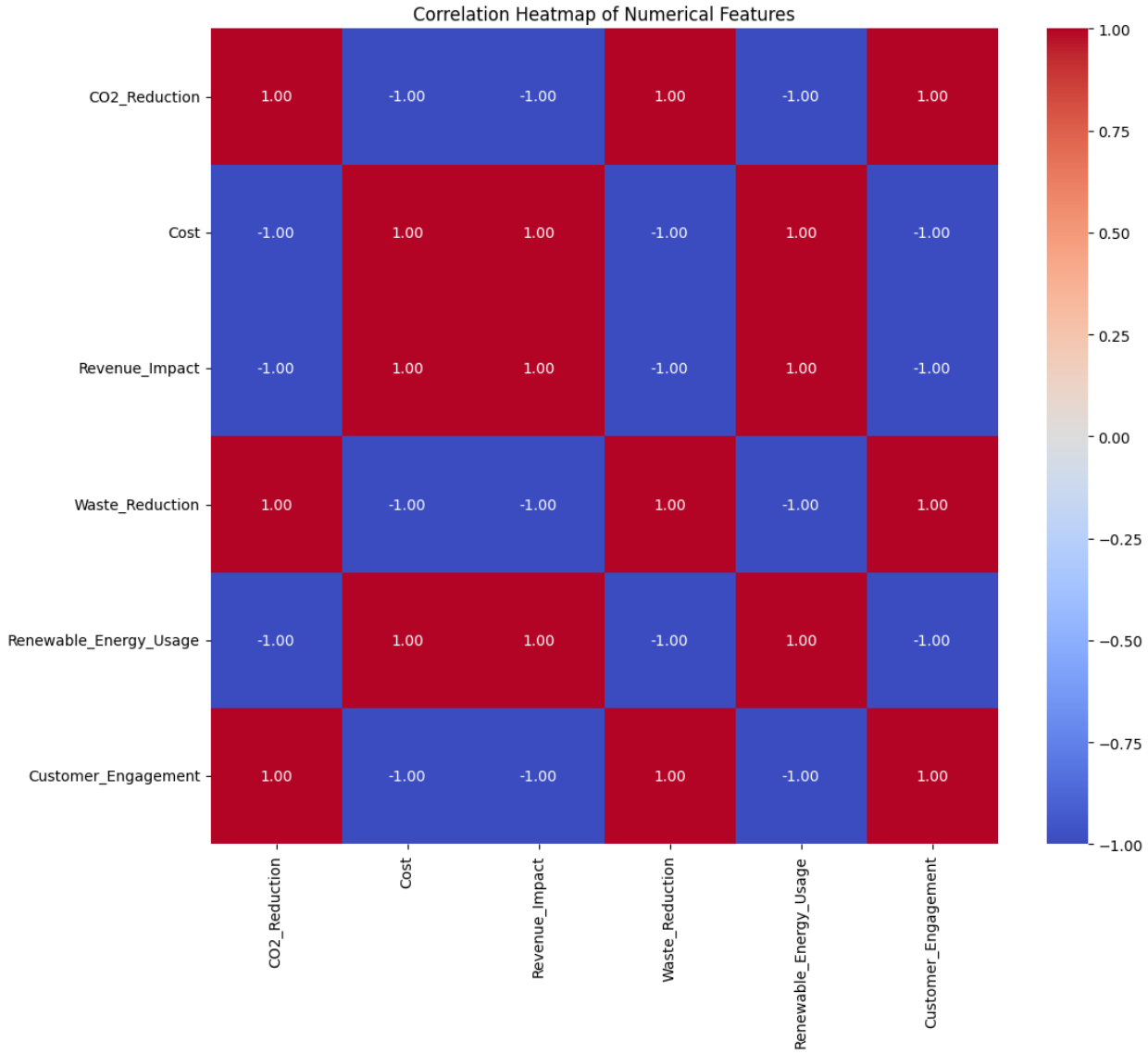


	A	B	C	D	E	F	G	H	I
1	ID	2_Reducti	Cost	venue_Imp	ste_Reduc	ble_Energy	ner_Engag	Category	
2	IKEA_01	50.5	124.8	89.7	1.3	112	45.9	Circular Economy	
3	IKEA_02	51.8	122.5	89.2	2.6	109.2	46.7	Sustainable Materials	
4	IKEA_03	53.1	120.2	88.7	3.9	106.4	47.5	Energy Efficiency	
5	IKEA_04	54.4	117.9	88.2	5.2	103.6	48.3	Circular Economy	
6	IKEA_05	55.7	115.6	87.7	6.5	100.8	49.1	Sustainable Materials	
7	IKEA_06	57	113.3	87.2	7.8	98	49.9	Energy Efficiency	
8	IKEA_07	58.3	111	86.7	9.1	95.2	50.7	Circular Economy	
9	IKEA_08	59.6	108.7	86.2	10.4	92.4	51.5	Sustainable Materials	
10	IKEA_09	60.9	106.4	85.7	11.7	89.6	52.3	Energy Efficiency	
11	IKEA_10	62.2	104.1	85.2	13	86.8	53.1	Circular Economy	
12	IKEA_11	63.5	101.8	84.7	14.3	84	53.9	Sustainable Materials	
13	IKEA_12	64.8	99.5	84.2	15.6	81.2	54.7	Energy Efficiency	
14	IKEA_13	66.1	97.2	83.7	16.9	78.4	55.5	Circular Economy	
15	IKEA_14	67.4	94.9	83.2	18.2	75.6	56.3	Sustainable Materials	
16	IKEA_15	68.7	92.6	82.7	19.5	72.8	57.1	Energy Efficiency	
17	IKEA_16	70	90.3	82.2	20.8	70	57.9	Circular Economy	
18	IKEA_17	71.3	88	81.7	22.1	67.2	58.7	Sustainable Materials	
19	IKEA_18	72.6	85.7	81.2	23.4	64.4	59.5	Energy Efficiency	
20	IKEA_19	73.9	83.4	80.7	24.7	61.6	60.3	Circular Economy	
21	IKEA_20	75.2	81.1	80.2	26	58.8	61.1	Sustainable Materials	
22	IKEA_21	76.5	78.8	79.7	27.3	56	61.9	Energy Efficiency	
23	IKEA_22	77.8	76.5	79.2	28.6	53.2	62.7	Circular Economy	
24	IKEA_23	79.1	74.2	78.7	29.9	50.4	63.5	Sustainable Materials	
25	IKEA_24	80.4	71.9	78.2	31.2	47.6	64.3	Energy Efficiency	
26	IKEA_25	81.7	69.6	77.7	32.5	44.8	65.1	Circular Economy	

