

Battle of the Neighbourhoods

IDENTIFYING OPTIMAL LOCATIONS TO PLACE TIER 1 AUTOMOTIVE
SUPPLIER COMPANIES IN INDIA

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Introduction and Background

- ▶ India is the 5th largest economy in the world and India's automotive industry is the fourth largest in the world. The automotive industry in India accounts for 4% of the country's gross domestic product.
- ▶ With the onset of emerging automotive technologies, there is enormous scope for Tier 1 automotive suppliers to place themselves in India.
- ▶ This capstone project explores the geographical locations of major automobile manufacturing plants and identifies major industrial areas in India.
- ▶ The results of this capstone project are useful for tier 1 automotive supplier companies who would like to set up their business in India.

Things to know before going ahead

The following text has been taken from: <https://medium.com/self-driving-cars/the-automotive-supply-chain-explained-d4e74250106f>

► **Manufacturers in the automotive industry**

Automotive manufacturers are the brands that everyone knows — Ford and Toyota and BMW and their competitors. These firms are commonly referred to OEMs (original equipment manufacturers), which is an unfortunate misnomer. While these manufacturers produce some original equipment, their real strength is in designing cars, marketing cars, ordering the parts from suppliers, and assembling the final product.

► **Tier 1 Suppliers in the automotive industry**

Companies that supply parts or systems directly to OEMs are called Tier 1 suppliers. Some of these brands are recognizable, like Bosch or Continental. Some of them are less so. Tier 1 suppliers specialize in making “automotive-grade” hardware. This means hardware that withstands the motion, temperature, and longevity demands of OEMs. These suppliers usually work with a variety of vehicle companies.

Business Problem

- ▶ The problem for this capstone project is to identify the optimal locations for setting up Tier 1 automotive supplier companies in India. We'll find the optimal locations for placing companies that desire to cater to the needs of all types of manufacturing plants.
- ▶ Depending upon the scope and financial strength of the tier 1 company, we'll answer three questions:
 1. If a tier 1 company wants to cater products to all automotive manufacturing plants in India, where should it place itself?
 2. If a tier 1 company wants to cater products to automotive manufacturing plants in a large part of India, where should it place itself?
 3. If a tier 1 company wants to cater to the automotive manufacturing plants in a small part of India, where should it place itself?

The Data-sets

I will be using the following data-sets for the analysis:

1. List of Industrial centres in India

https://en.wikipedia.org/wiki/List_of_industrial_centres_in_India

2. List of vehicle plants in India

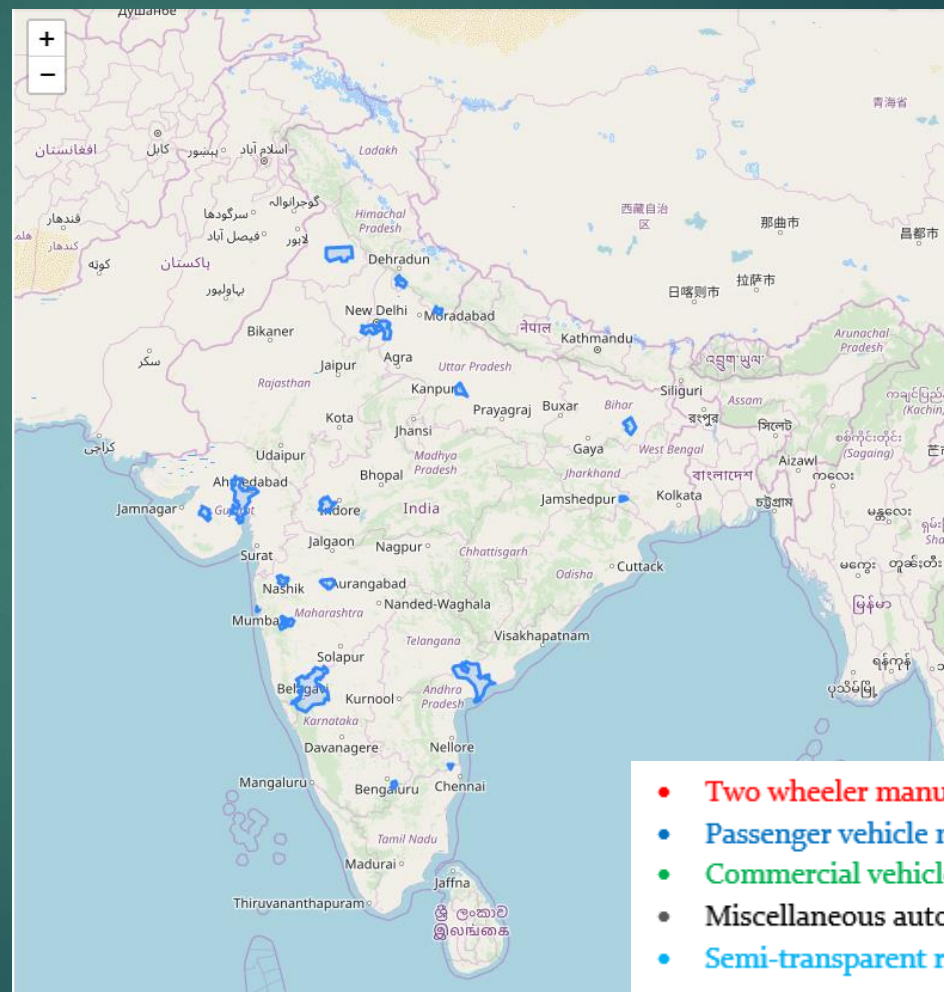
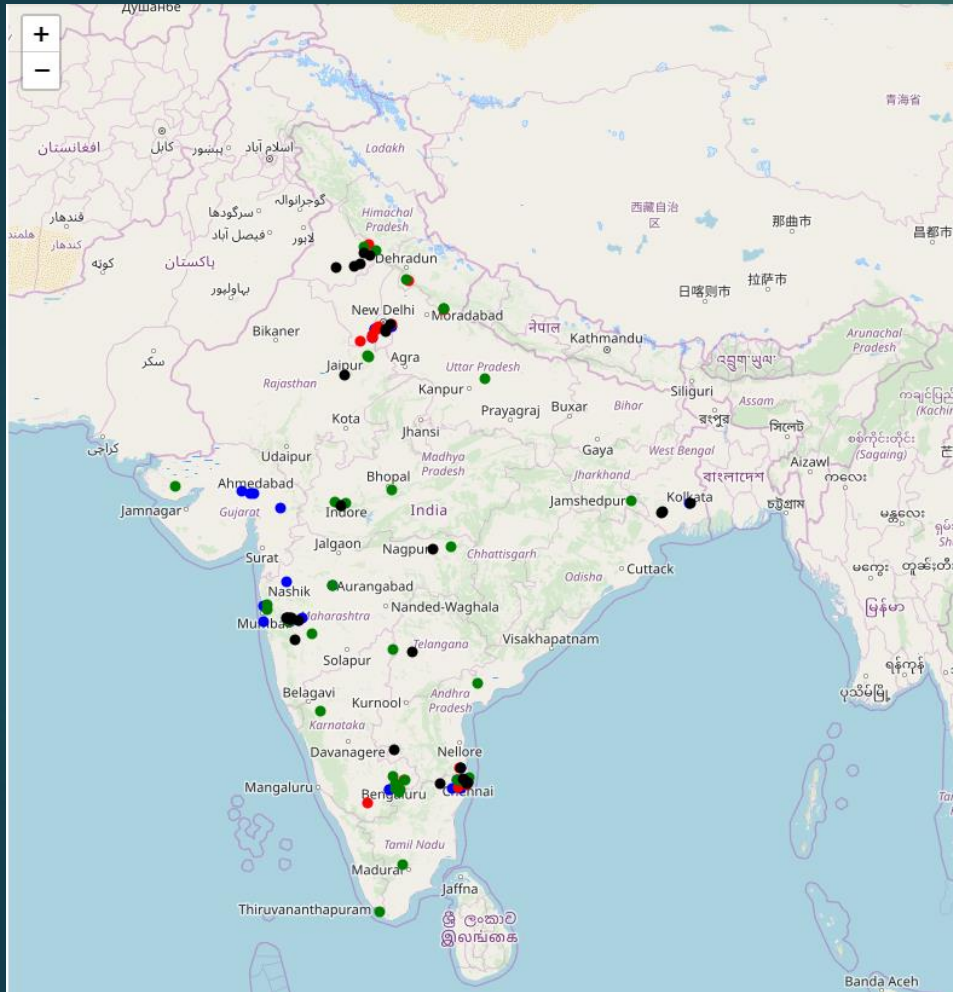
https://en.wikipedia.org/wiki/List_of_vehicle_plants_in_India

3. After parsing, cleaning and plotting this data, I'll cluster the data using K-means clustering algorithm and visualize the clusters.

