AIRPURE INNOVATIONS

Exploratory Data Analysis for Analysing the Product Market Fit for a Startup

Presented By: Prakriti Gupta

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About The Company

AirPure Innovations ” is a young startup created in response to India’s air pollution crisis—where 14 of the world’s 20 most polluted cities are in India. The company aims to reduce the pollution levels in India by bringing a revolutionary product that can be integrated into the state’s infrastructure or can target D2C consumerism, as people want to upgrade to healthy living, especially those who live in polluted cities.

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Problem Statement

The company is in the product development phase and investing in the initial stages of Research and Development. However, before creating or launching such a product in the market, it makes sense to understand the market gap and analyze whether people or the government will be interested in investing in the product.

A data-driven approach is essential to guide strategic decisions and ensure the product meets real environmental and consumer needs.

Major Concerns

- The specific pollutants their purifier should target,
- The most valued features by potential users,
- The regions with the highest demand and corresponding market size, and
- How to tailor R&D efforts based on localized pollution trends.

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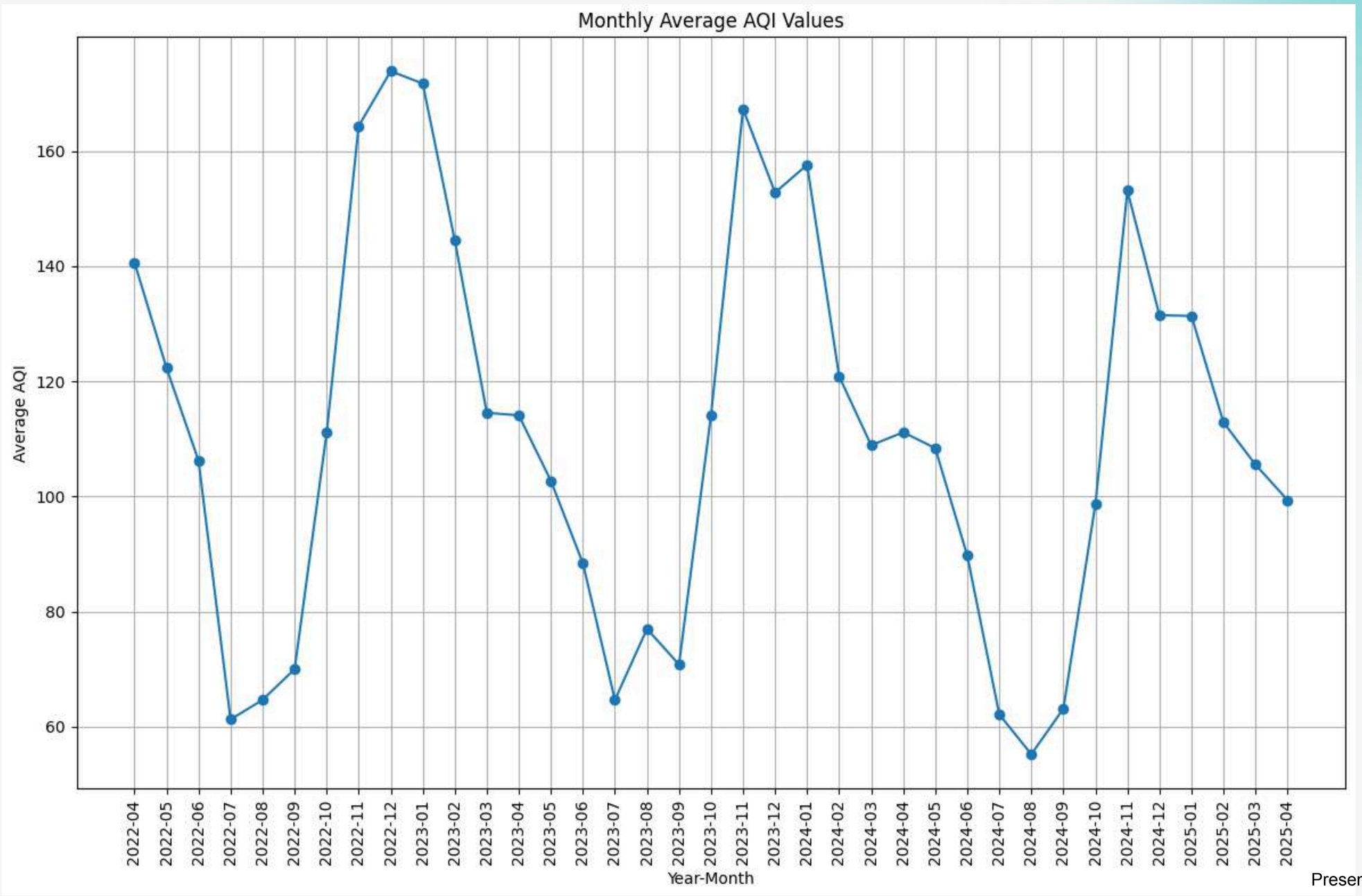
Observations Concluded