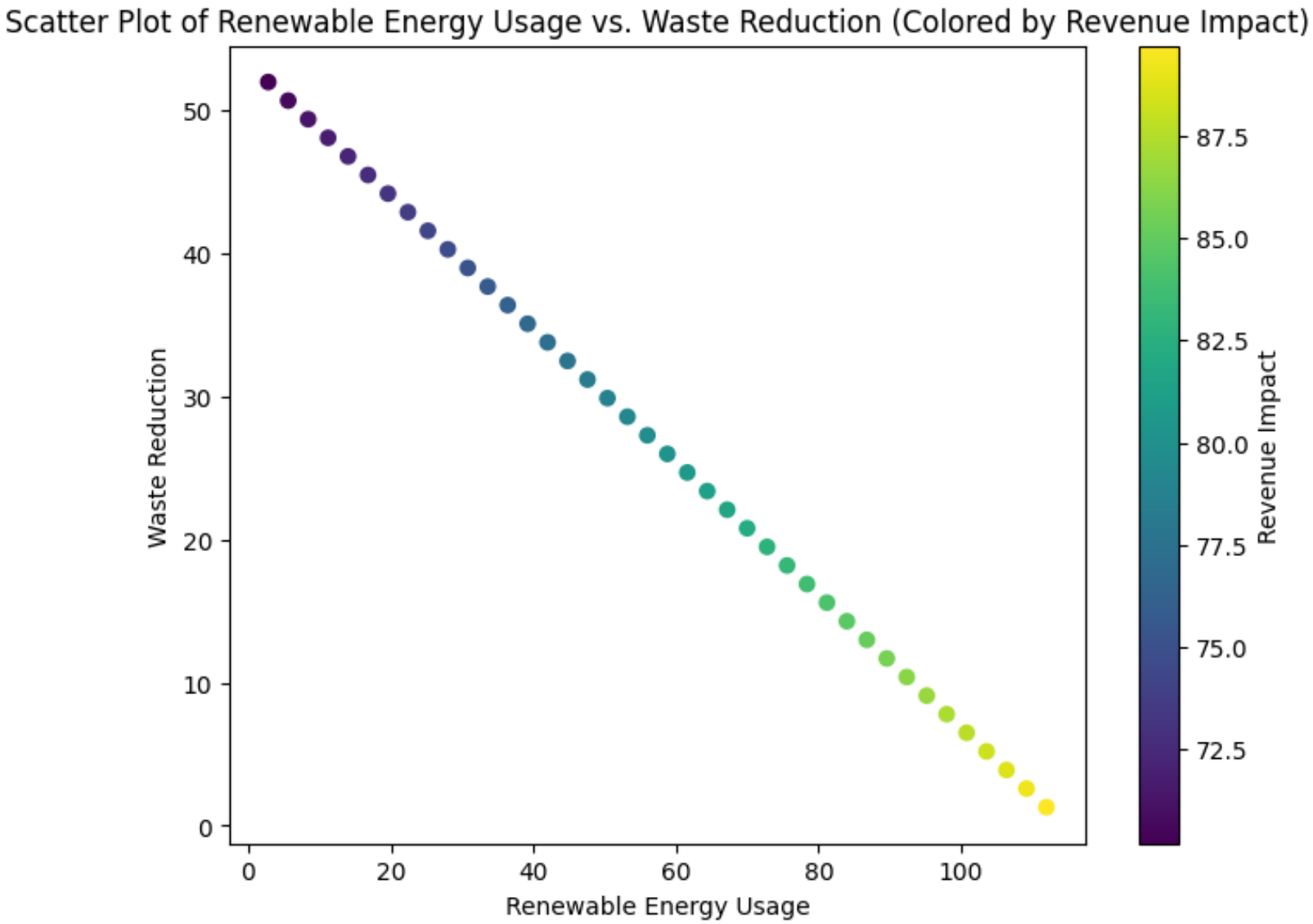
- **Type**: Data on sustainability initiatives.
- **Key Columns**:
- **Renewable Energy Usage**: Percentage from renewable sources.
- **Revenue Impact**: Financial impact of initiatives.
- **Waste Reduction**: Measure of waste reduction.
- **Purpose**: Analyzing relationships between energy usage, waste reduction, and financial outcomes.
- **Data**: Mix of numeric and categorical for visual analysis.



The uploaded image shows a pair plot generated using sns.pairplot() from the Seaborn library, visualizing relationships among numerical variables in a dataset.Each diagonal represents histograms (or kernel density plots) of individual variables, while the off-diagonal subplots show scatter plots representing pairwise relationships between the variables.



The heatmap visualizes the correlations between numerical features in the dataset:
Axes: Both the x-axis and y-axis represent the numerical columns.
Colors: Red tones indicate strong positive correlations (close to +1).
Blue tones indicate strong negative correlations (close to -1).
White or neutral shades indicate weak or no correlation (close to 0).
Annotations: Each cell displays the exact correlation value, formatted to two decimal places.
Insights:Identify features with strong positive relationships (e.g., values close to 1).
Spot features with strong negative relationships (e.g., values close to -1).
Weak or no relationships appear close to 0.



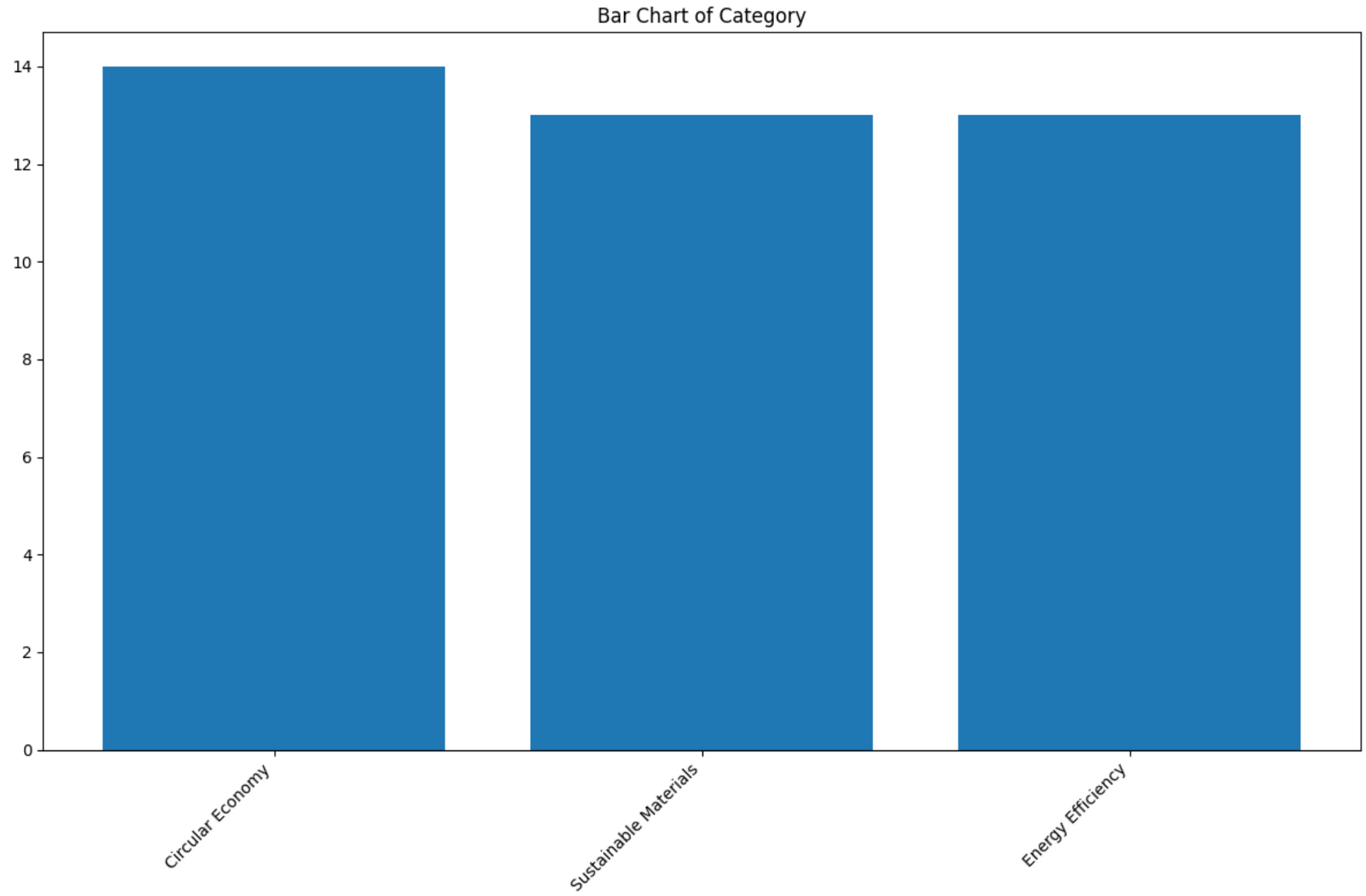
Key Features:

•**Position**: Each point represents a dataset entry.

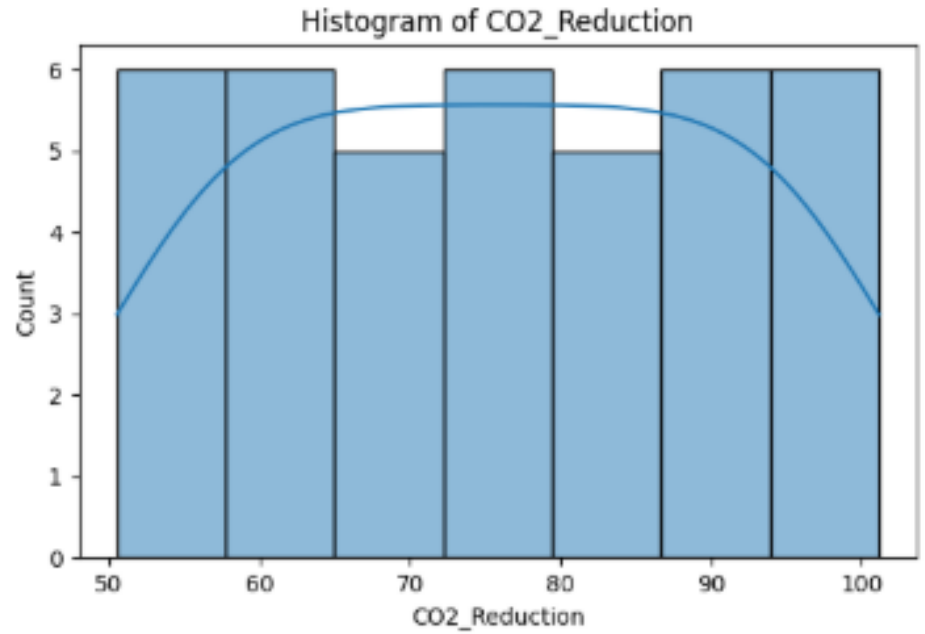
•**Color**: Bright yellow-green indicates higher revenue impact, while darker shades indicate lower impact.

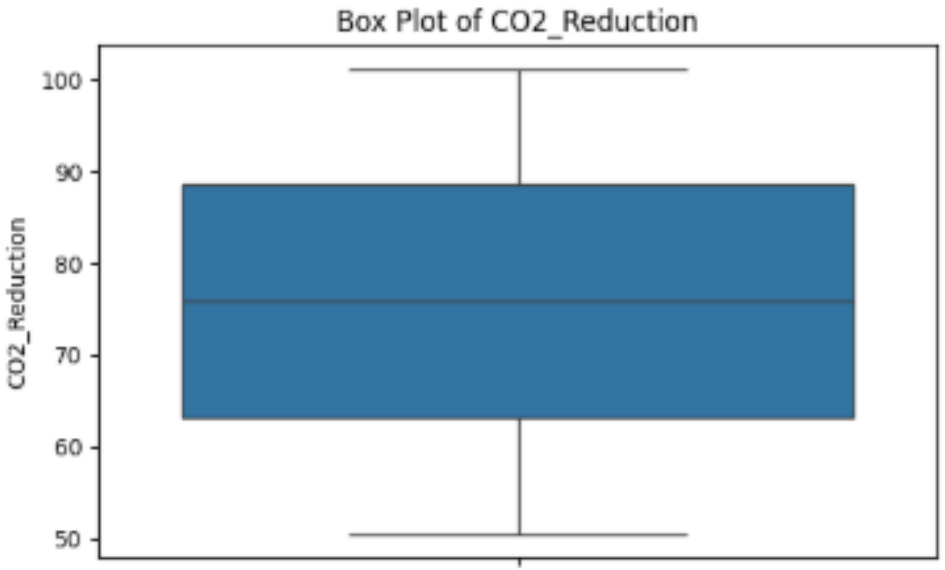
•**Insights**: Patterns or clusters may reveal how revenue impact varies with energy usage and waste reduction.