4. The cluster with the greatest number of manufacturing plants in it will have the highest number of business opportunities, and that cluster's centre will be the most ideal location to start a tier 1 company geographically

5. Since operating a manufacturing company requires industrial resources, I'll use the data from point number 1 and locate the industrial area nearest to the coordinates obtained in point number 4 to come up with the final solution.

Data Visualization



- Two wheeler manufacturing plants
- Passenger vehicle manufacturing plants
- Commercial vehicle manufacturing plants
- Miscellaneous automotive manufacturing plants
- Semi-transparent regions are the identified industrial areas

Automobile manufacturing plants in India

Major industrial hubs in India

Methodology

- ▶ To answer the three questions mentioned in the 'Business problem' slide, I have run the K-means clustering algorithm twice.

Lets go through the problems one by one:

1. If a tier 1 company wants to cater products to all automotive manufacturing plants in India, where should it place itself?

- ▶ The ideal location is the industrial areas nearest to the centroid of all the manufacturing plants in India.

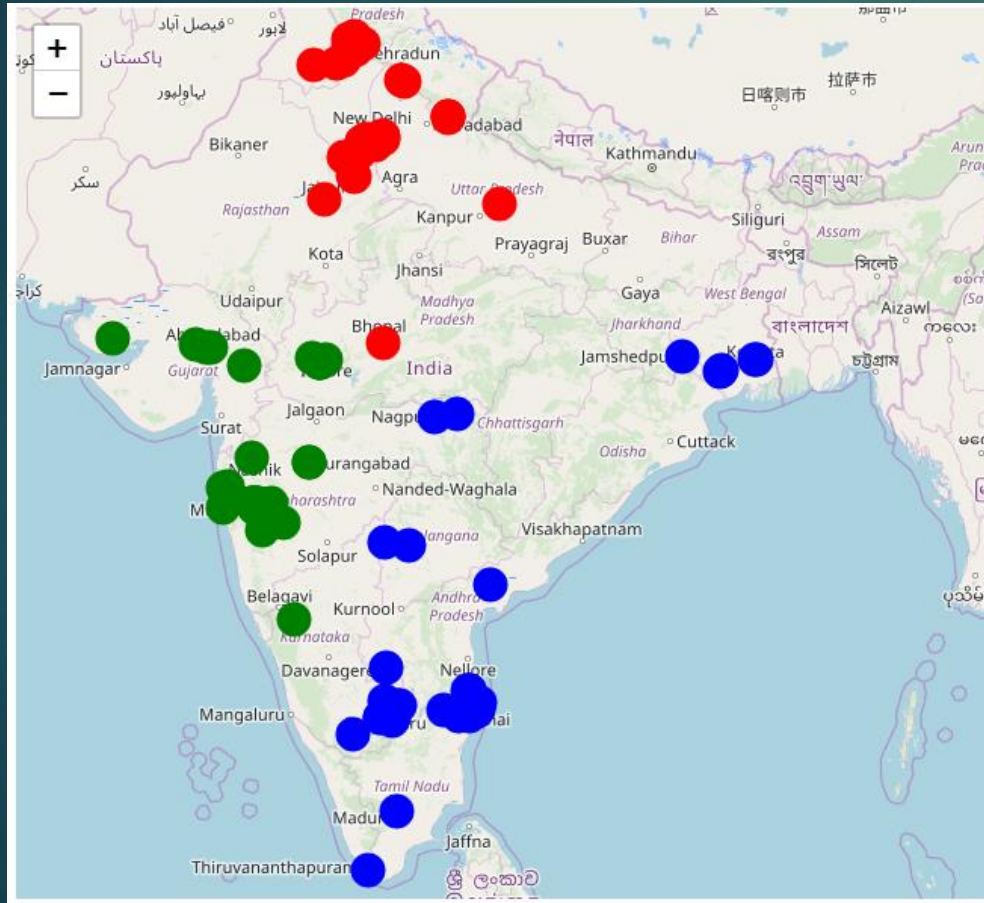
2. If a tier 1 company wants to cater products to automotive manufacturing plants in a large part of India, where should it place itself?