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Monthly Average AQI Vs Year-Month

OBSERVATION 1

- The AQI value follows a seasonal pattern of increase.
- The AQI value rises rapidly from **September (9th Month) to December (12th Month)**. These months in India
- coincide with the major festive season.
- People travel frequently, and pollution-causing factors like firecrackers, natural decomposition, and religious activities contribute to increased burning activities. This, in turn, leads to a rise in the severity of AQI.

OBSERVATION 2

- The AQI value shows a noticeable **decrease from April (4th Month) to July (7th Month)**.
- This period coincides with the onset of summer and the beginning of the monsoon in India. During these months,
- increased temperatures and strong winds help disperse pollutants more effectively.
- Additionally, the arrival of monsoon rains significantly reduces airborne pollutants by washing away dust, soot, and other particulates.
- There are also fewer pollution-inducing events such as festivals or stubble burning. All these factors together contribute to a decline in AQI severity during this time.

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Most Prominent Pollutants

	prominent_pollutants	actual_frequency
0	PM10	122903
1	PM2.5	68451
2	O3	20247
3	CO	15234
4	SO2	4495
5	NO2	4370
6	NH3	73
7	SO3	13

Assumption

We assume that on days when there are more than one, they equally contribute to the AQI conditions that day. For example, if there are two pollutants in the AQI on a given day, then each one of them contributes 50%. Likewise, if there are three pollutants present on one day, then each contributes 33.33% to the total AQI that day.

OBSERVATION 3

- The key pollutants that Airpure Innovations must address through their air purifiers are PM10, PM2.5, O_3, CO, SO_2, and NO_2.
- To ensure maximum effectiveness, the purifiers should be designed as an integrated system capable of targeting all these major pollutants.
- This comprehensive approach can also serve as a distinctive selling point for the company, highlighting its ability to tackle nearly all critical air quality concerns with a single solution.

States with the Most Recorded Days of Unhealthy Air Quality (Poor to Severe)

	state	total_frequency
0	Bihar	5975
1	Haryana	4781
2	Uttar Pradesh	3513
3	Rajasthan	3387
4	Odisha	1670
5	Madhya Pradesh	1322
6	Maharashtra	1166
7	West Bengal	1026
8	Assam	958
9	Punjab	872

OBSERVATION 4

- Based on the table shown, we observe that Northern India is a good market to start with.
- **Bihar, Haryana, Uttar Pradesh, Delhi, and Rajasthan** are the states in the northern part of India, where air pollution levels are a major concern.
- These states serve as major industrial hubs, housing extensive manufacturing units and playing a pivotal role in the export and supply of a wide range of commodities.
- These states experience varying climatic conditions throughout the year. They are also prominent centers of cultural and religious heritage. So pollution is a persisting issue here. Hence, these states would be ideal to test the performance of air purifiers.