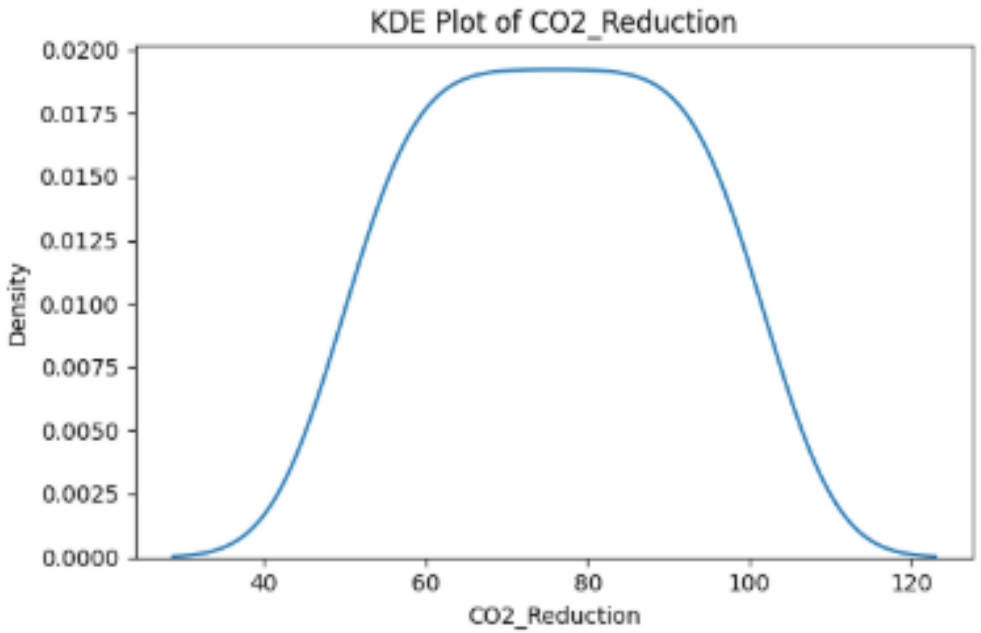
This plot highlights potential trends or correlations among the variables.

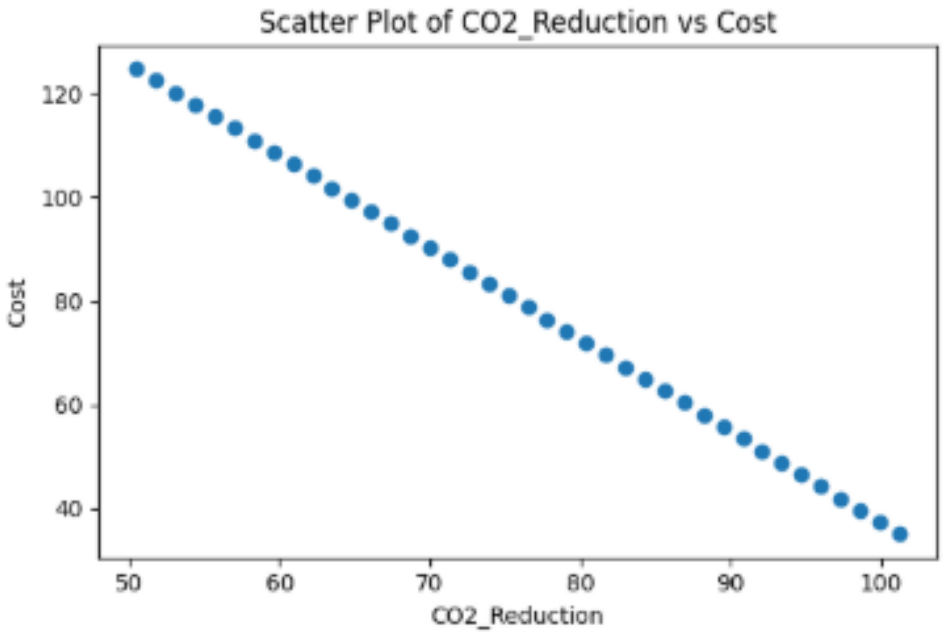


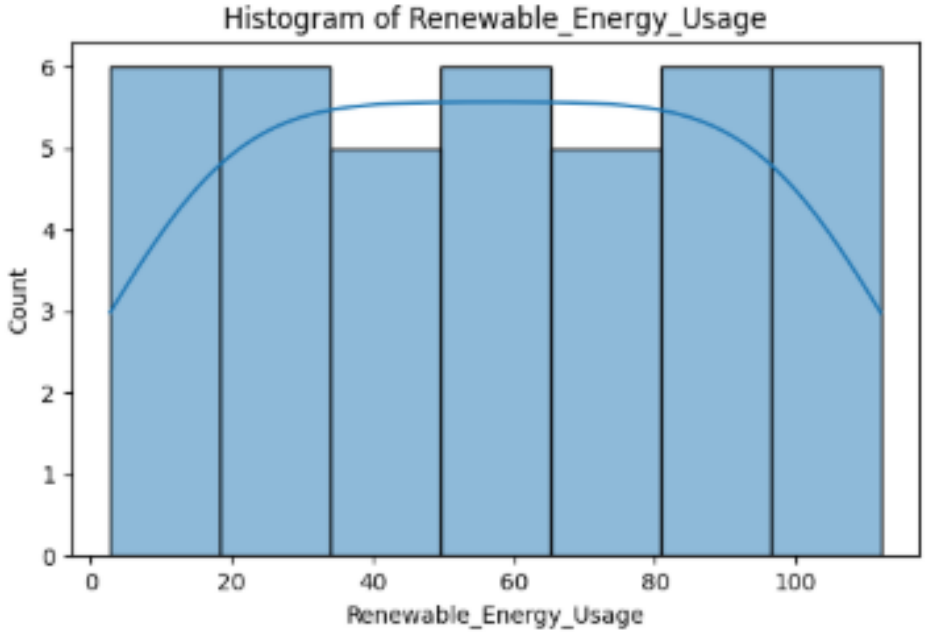
- Key Features:X-axis: Categories in the column.
- Y-axis: Count of occurrences for each category.
- Insights: Highlights the most and least frequent categories in the dataset.
- Rotated x-axis labels improve readability for longer category names.