- ▶ To answer this, I have clustered all manufacturing plants in India into 3 clusters based on their geographical coordinates. The ideal location to place such a company is in the industrial areas nearest to the centroid of the cluster with the most number of companies in it. I have called the three clusters as “**Super-clusters**” in my notebook.

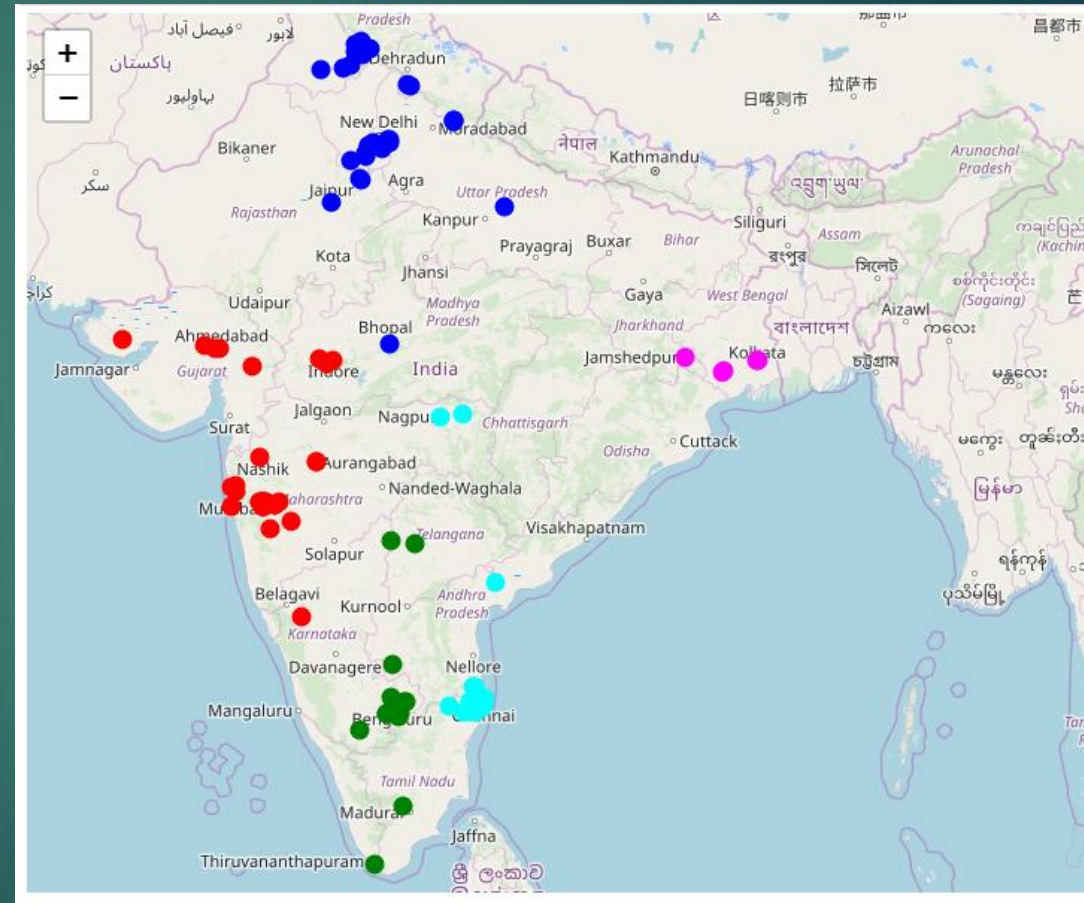
3. If a tier 1 company wants to cater to the automotive manufacturing plants in a small part of India, where should it place itself?

