Analysis Report on which location in India is most suitable to create the early market in accordance with Innovation Adoption Life Cycle

By

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Github Link: https://github.com/PrabhanshuSingh94/EV_Startup_City

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Step1. Formulating Questions on the basis of Client Requirement

What type of EV the company will provide?

- The focus of this analysis report will be on electric vehicles (EVs) specifically in the four-wheeler category. We will utilize a dataset to study various aspects of the electric four-wheeler market.

To whom the EV will sell?

- The target customer segment for the electric vehicles (EVs) will primarily consist of individuals who express a willingness to adopt EVs in the future. This determination is based on the analysis of the data.
- The next key factor in identifying the target customer segment for the electric vehicles (EVs) will be based on people's reviews and their inclination towards replacing their existing petrol or diesel vehicles with electric ones. This consideration is vital in understanding the potential market for EV adoption.
- Furthermore, an essential factor to consider in determining the viability of the electric vehicle (EV) market in various cities will be the mean annual salary of the residents in those selected cities, as EVs are generally perceived as being higher in cost compared to traditional petrol or diesel vehicles. This information will provide insights into the affordability and purchasing power of potential customers in different locations.

Step2. Collecting the data based on Client Requirement

For the analysis of the electric vehicle (EV) market, a dataset named 'EV_data.csv' has been compiled, containing the following factors:

1. Age: The age of the individual participant.

2. City: The city of residence of the participant.

3. Education: The educational background of the participant.

4. Number of Family Members: The total number of members in the participant's family.

5. Would you prefer replacing all vehicles to Electronic vehicles?: A yes/no/maybe response indicating the participant's willingness to replace all their vehicles with electric vehicles (EVs).

6. If Yes/Maybe what type of EV would you prefer?: An open-ended response specifying the type of electric vehicle the participant would prefer if they are open to replacing their vehicles.

7. Do you think Electronic Vehicles are economical?: A yes/no response reflecting the participant's perception of the economic viability of electric vehicles.

8. Which brand of vehicle do you currently own?: The brand of the participant's current vehicle.

9. How much money could you spend on an Electronic vehicle?: A range indicating the maximum amount the participant is willing to spend on an electric vehicle.

10. Preference for wheels in EV: The participant's preference for the number of wheels in an electric vehicle (EV), such as 2-wheeler, 4-wheeler, etc.

11. Do you think Electronic vehicles will replace fuel cars in India?: A yes/no response indicating the participant's opinion on the potential for electric vehicles to replace traditional fuel-powered cars in India.

```
df = pd.read_csv(r'C:\Users\prabh\OneDrive\Desktop\EV_Data.csv')
df.head()
```

	Age	City	Profession	Education	No. of Family members	Annual Income	Would you prefer replacing all your vehicles to Electronic vehicles?	If Yes/Maybe what type of EV would you prefer?	Do you think Electronic Vehicles are economical?	Which brand of vehicle do you currently own?	How much money could you spend on an Electronic vehicle?	Preference for wheels in EV	Do you think Electronic vehicles will replace fuel cars in India?
0	30	Nabha	Political Background	Graduate	5	1193875.647	Maybe	SUV	Yes	Hyundai	<5 lakhs	2	I don't think so
1	27	Dehradun	Political Background	Graduate	4	1844540.398	Yes	SUV	Yes	Honda	<15 lakhs	4	Yes, in <20years
2	32	Kashipur	Political Background	Graduate	4	2948150.113	Yes	Hatchback	Yes	KIA	<15 lakhs	4	Yes, in <20years
3	55	Haldwani	Business	Graduate	3	2832379.739	Maybe	Hatchback	No	Hyundai	<5 lakhs	4	Yes, in <10 years
4	26	Satara	Political Background	Graduate	4	2638750.576	Yes	Sedan	Yes	McLaren	<15 lakhs	4	Yes, in <20years