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Cities with the Most Recorded Days of Unhealthy Air Quality (Poor to Severe)

11 rows | 11 rows × 3 cols

	state	area	total_frequency
0	Delhi	Delhi	528
1	Uttar Pradesh	Greater Noida	522
2	Haryana	Gurugram	498
3	Bihar	Patna	449
4	Uttar Pradesh	NOIDA	446
...	...	...	...
255	Karnataka	Hubballi	1
256	Karnataka	Raichur	1
257	Tamil Nadu	Pudukottai	1
258	Tamil Nadu	Salem	1
259	Tamil Nadu	Tiruchirappalli	1

OBSERVATION 5

- Delhi NCR includes some of the most polluted urban cities in Delhi and Uttar Pradesh, indicating a potentially high demand for air purifiers in this region.
- The population in Delhi NCR largely comprises upper-middle- and upper-class segments. This makes it easier to create awareness, as these groups are more likely to resonate with the problem statement of air pollution.
- Additionally, due to their socio-economic status, people in this region are more health-conscious, making them an ideal audience to pilot and test the effectiveness of air purifiers.

Vehicle-Class VS Average AQI Emitted in General

	vehicle_class	average_aqi_emitted
0	M-CYCLE/SCOOTER	13183.774829
1	AGRICULTURAL TRACTOR	2102.661752
2	MOTOR CAR	1414.626633
3	E-RICKSHAW(P)	1144.517329
4	MOPED	594.774813
5	GOODS CARRIER	504.866625
6	MOTORISED CYCLE (CC > 25CC)	430.377072
7	TRAILER (AGRICULTURAL)	389.681388
8	THREE WHEELER (PASSENGER)	303.429741
9	TRACTOR (COMMERCIAL)	247.825980

3 rows 3 rows × 3 cols

	vehicle_type	mean_aqi	total_frequency_usage
0	Four-Wheeler or More	402.510311	44661
1	Three-Wheeler	300.119352	10800
2	Two-Wheeler	5756.478145	9380

OBSERVATION 6

- We can observe that the vehicles contributing to higher average AQI values are ["M-CYCLE/SCOOTER, AGRICULTURAL TRACTOR", "MOTOR CAR", "E-RICKSHAW (P)", "MOPED", "GOODS CARRIER", "MOTORISED CYCLE (CC > 25CC)", "TRAILER (AGRICULTURAL)", "THREE WHEELER (PASSENGER), TRACTOR (COMMERCIAL)"]

- Two-wheelers contribute the highest in pollution, followed by three-wheelers and four-wheelers. Even though the usage of the two-wheelers is less, they are contributing the most to the pollution patterns.

- Fuels contributing to higher AQI levels (in descending order) are: Petrol, Electric (BOV), Pure EV, Ethanol, and CNG. These are the fuels, irrespective of being used in any type of vehicle class, that are contributing to the pollution patterns.

Market Size As Per Population Figures

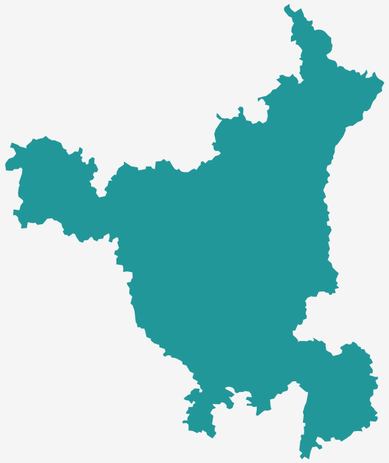
Having established that the **northern region of India** presents a **feasible market**—both due to favorable climatic conditions and pressing pollution concerns—we now aim to assess the market size in terms of population across the respective states: **Bihar, Haryana, Uttar Pradesh, Delhi, and Rajasthan.**

state	yoy%
Bihar	2.068163
Delhi	1.937028
Haryana	2.638320
Rajasthan	1.641758
Uttar Pradesh	1.627887

Through the ***Year-on-Year (YoY) population growth figures***, our objective is to analyze whether the increasing population in the selected states presents a viable opportunity for scaling our business.

If not, we aim to identify which states should be filtered out and, instead, consider launching the product or collaborating with the government to improve air pollution levels and create a more favorable environment for future scalability.