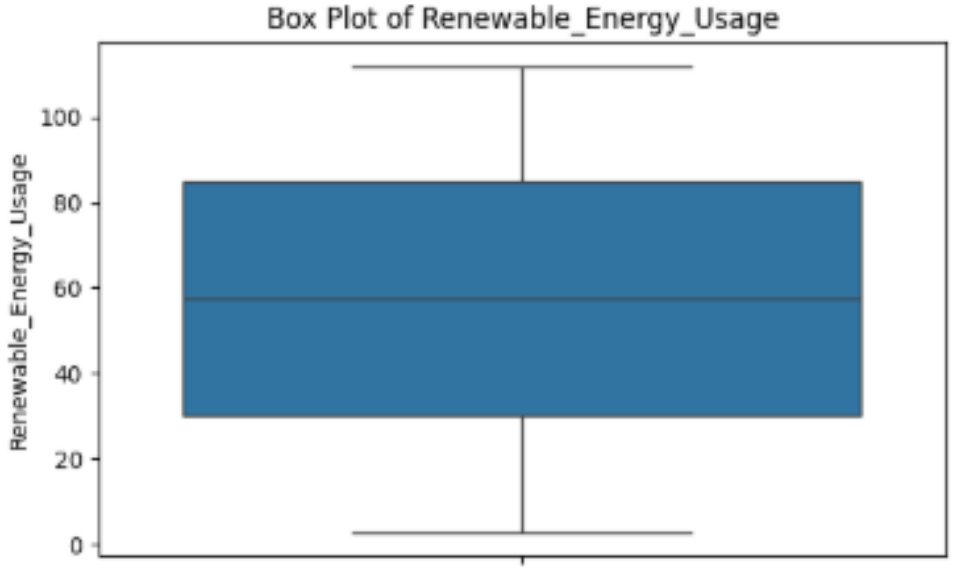

Histogram of CO2_Reduction
Count
CO2_Reduction
0
1
2
3
4
5
6
50
60
70
80
90
100

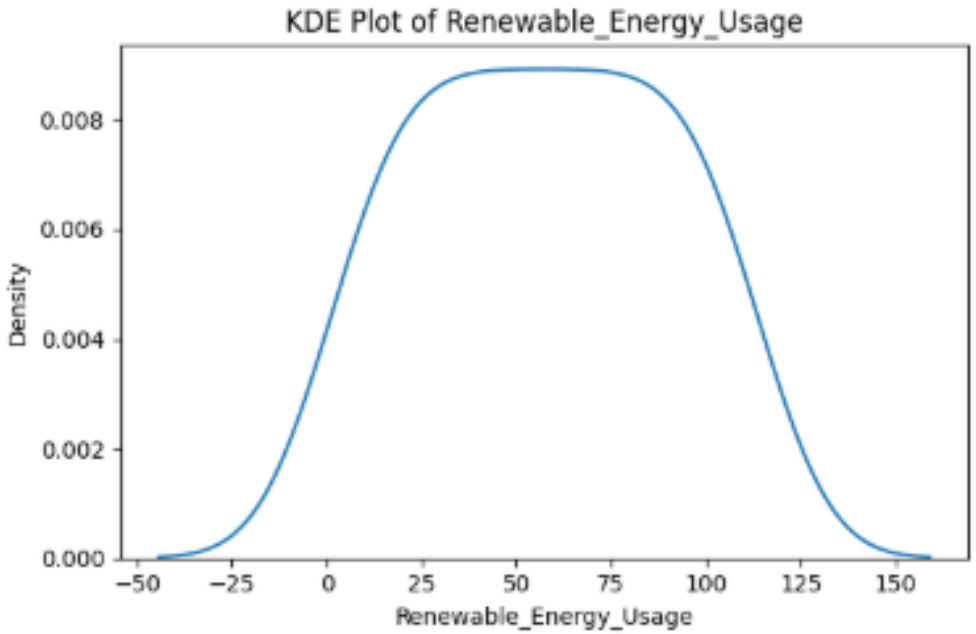

Box Plot of CO2_Reduction
CO2_Reduction
50
60
70
80
90
100

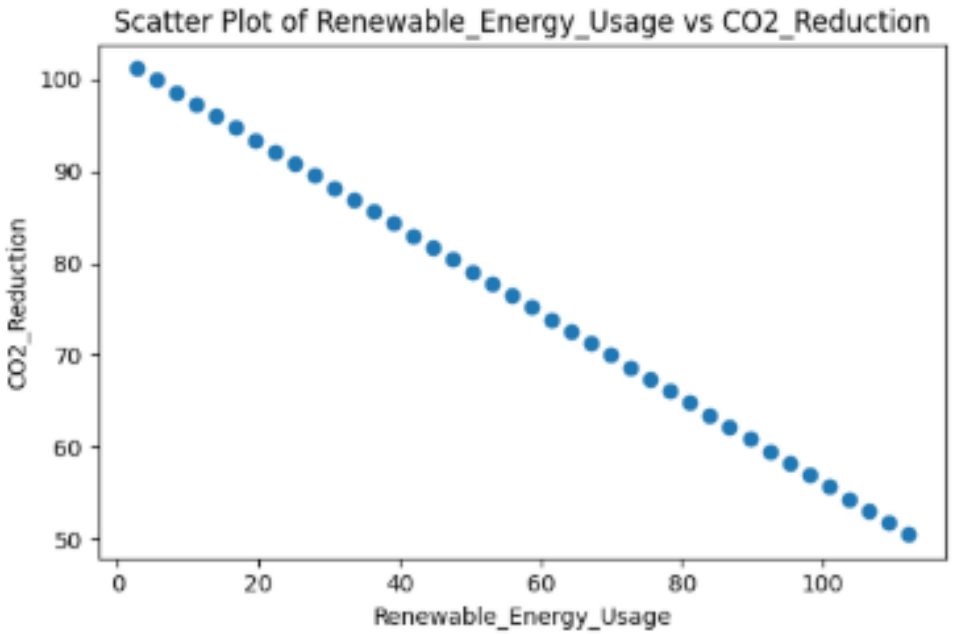

KDE Plot of CO2_Reduction
Density
CO2_Reduction
0.0000
0.0025
0.0050
0.0075
0.0100
0.0125
0.0150
0.0175
0.0200
40
60
80
100
120