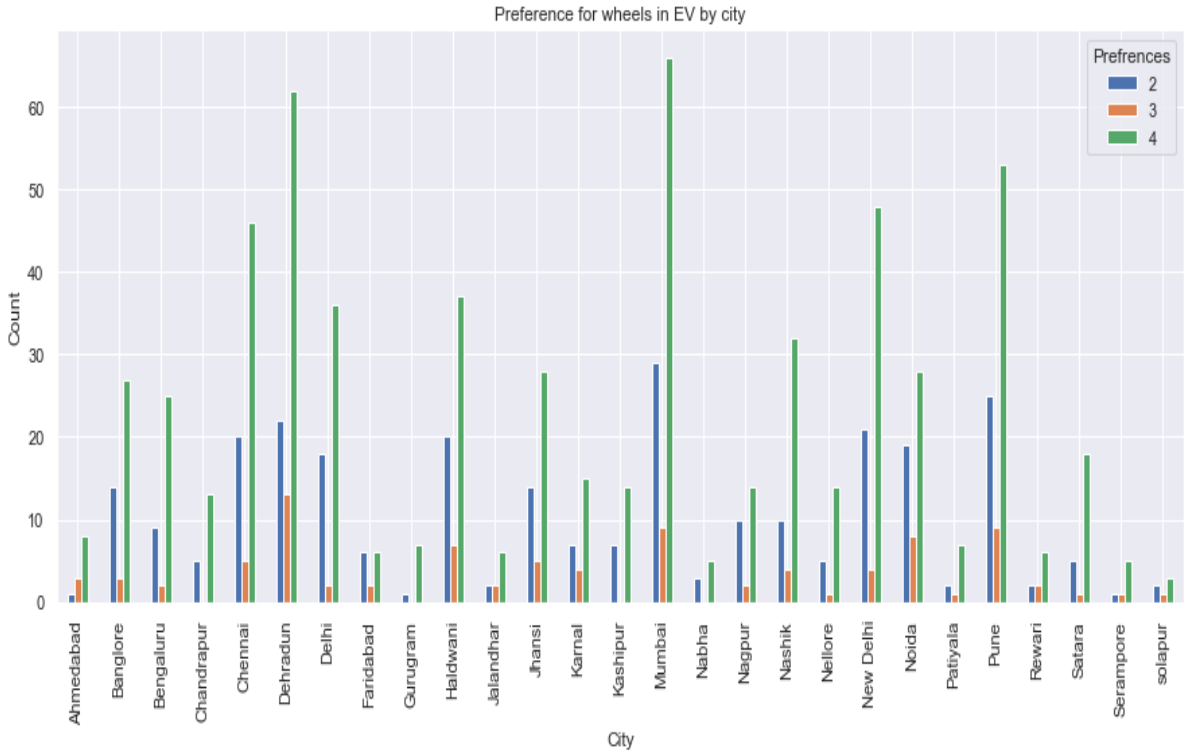
Step3. Analysing on Different Factors

Market Analysis Report: Electric Vehicle (EV) Market Trends

1. Preference for Wheels in EV by City:

The analysis of the electric vehicle market based on the preference for the number of wheels in EVs has shown significant variations across different major cities. Among the cities under consideration, including Mumbai, Dehradun, Pune, and New Delhi, preferences for wheels in EVs differ. Further analysis and visualizations will be presented below.

The preference for the number of wheels in EVs is an important consideration when understanding consumer preferences in major cities such as Mumbai, Dehradun, Pune, and New Delhi. The following bar chart illustrates the distribution of preferences:

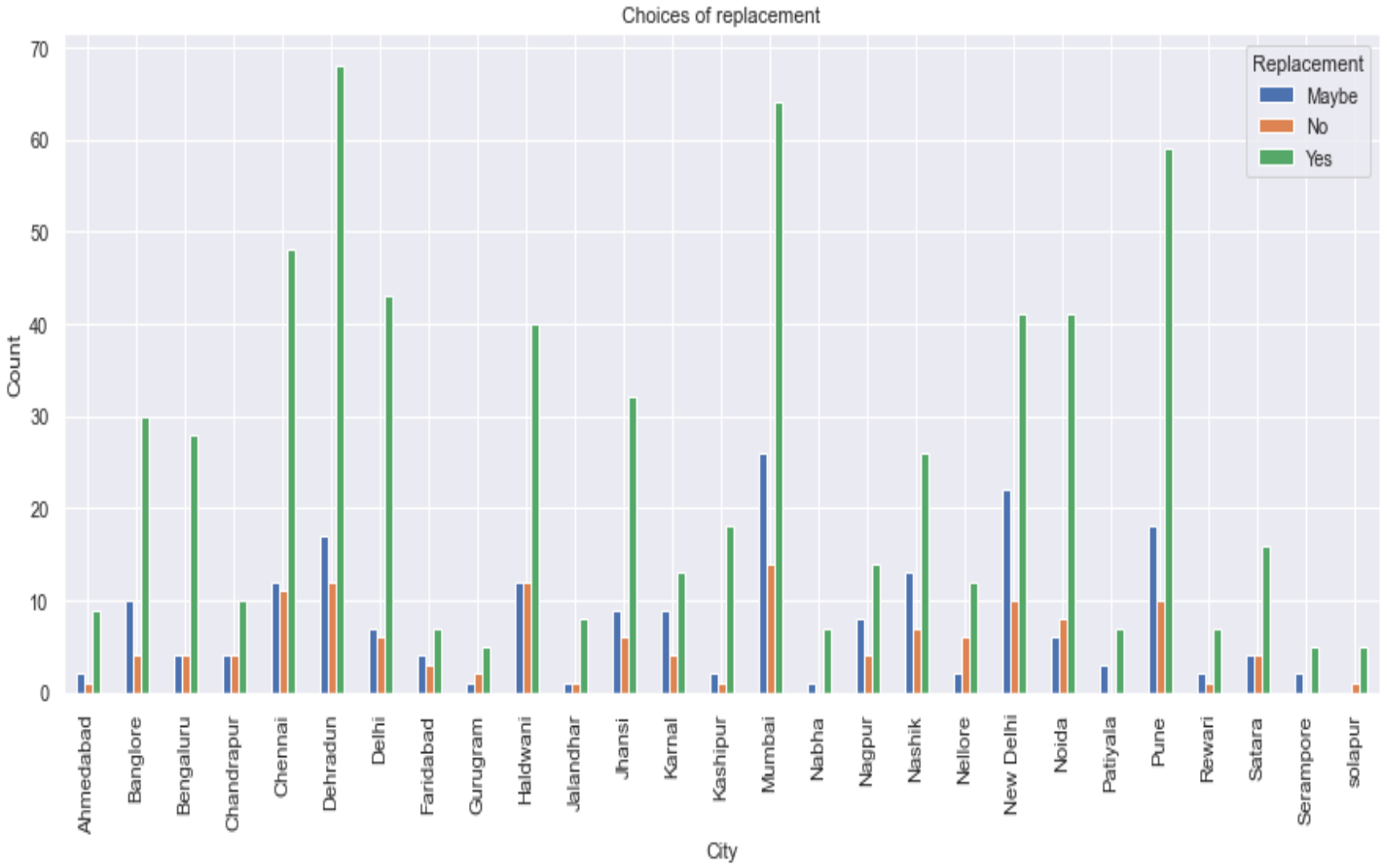


The chart shows the breakdown of preferences for different types of EVs based on the number of wheels in each city. This information can help in tailoring the product offerings to cater to specific preferences in each city.

2. Replacement of Petrol/Diesel Vehicle:

Examining the inclination to replace traditional petrol/diesel vehicles with electric vehicles has revealed varying levels of interest across different major cities.

The cities of Dehradun, Mumbai, Pune, and Chennai stand out in terms of the willingness to replace conventional vehicles with EVs. More detailed insights will be illustrated in the visual representations below.