- ▶ To answer this, I have clustered all manufacturing plants in India into 5 clusters based on their geographical coordinates. The ideal location to place such a company is in the industrial areas nearest to the centroid of the cluster with the most number of companies in it. I have called the three clusters as “**Sub-clusters**” in my notebook.

Results : K-means clustering based on geographic coordinates



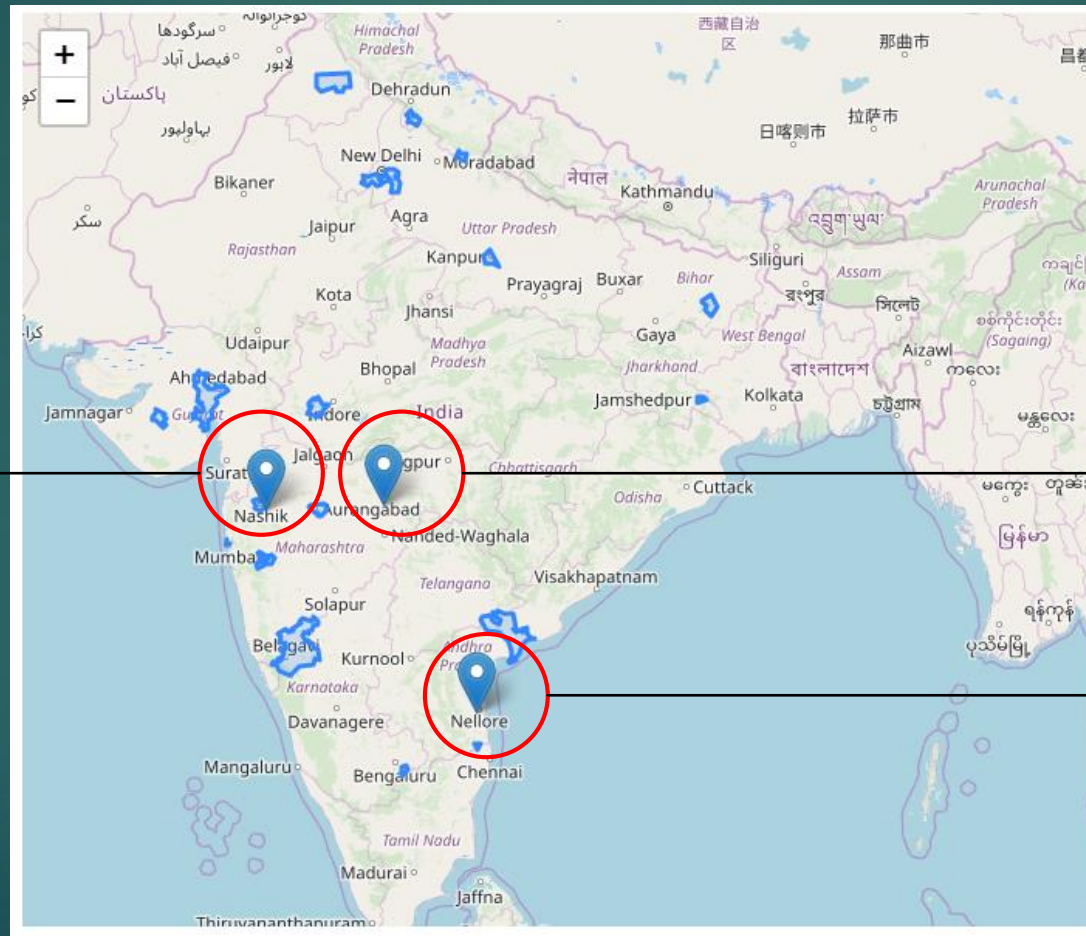
K=3 (Super-Clusters)



K=5 (Sub-Clusters)

Results : Geometric centres of clusters with most business opportunities

Ideal geographic location to place Tier-1 company in Super-cluster. This place is near to industrial area in Nashik, and Nashik should be an ideal solution.



Ideal geographic location to place Tier-1 company that supplies to all plants in the country. **There is no industrial area nearby.**

Ideal geographic location to place Tier-1 company in Super-cluster. **This place is centrally located between two industrial areas. It will be most suitable to place this in the nearest industrial area.**

Discussion and Conclusion

Calculating the distances of cluster centroids from different industrial areas, and identifying industrial areas that are most suitable to place tier-1 companies.