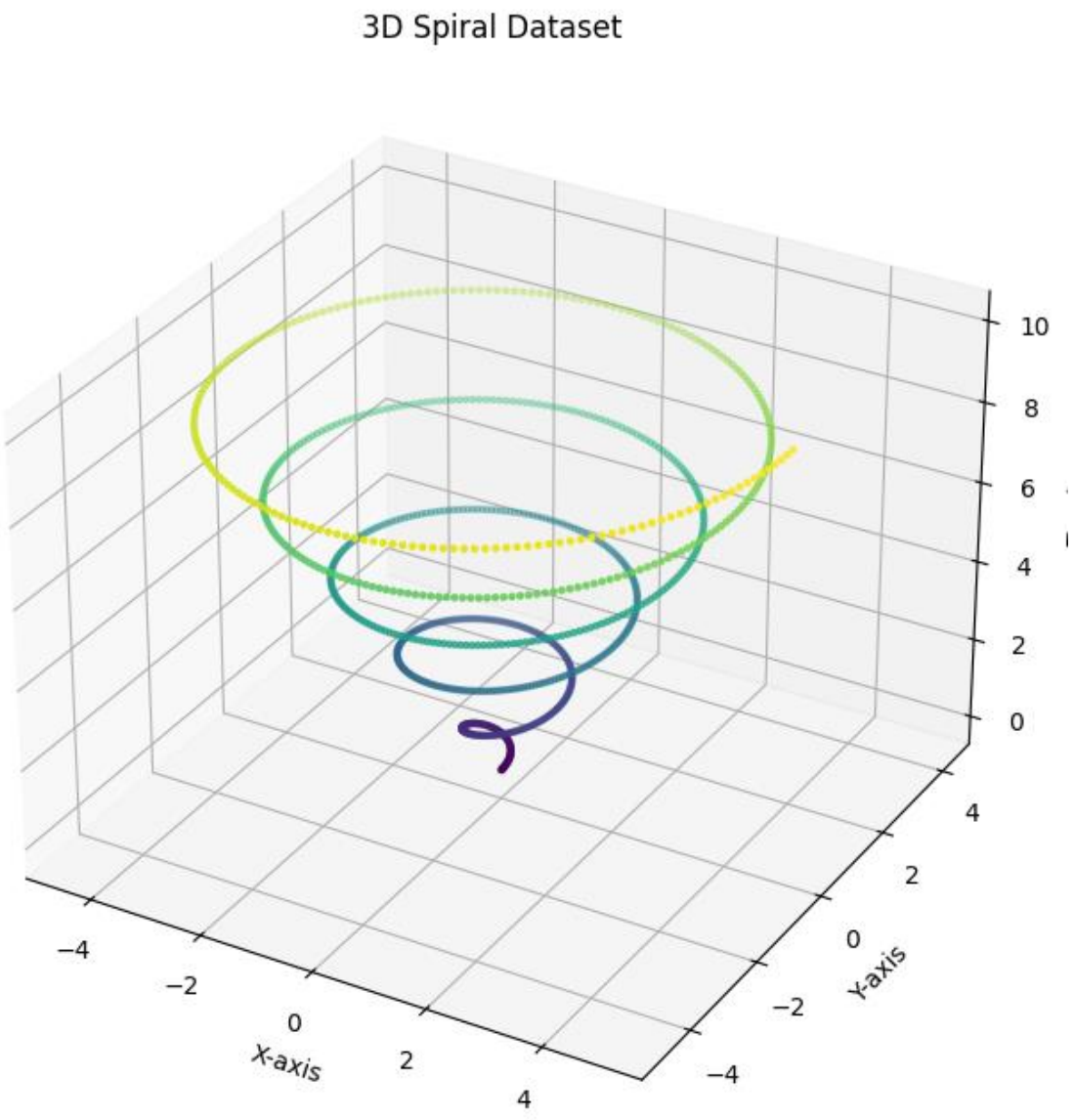

Scatter Plot of CO2_Reduction vs Cost
Cost
CO2_Reduction
40
60
80
100
120
50
60
70
80
90
100


Histogram of Renewable_Energy_Usage
Count
Renewable_Energy_Usage
0
1
2
3
4
5
6
0
20
40
60
80
100


Box Plot of Renewable_Energy_Usage
Renewable_Energy_Usage
0
20
40
60
80
100


KDE Plot of Renewable_Energy_Usage
Density
Renewable_Energy_Usage
0.000
0.002
0.004
0.006
0.008
−50
−25
0
25
50
75
100
125
150

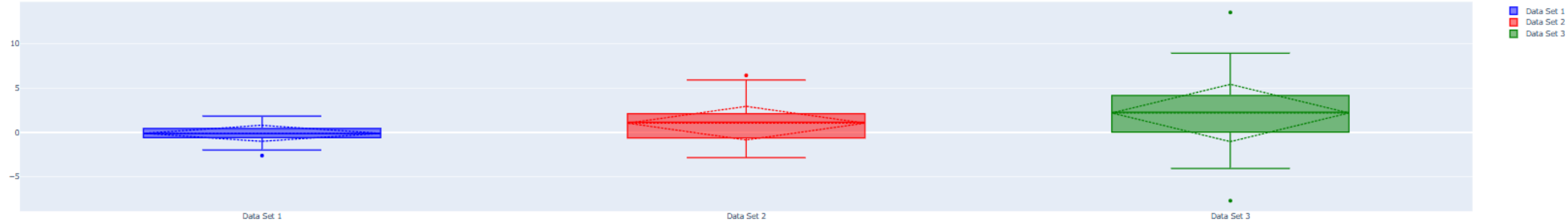

Scatter Plot of Renewable_Energy_Usage vs CO2_Reduction
CO2_Reduction
Renewable_Energy_Usage
50
60
70
80
90
100
0
20
40
60
80
100



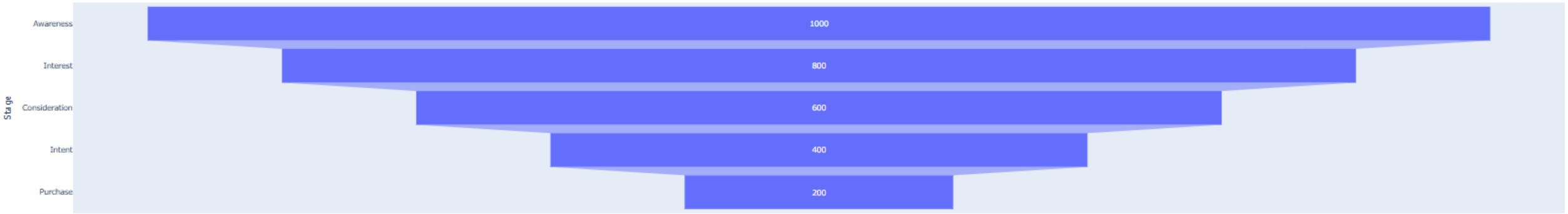
Key Features of the Graph:

- X-axis and Y-axis: The dataset forms a spiral on the XY-plane, with the radius gradually increasing as the spiral completes multiple turns.
- Z-axis: The points rise vertically along the Z-axis, creating a helical structure that spirals upward.
- Color Gradient: The points are colored based on their angular position (theta), with the Viridis colormap applied to visually distinguish different parts of the spiral.
- Points Distribution: The points are uniformly distributed along the spiral, with a smooth transition between the X, Y, and Z coordinates, providing a clear 3D representation.