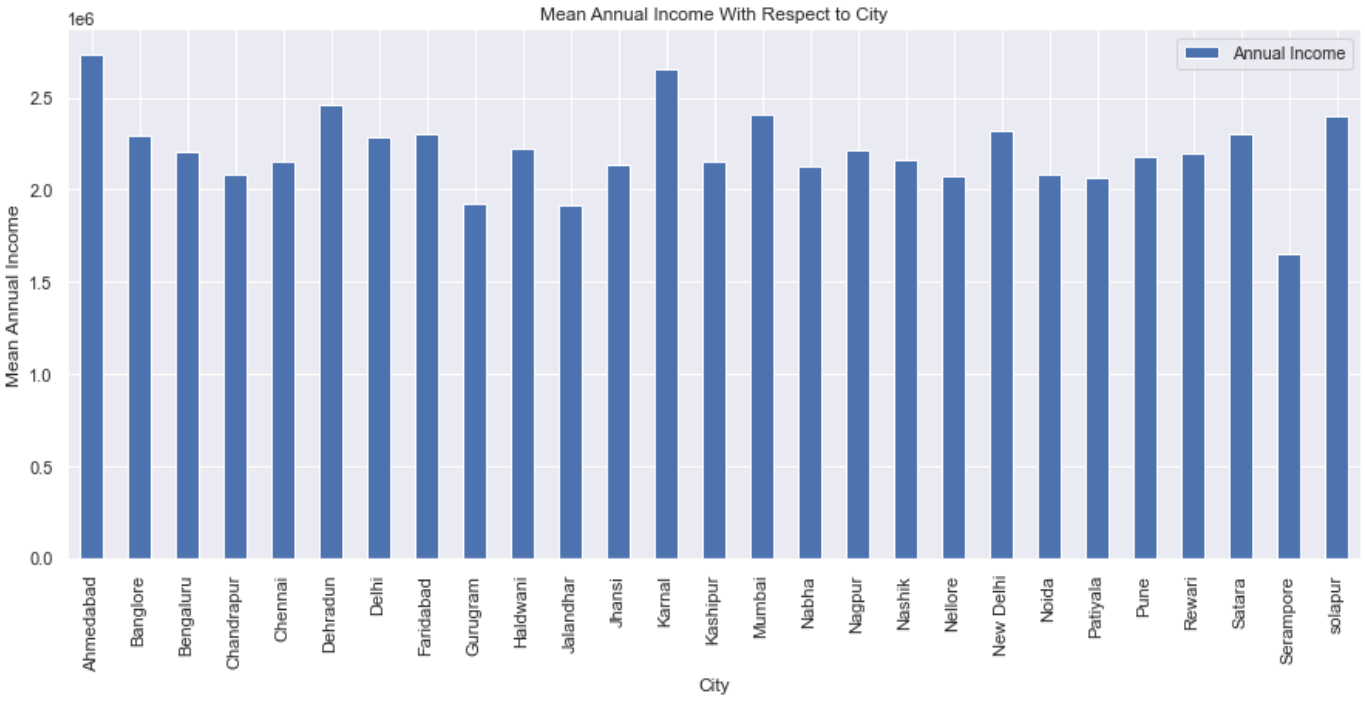


The graph highlights the proportion of respondents willing to replace their conventional vehicles with electric vehicles in different cities. This information aids in identifying the cities with a higher willingness to embrace EVs.

3. Mean Annual Income With Respect to City:

The evaluation of mean annual income in relation to different cities has identified key income centres. Cities such as Ahmedabad, Karnal, Dehradun, Mumbai, and New Delhi exhibit higher mean annual incomes. These cities are significant contributors to the potential market for electric vehicles. The visualizations below will offer a clearer understanding of income disparities among cities.

The mean annual income in relation to various cities is a key factor in determining the affordability of electric vehicles. The bar chart below displays the mean annual income for each city:



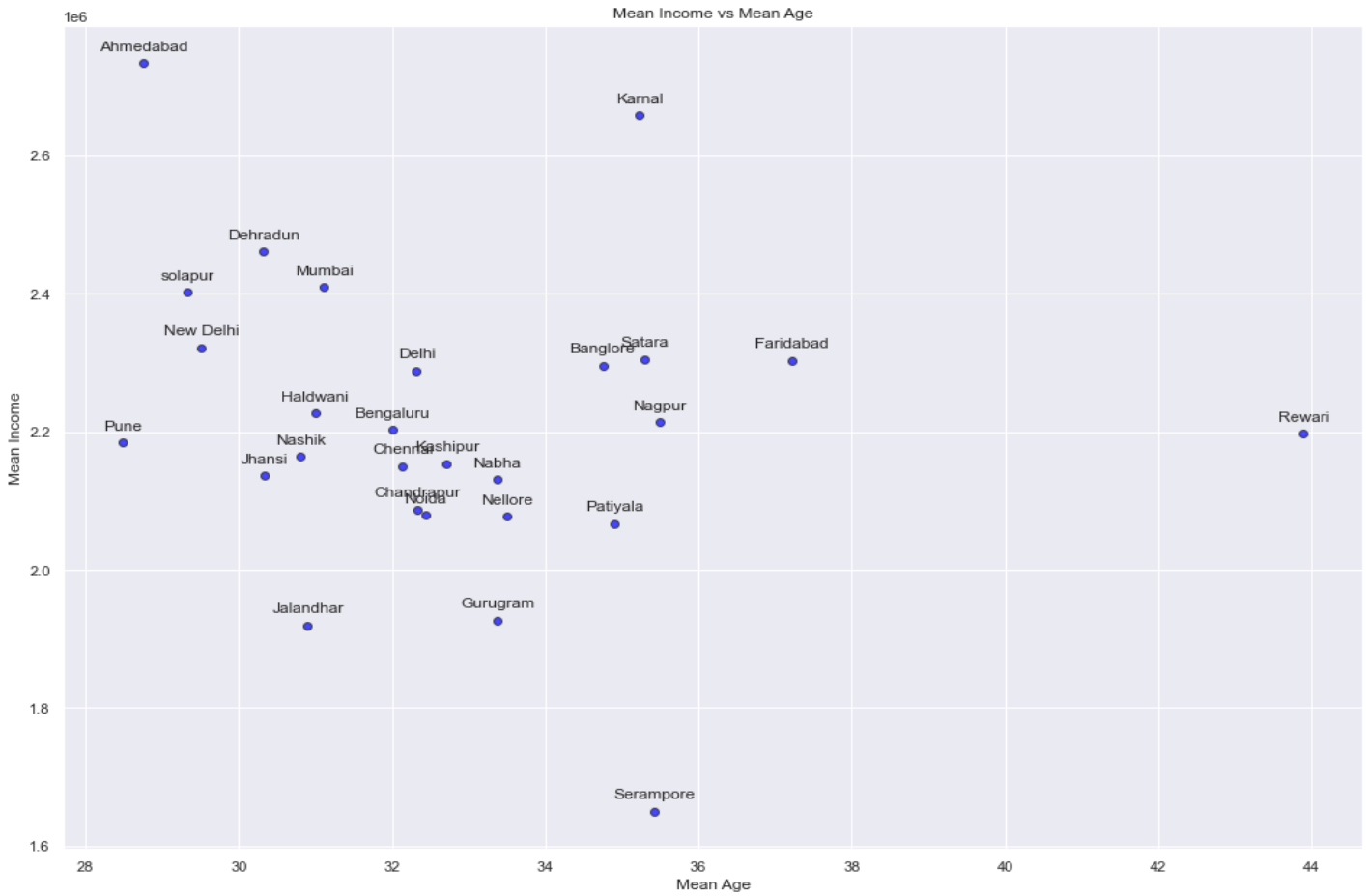
Graph

The graph showcases the income levels in different cities, helping to identify potential high-income markets for electric vehicles.

4. Mean Income vs Mean Age:

An insightful analysis of mean income and mean age indicates a promising trend for targeting the younger generation with effective income. This demographic represents a potentially lucrative segment of the market for electric vehicles. The graph below illustrates the correlation between mean income and mean age.

The correlation between mean income and mean age provides insights into targeting the younger generation with substantial disposable income. The scatter plot below illustrates this correlation:



The scatter plot demonstrates the relationship between mean income and mean age across cities, suggesting a potential customer segment for EVs.

This comprehensive analysis report offers a glimpse into the electric vehicle market's dynamics across various factors. By considering preferences, replacement trends, income levels, and demographic correlations, we aim to provide actionable insights to guide startup's market strategy. The accompanying visualizations offer a visual representation of the data trends, empowering informed decision-making.

Variance Inflation Factor (VIF) Analysis: Identifying Multicollinearity

In our endeavour to determine the most suitable city for Electric Vehicle (EV) startup, we conducted a comprehensive Variance Inflation Factor (VIF) analysis. The

VIF values were computed for each predictor variable, shedding light on the presence of multicollinearity among the features in the dataset. Multicollinearity can affect the reliability and interpretability of regression models, and understanding its implications is crucial for making informed decisions.

Here are the VIF values for the predictor variables:

1. Age (VIF: 8.16): The age variable exhibits a moderate level of multicollinearity with other predictors, indicating potential interactions with demographic and preference-related factors.

2. Profession (VIF: 3.88): Profession displays a moderate correlation with other variables. Exploring how this variable contributes to the overall analysis is essential.

3. Education (VIF: 1.44): Education showcases a low level of correlation, suggesting it is relatively independent of other factors in the dataset.

4. No. of Family Members (VIF: 8.34): The number of family members has a moderate degree of multicollinearity, implying associations with economic and preference-related factors.

```
calc_vif(X)
```

	variables	VIF
0	Age	8.156787
1	Profession	3.875049
2	Education	1.440221
3	No. of Family members	8.336973
4	Annual Income	5.716729
5	Would you prefer replacing all your vehicles t...	4.088190
6	If Yes/Maybe what type of EV would you prefer?	7.092470
7	Do you think Electronic Vehicles are economical?	6.311455
8	Which brand of vehicle do you currently own?	6.848635
9	How much money could you spend on an Electroni...	13.204807
10	Preference for wheels in EV	12.569974
11	Do you think Electronic vehicles will replace ...	4.787065

5. Annual Income (VIF: 5.72): Annual income demonstrates moderate multicollinearity, suggesting it interacts with various aspects of the EV market analysis.

6. Preference for EV Replacement (VIF: 4.09): This variable exhibit jmoderate multicollinearity, potentially relating to factors influencing the preference for electric vehicle adoption.

7. Preferred EV Type (VIF: 7.09): The preferred type of EV displays moderate multicollinearity, indicating potential connections with demographic and preference-related variables.

8. Economic Perception of EVs (VIF: 6.31): The perception of EVs as economical exhibits moderate multicollinearity, suggesting links with economic and preference-based factors.

9. Current Vehicle Brand (VIF: 6.85): Current vehicle brand showcases moderate multicollinearity, implying associations with consumer preferences and choices.

10. Maximum Spending on EV (VIF: 13.20): This variable demonstrates a high level of multicollinearity, indicating strong interactions with other economic and preference-related factors.