	Place	Significance	Latitude	Longitude	Distance from ideal location at country centre	Distance from ideal location in best super-cluster	Distance from ideal location in best sub-cluster
1	Rudrapur	AUTOMOBILE, FMCG, CHEMICAL, PHARMACUETICAL, PRE...	28.987508	79.414121	1032.911893	1631.625159	1163.004903
5	Vijayawada	AUTO PARTS	16.506174	80.648015	521.859245	255.907108	799.540662
13	Jamshedpur	IRON AND STEEL, AUTO PARTS	22.804566	86.202875	981.393910	1154.013789	1315.208483
19	Kharagpur	CHEMICALS, MACHINERY, HEAVY METALS, AUTOMOBILE...	22.346010	87.231975	1070.166766	1181.419332	1409.537519
22	Pithampur	AUTO CLUSTER, MEDICINE, COTTON YARN, AUTO TEST...	22.611121	75.677269	341.643952	1022.911835	361.713750
23	Belagavi	HYDRAULICS, HEAVY TOOLS, AUTOMOTIVE EXPORTS, A...	15.849695	74.497674	537.587354	603.223890	443.621296
26	Noida	SOFTWARE, ELECTRONIC COMPONENTS, MOBILE PHONES, ...	28.535516	77.391026	959.316330	1601.471957	1033.206645
30	Kanpur	LEATHER, CHEMICAL, FERTILIZERS, IRON AND STEEL...	26.449923	80.331874	792.454299	1349.427766	987.953446
31	Rajkot	AUTO-COMPONENTS, CASTING AND FORGINGS, JEWELRY...	22.303894	70.802160	719.941414	1306.142252	427.150392
39	Ahmedabad	AUTOMOBILE, ENGINEERING, PHARMACEUTICAL, CHEMI...	23.022505	72.571362	595.128738	1236.419509	384.747037
44	Ludhiana	BICYCLE MANUFACTURING, BICYCLE PARTS, METAL FA...	30.900965	75.857276	1230.263011	1889.130819	1249.861031
45	Pimpri-Chinchwad	AUTOMOBILE, CARPLANTS, FACTORIES ETC.	18.629781	73.799709	389.328917	806.673818	130.839252
46	Mumbai	PETROLEUM, AUTOMOBILES, ELECTRONICS, ENTERTAIN...	19.075984	72.877656	467.787780	914.684219	136.047277
52	Sri City	AUTOMOTIVE, CHEMICALS, COSMETICS, PACKAGING ...	13.526866	79.980175	767.364324	89.342116	950.253898
55	Nashik	AUTOMOBILE MANUFACTURING, GRAPES EXPORT, PHARM...	19.997453	73.789802	361.905954	904.256898	25.967811
57	Hosur	AUTO MOBILES, PLASTICS, CHEMICALS	12.740913	77.825292	799.976170	284.288519	888.770035
58	Haridwar	SUGAR MILL, CEMENT, AUTO MOBILES, PHARMACEUTIC...	29.945691	78.164248	1119.849703	1746.445734	1206.578640
59	Faridabad	AUTO COMPONENTS	28.408912	77.317789	945.152959	1588.840495	1017.506002
61	Gurugram	AUTOMOBILES, IT, AUTO COMPONENTS	28.459497	77.026638	951.024250	1599.650873	1013.231342
64	Pune	AUTOMOBILES, MANUFACTURING, PHARMACEUTICALS, I...	18.520430	73.856744	388.554444	794.739328	142.531029
65	Aurangabad	AUTOMOBILES, MANUFACTURING, PHARMACEUTICALS, C...	19.876165	75.343314	199.479352	783.876227	148.864127

As seen from this table:

1. The most suitable industrial area to place a tier-1 automotive supplier company that delivers to all types of automotive manufacturing facilities in India is in Aurangabad.
2. The most suitable industrial area to place a tier-1 automotive supplier company that delivers to manufacturing facilities in an entire region is in Sri City in South India.
3. The most suitable industrial area to place a tier-1 automotive supplier company delivers to manufacturing facilities in a local (relatively smaller) region is in Nashik.



Thank you!