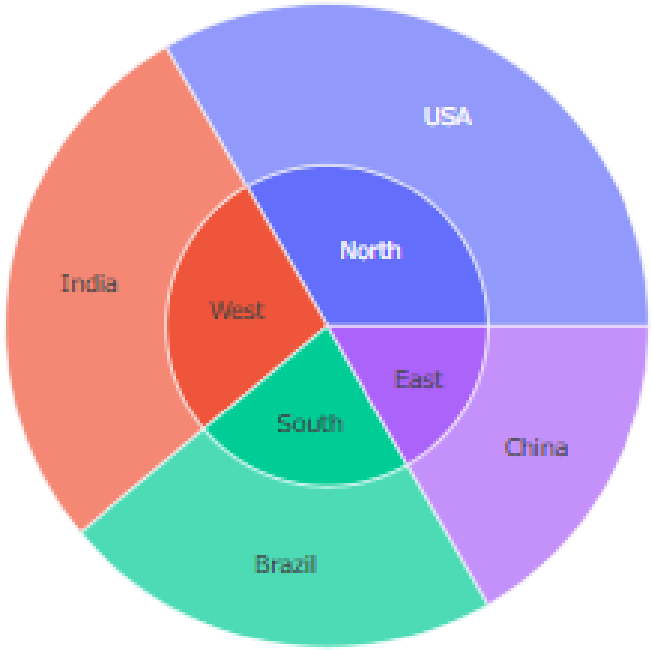
3D Box Plot



Funnel Chart

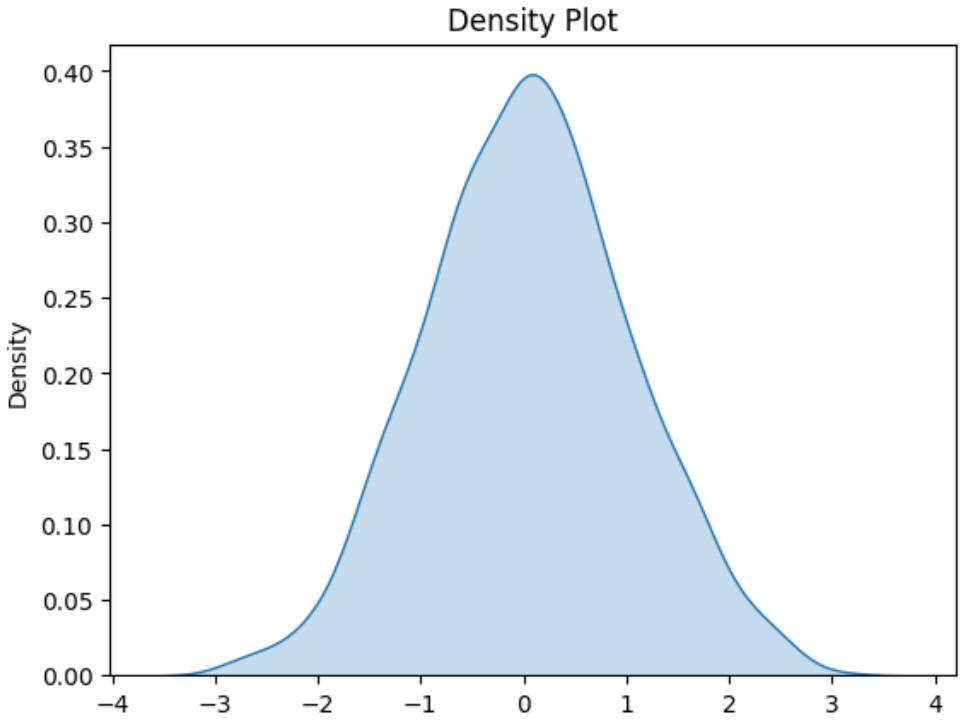


Sunburst Chart

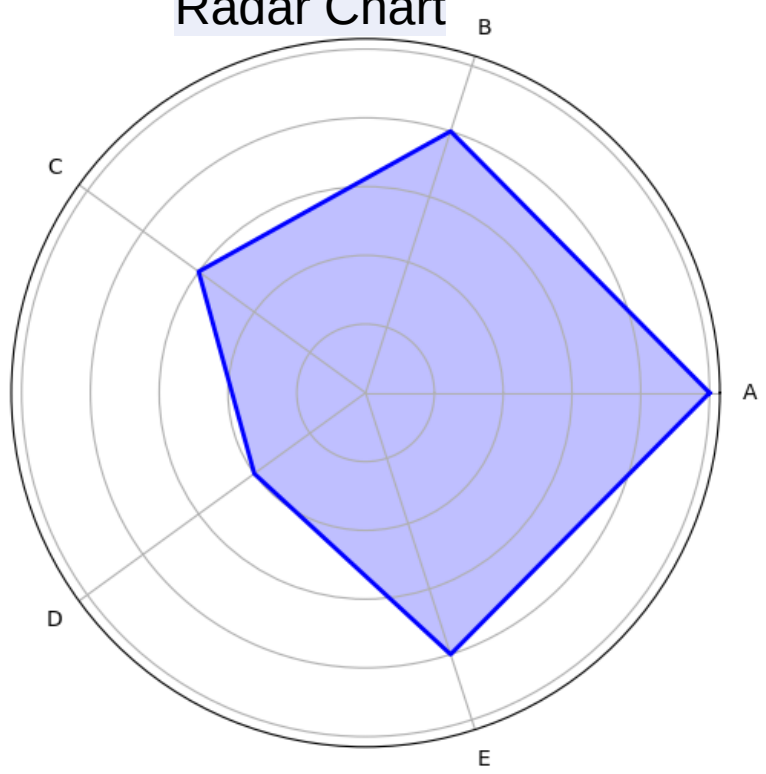


Sunburst Chart: A radial chart used to visualize hierarchical data, with each level represented by a ring, and inner rings showing broader categories while outer rings break down into subcategories.

Density Plot: A smooth, continuous version of a histogram, showing the distribution of a dataset and its probability density, often used to understand the underlying distribution of data.