11. Preference for Wheels in EV (VIF: 12.57): The preference for the number of wheels in an EV exhibits high multicollinearity, potentially affecting the analysis of vehicle preferences.

12. Belief in EV Replacement (VIF: 4.79): The belief in EVs replacing fuel cars in India displays moderate multicollinearity, suggesting links with future expectations and market perceptions.

Interpreting the VIF values enables us to make informed decisions regarding feature selection and model building. Variables with high VIF values may require careful consideration to avoid multicollinearity-related issues. On the other hand, variables with lower VIF values offer more independence and reliability for analysis.

Incorporating the insights from the VIF analysis, we can refine our approach to identifying the best EV startup city and tailoring our strategies to effectively target the most promising markets.

K-Means Clustering Analysis for Identifying Best EV Startup Cities

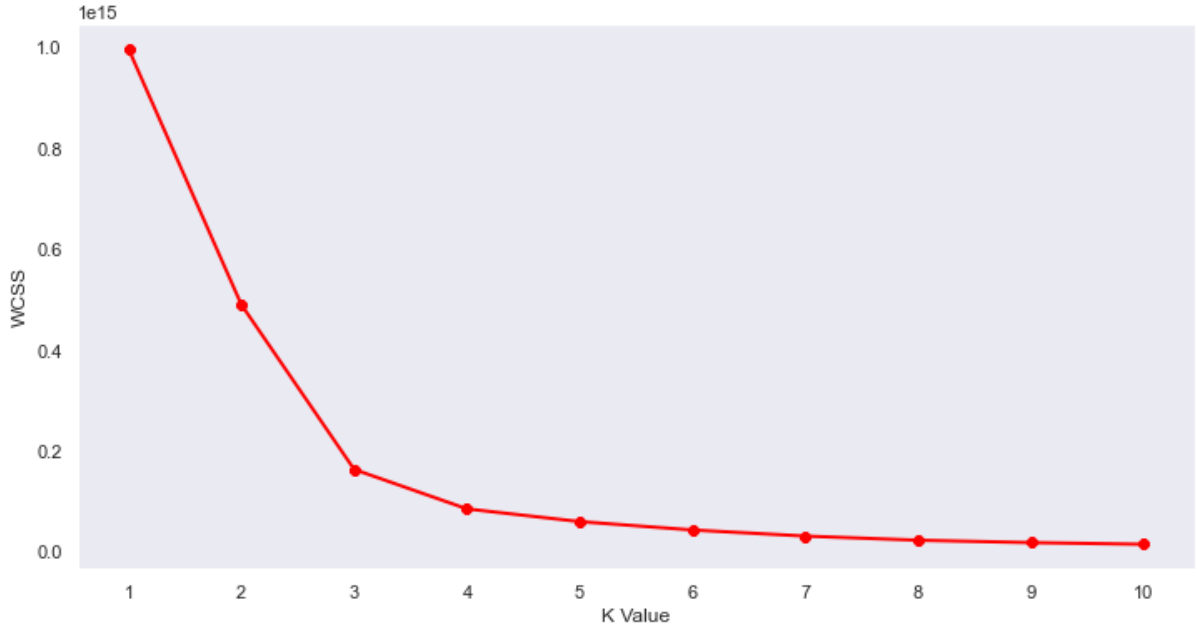
In the pursuit of identifying the most suitable city for Electric Vehicle (EV) startup, we turn to the power of K-Means clustering, a data exploration technique that aids in grouping cities based on shared characteristics. By analysing various factors and leveraging K-Means clustering, we aim to uncover potential insights that could guide decision-making process.

The heart of the analysis lies in K-Means clustering. This technique partitions the cities into distinct clusters based on their shared characteristics, enabling us to uncover patterns and similarities that might not be apparent at first glance. The elbow method plot, generated by the code, plays a pivotal role in determining the optimal number of clusters.

Insights from K-Means Clustering: The clusters generated through K-Means clustering offer valuable insights that can aid in identifying the best EV startup city:

1. **Grouped Characteristics:** Cities within the same cluster share common traits such as income levels, preferences for EV adoption, and potentially even geographical factors. This grouping can help tailor EV offerings and marketing strategies to resonate with the preferences of each cluster.

2. **Targeted Marketing:** Understanding the preferences and characteristics of each cluster allows you to implement targeted marketing campaigns. For example, cities within a cluster might have a higher inclination towards EV adoption, enabling you to focus marketing efforts more effectively.
3. **Strategic Decision-Making:** Armed with cluster-specific insights, you can make informed decisions about where to launch startup. Whether it's a city with a high demand for eco-friendly transportation or one with a strong demographic of potential EV adopters, K-Means clustering provides guidance.