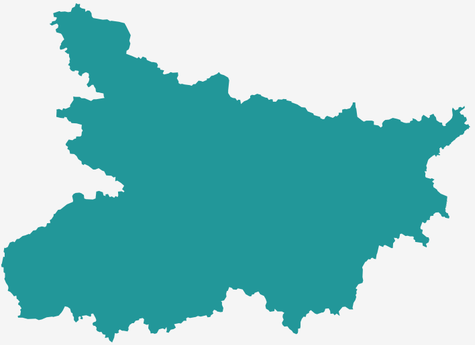
Market Size As Per Population Figures



Haryana

Highest YoY Growth

- The state exhibits **rapid urban expansion**, particularly in cities like Gurugram and Faridabad.
- It also experiences high migration inflow due to increasing employment opportunities and robust infrastructure.
- The growing population presents a **fast-expanding consumer base**, making Haryana a **strategic testing ground for Air Pure Innovations.**
- The state offers potential first-mover advantages, and there is a significant **B2C market** driven by urban demand and health-conscious consumers.
- The state is also proactive about tackling the pollution causes, and hence further opens doors for collaboration with the government.



Bihar

- Bihar faces challenges such as unemployment, high birth rates, and lower literacy levels, with a majority of the population leading a modest lifestyle.
- As such, the state may not currently be the ideal launchpad for Air Pure Innovations in a traditional B2C model. However, there is potential for growth through **B2B partnerships or government-backed initiatives**, especially in public health and infrastructure segments.

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Market Size As Per Population Figures

Rajasthan

- Rajasthan is a state that suffers from **both air pollution and harsh summer climates**. Pollution caused by sand and other particulate matter is quite prominent here, making it a suitable region for the introduction of air purifiers.
- Additionally, Rajasthan has a **significant section of middle, upper-middle, and affluent populations.** The state is also a **popular destination for vacations** and **destination weddings** and holds architectural and cultural significance, attracting a steady influx of tourists.
- AirPure Innovations can scale their air purifiers at both **B2C and B2B levels** by **collaborating with hospitality businesses such as hotels and resorts**, offering them the opportunity to test and adopt their products.

Delhi

- Delhi exhibits characteristics similar to Haryana, with a **high concentration of middle, upper-middle, and affluent segments.**
- The population here tends to **prioritize health and quality of life**, making it **receptive to air purification products**. Scalability in Delhi depends heavily on mass awareness and strategic positioning.
- There is **strong potential for both B2C growth and collaborations with government** and institutions (B2B/Govt models), especially in public spaces and urban infrastructure.

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Market Size As Per Population Figures

Uttar Pradesh

- In Uttar Pradesh, there is **significant scope for collaboration with the government**.
- As a **major production hub** of governmental projects, the state has witnessed substantial developmental changes and rapid urbanization.
- Partnering with the government can help reduce financial burdens and ensure smoother large-scale deployment.
- Given the scale and diversity of the population, Uttar Pradesh offers an ideal environment to test and scale air purifiers through **government-backed projects.**
- This makes it one of the most strategic options for AirPure Innovations to focus on pilot testing and deployment through public-sector collaborations.

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Insights Summary

- The The **AQI value in India increases from September to December** due to increased pollution-causing activities during the festive season. However, it **decreases from April to July** due to increased temperatures, strong winds, and the arrival of monsoon rains, which help disperse pollutants more effectively. This decline in AQI severity is attributed to fewer pollution-inducing events.

- Airpure Innovations should design their air purifiers as integrated systems targeting major pollutants like **PM10, PM2.5, O_3, CO, SO_2, and NO_2,** ensuring maximum effectiveness and highlighting their unique selling point.

- **Northern India**, including Bihar, Haryana, Uttar Pradesh, Delhi, and Rajasthan, is a prime market for air purifiers due to its high air pollution levels. These states, known for their manufacturing units and cultural and religious heritage, are ideal for testing the performance of air purifiers.

- Observation 6 shows that vehicles with higher average AQI values contribute to pollution, with **two-wheelers being the most polluting**.

- Fuels contributing to higher AQI levels include **petrol, electric (BOV), pure EV, ethanol, and CNG**, regardless of the fuel used in any vehicle class. This highlights the significant role of vehicles in causing pollution patterns.

- State-wise breakdown was provided for the product market in the northern part of India. The ideal states for market expansion are Haryana, Bihar, Delhi, Uttar Pradesh, and Rajasthan.

- Uttar Pradesh and Bihar present strong potential for government collaboration, while the others are well-suited for both B2C and B2B consumerism models.

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