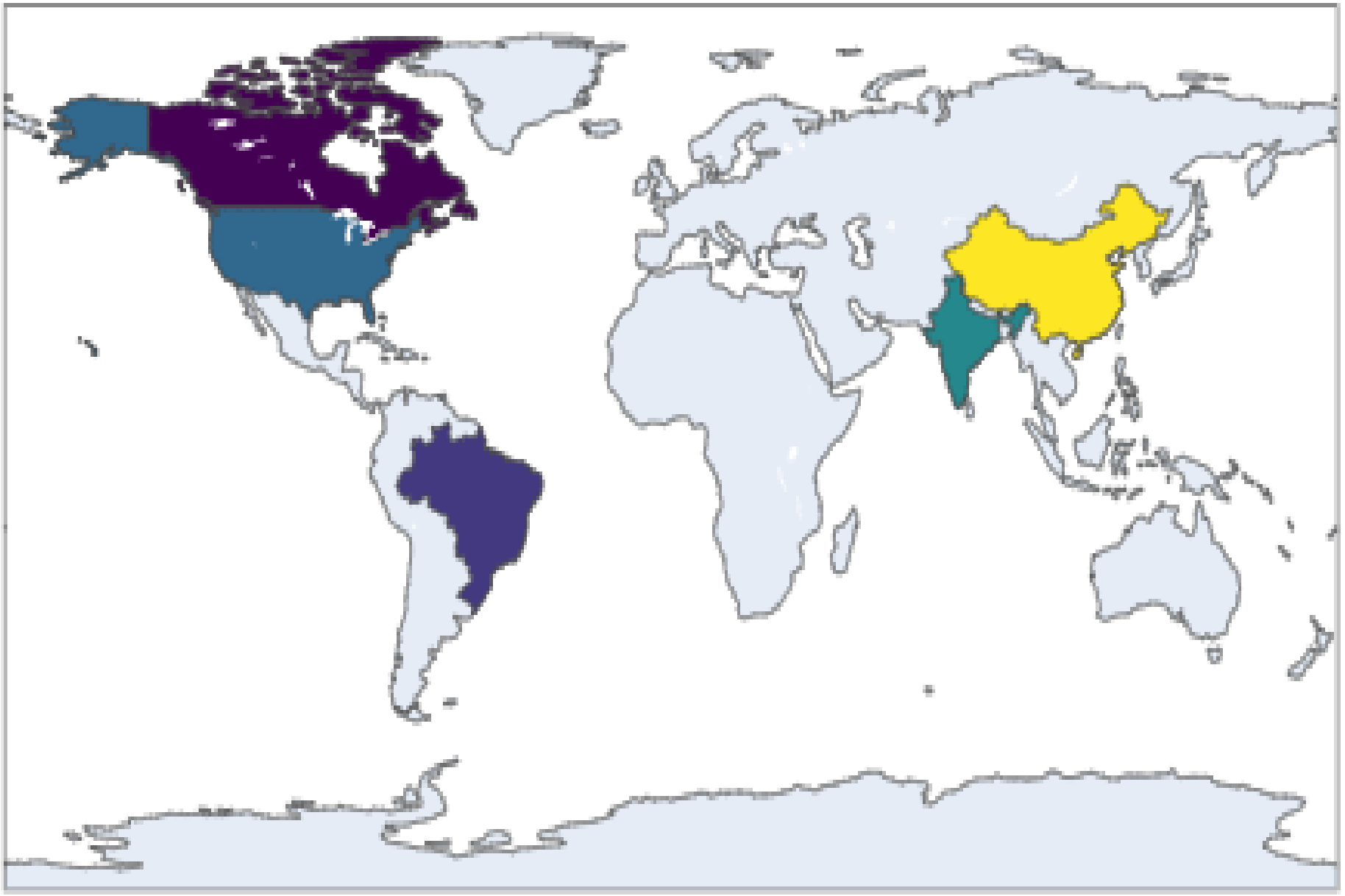


Radar Chart



Radar Chart: A graphical representation of multivariate data with multiple axes, where each axis represents a variable, and the data points are plotted along these axes to form a polygon.

Choropleth MAP



Conclusion

Summary

•IKEA’s sustainability initiatives demonstrate strong correlations between environmental, economic, and social impacts.
•Key drivers include cost efficiency, renewable energy usage, and customer engagement.
•Linear regression and clustering revealed actionable insights to prioritize high-impact initiatives.
•Recommendations were made to optimize sustainability strategies and enhance outcomes.

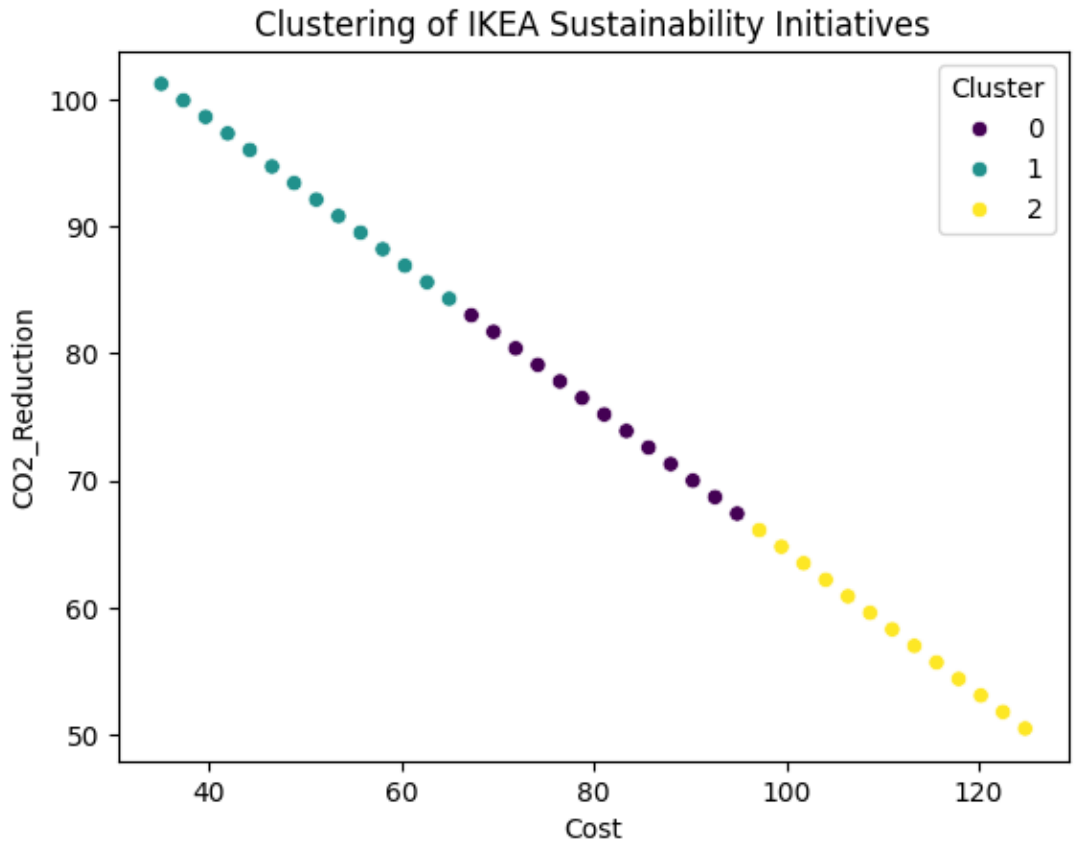
Future Work

- **Broader Analysis**: Expand the dataset to include more initiatives and global operations.
- **Real-Time Monitoring**: Integrate IoT and real-time data tracking for continuous evaluation.
- **Emerging Technologies**: Explore AI and machine learning to predict long-term sustainability impacts.
- **Comparative Studies**: Benchmark IKEA's sustainability performance against industry peers.
- **Stakeholder Engagement**: Assess the role of customer and community participation in driving impact.

References

- IKEA Sustainability Report: https://www.ikea.com/ms/en_US/this-is-ikea/sustainable-everyday/sustainability-report
- IKEA and Sustainability Practices (World Economic Forum): https://www.weforum.org/agenda/2021/01/how-ikea-is-becoming-more-sustainable/
- Sustainability and Corporate Responsibility at IKEA: https://about.ikea.com/en/sustainability
- Case Studies on IKEA's Circular Economy (Ellen MacArthur Foundation): https://ellenmacarthurfoundation.org/case-studies/ikea-designs-for-circularity
- IKEA Carbon Footprint Reduction: https://www.climateaction.org/news/ikea-reduces-carbon-footprint-while-increasing-sales
- Sustainable Energy Goals at IKEA: https://www.reuters.com/business/sustainable-energy-ikea-2022

Result




```python
from sklearn.cluster import KMeans
import matplotlib.pyplot as plt

# Exclude non-numeric columns like 'Initiative_ID' and 'Category'
X_for_clustering = df.drop(['CO2_Reduction', 'Category', 'Initiative_ID'], axis=1)

kmeans = KMeans(n_clusters=3, random_state=42)
df['Cluster'] = kmeans.fit_predict(X_for_clustering)

sns.scatterplot(data=df, x='Cost', y='CO2_Reduction', hue='Cluster', palette='viridis')
plt.title("Clustering of IKEA Sustainability Initiatives")
plt.show()
```

Thank You!