Actionable Steps: To fully harness the potential of K-Means clustering for EV startup, consider the following steps:

1. **Cluster Interpretation:** Examine the characteristics and commonalities within each cluster to gain a deep understanding of the preferences and behaviours of potential customers.
2. **City Selection:** Leverage the insights gained from clustering to narrow down options for the best city to launch EV startup. Factors like willingness to adopt EVs, income levels, and preferences should guide decision.
3. **Customized Offerings:** Tailor EV offerings, pricing strategies, and marketing campaigns to align with the preferences and needs of each cluster. This customization can enhance the appeal of products and services.

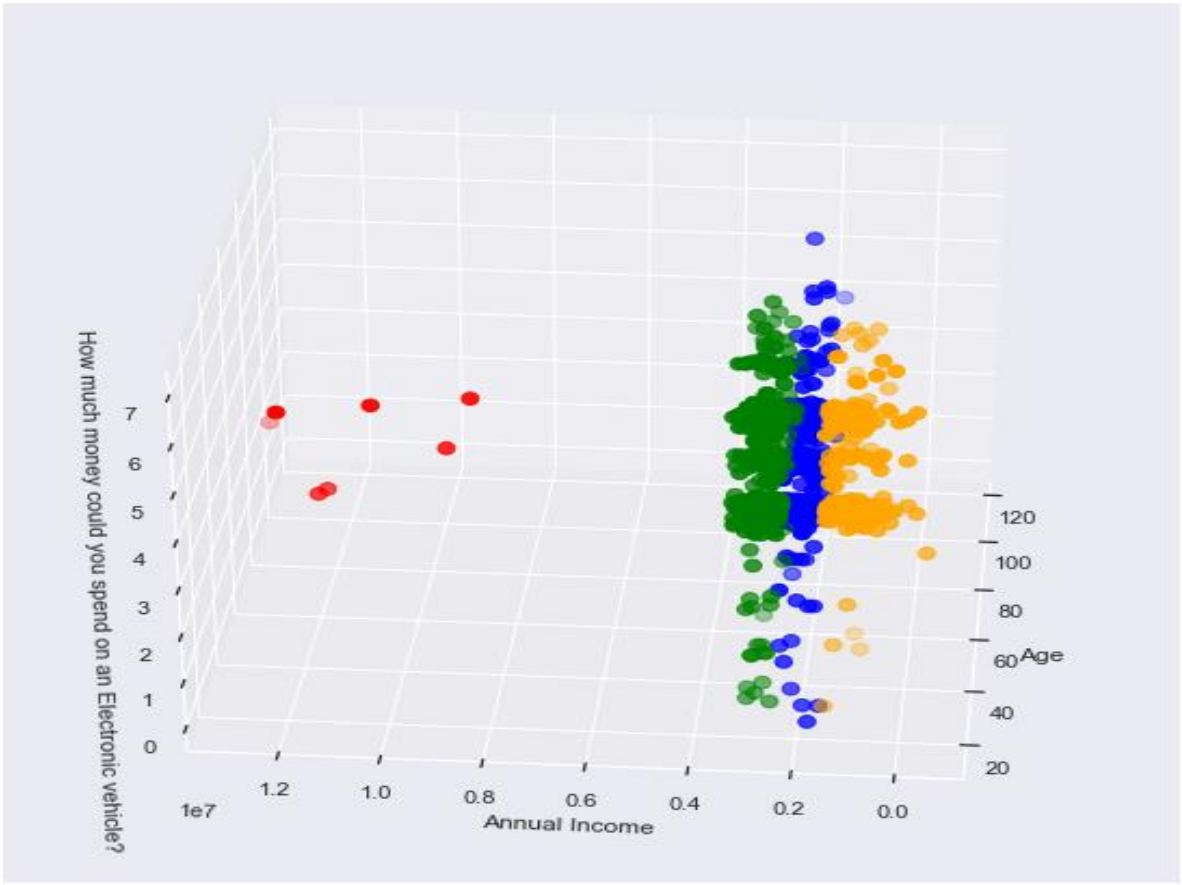
Analysis Report: The combination of Variance Inflation Factor (VIF) calculation and K-Means clustering provides a comprehensive approach to identifying the best EV startup city. By understanding the inherent characteristics and preferences of different clusters of cities, you can make informed decisions that position startup for success in the dynamic and competitive electric vehicle market.

Analysing the EV Market:

Visualizing Customer Segments for Strategic Decision-Making

In the rapidly evolving landscape of Electric Vehicles (EVs), understanding customer preferences and behaviours is essential for a successful EV startup. One powerful tool for gaining insights into potential customer base is data visualization, which can help identify distinct customer segments and guide business strategies. In this article, we will explore a 3D scatter plot visualization that demonstrates how K-Means clustering can uncover valuable information about target audience.

The Visualization: Customer Segmentation in 3D Space



The 3D scatter plot shown above is a representation of customer segmentation based on three key factors: Age, Annual Income, and the Amount a customer is willing to spend on an Electronic Vehicle (EV). Each point on the graph represents an individual customer, and the points are color-coded according to their assigned cluster.

Why This Visualization Matters

1. **Identifying Customer Clusters:** The distinct clusters formed by the points represent different groups of customers with similar characteristics. These clusters are identified using K-Means clustering, a machine learning technique that groups data points based on their similarities.
2. **Understanding Customer Profiles:** The position of clusters along the three axes provides insights into customer profiles. For instance, clusters might represent "High Income, High Spending" customers (in red), "Medium Income, Medium Spending" customers (in blue), "Low Income, Low Spending" customers (in green), and "Medium Income, High Spending" customers (in orange).
3. **Targeted Marketing Strategies:** By understanding customer segments, you can tailor marketing campaigns to resonate with each group. For example, "High Income, High Spending" customers might be interested in luxury EV features, while "Medium Income, Medium Spending" customers might prioritize affordability and practicality.
4. **Product Development:** Insights from this visualization can guide product development. If a significant portion of customers falls within a specific cluster, you can design EV models that cater to their preferences, whether it's advanced technology, budget-friendly options, or specific features.
5. **Pricing Strategies:** Knowing the spending patterns of different customer groups can inform pricing strategies. For instance, if there's a cluster of customers willing to spend more on EVs, you might consider offering premium models at higher price points.
6. **Location-Based Insights:** Although not shown in the visualization, you can extend this analysis to include geographical data. By mapping clusters to specific cities or regions, you can understand where different customer segments are located and tailor the market penetration strategies accordingly.

Analysis Report:

Data visualization, particularly through techniques like K-Means clustering and 3D scatter plots, can provide actionable insights that drive the EV startup's success. Understanding customer segments, preferences, and behaviors allows you to make informed decisions, develop targeted marketing campaigns, create relevant products, and optimize pricing strategies. As the EV market continues to grow, leveraging data-

driven visualizations will give you a competitive edge and enable you to build a strong and sustainable business in the exciting world of Electric Vehicles.

Conclusion:

Charting the EV Future - Early Market Insights

In the pursuit of carving a niche in the Electric Vehicle (EV) market, our comprehensive analysis has illuminated a path towards establishing a successful early market presence. Delving into the intricacies of the Innovation Adoption Life Cycle, we scrutinized key factors to identify the most opportune locations within India to seed the roots of our EV startup.

Our analysis culminated in a resounding conclusion: Dehradun, Mumbai, Pune, Chennai, and Delhi have emerged as the front-runners in fostering an environment ripe for innovation adaptation. These cities, propelled by their demographic dynamism and evolving transportation landscape, hold the promise of being early adopters of EV technology.

Drawing upon a mosaic of datasets, reviews, and customer preferences, we unveiled valuable insights. From the preference for EV wheels to the willingness of individuals to embrace an eco-friendly future, each data point fortified the foundation of our assessment.

Moreover, the intertwining threads of Mean Annual Income and Mean Age guided us toward a promising intersection – a younger generation endowed with economic prowess, poised to embrace the EV revolution. This pivotal nexus bodes well for the market penetration of our cutting-edge offerings.

The embodiment of our analysis was vividly manifested in a captivating 3D scatter plot. This visualization, a harbinger of customer segmentation, uncloaked the distinct clusters that dot the landscape of potential consumers. It not only illuminates the diverse strata of customer profiles but also underpins strategic decisions for tailored marketing, product development, and pricing strategies.

In the grand tapestry of the Indian market, Dehradun, Mumbai, Pune, Chennai, and Delhi emerge as beacons beckoning us towards an electrifying future. With each city possessing its unique blend of characteristics, we stand poised to sow the seeds of innovation and cultivate a market primed for early adoption.

As we traverse this uncharted terrain, armed with data-driven insights and a resolute vision, our journey towards catalyzing the EV ecosystem finds its foundation. The road ahead is electrifying, and we embrace it with unwavering enthusiasm, fortified by our in-depth analysis and the potential of these dynamic cities.

Together, we forge the future of EVs, and the early market beckons – in Dehradun, Mumbai, Pune, Chennai, and Delhi, a symphony of innovation and adaptation awaits.

<The EV future is now, and we are at the vanguard of its realization.>

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