

IBM DATA SCIENCE PROFESSIONAL CERTIFICATE

THE BATTLE OF THE **NEIGHBOURHOODS - REPORT**



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1. Introduction & Business Problem:

1.1 Problem Background

Bengaluru aka Bangalore is one of the fast-growing metro cities in INDIA. Since it is also known as the "Silicon Valley" of India, most of the IT enthusiast and professionals find Bengaluru as their dream destination. All major IT companies, be it service providers or Product companies have their office in Bengaluru. Not just MNCs but several Start-Ups too have their blooming roots in Bengaluru.

Business/Tech parks are changing the outlook of the city and even expanding the rarely populated parts of the city into highly populous destinations. Finding an ideal place to construct a business/tech park to rent it on a lease or to sell to the interested parties is a challenging venture. The Park has to be built in such a place where transport and other amenities are easily available. There are several business/tech parks in Bengaluru, some being very popular and pricey, yet there are some which are vacant and even never occupied.

The main goal of this project is to find an apt location for the construction of a business/tech park and also to determine whether this will be a success or failure.

1.2 Business Problem

This capstone project aims to analyze and select an apt location for the construction of business/tech Park in Bengaluru city, the capital of Karnataka, India. With the help of Data Science methodology and Machine Learning algorithms like clustering, this project looks forward to answering the business problem: Where would you recommend a property developer, if he/she is looking to construct a business/tech park in the city of Bengaluru?

1.3 Target audience

This project mainly targets the investors and potential property developers' who are interested to invest in such a multi-million dollar venture. This also

targets the prospective clients of such property developing companies who are keen to know the possibility and feasibility of such a giant project and is ready to collaborate with the company.

2. Data:

- List of neighbourhoods in Bengaluru city (without their PIN codes). The project is confined to the capital city of Bengaluru from Wikipedia page:
https://en.wikipedia.org/wiki/List_of_neighbourhoods_in_Bangalore
- Latitude and Longitude data of these of the neighbourhoods in Bengaluru city to plot maps using geopy's geocoder. (In case if the geo-coordinates were not available easily, List of places in Bengaluru District with latitude and longitude, along with PIN codes from direct download from this site:
<https://download.geonames.org/export/zip/IN.zip>)
- Venue data, specifically data related to business/tech parks in Bengaluru city from FourSquareAPI. This data is necessary to cluster the regions and hence find the ample location
- The latest per square feet property (land) rate in Bengaluru for each of the locations from property guidance sites maintained by Govt. or other general information site like this one:
<https://www.karnataka.com/real-estate/land-guidance-value-bangalore/> , to know the average price of the land needed and also the prospective selling or leasing price of the business park's commercial space.

3. Methodology

3.1 Data scraping and wrangling

The Wikipedia page

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

contains the list of neighbourhoods in Bengaluru city. Data is scraped using read_html method from the pandas library, which returned a list of all tables and other data on the web page. The neighbourhoods were divided into 8 zones, and each zone and associated neighbourhoods were tabulated. Each

table was mapped to its corresponding zone and made into a dictionary first before making it to a data frame as below:

	Central	Eastern	North-Eastern	Northern	South-Eastern	Southern	Southern Suburbs	Western
0	Cantonment area	Bellandur	Banaswadi	Hebbal	Bommanahalli	Banashankari	Anjanapura	Basaveshwaranagar
1	Domlur	CV Raman Nagar	HBR Layout	Jalahalli	Bommasandra	Basavanagudi	Arekere	Kamakshipalya
2	Indiranagar	Hoodi	Horamavu	Mathikere	BTM Layout	Girinagar	Begur	Kengeri
3	Jeevanbheemanagar	Krishnarajapuram	Kalyan Nagar	Peenya	Electronic City	J. P. Nagar	Gottigere	Mahalakshmi Layout
4	Malleswaram	Mahadevapura	Kammanahalli	R. T. Nagar	HSR Layout	Jayanagar	Hulimavu	Nagarbhavi

This data frame is transposed and columns were named as "Zone" and "Neighborhood"

Data set after data wrangling:

	Zone	Neighborhood
0	Central	Cantonment area
1	Eastern	Bellandur
2	North-Eastern	Banaswadi
3	Northern	Hebbal
4	South-Eastern	Bommanahalli

The data required for knowing the average price of the property (land) for the construction and also for the prospective renting or selling price of the commercial space; the business park hoists, extracted from this land guidance price site: <https://www.karnataka.com/real-estate/land-guidance-value-bangalore/> . As above the data is scraped using pandas read_html method and the resulting list is changed to a data frame as below:

	Area	Residential rates (All numbers in Rs Sq/ft)	Commercial rates(All numbers in Rs Sq/ft)
0	BLR – Central business Districts	NaN	NaN
1	MG Road	NaN	20000
2	Kasturba Rd	NaN	15000
3	Cubbon Rd	12500.0	NaN
4	Church Street	12500.0	15000

Since the resulting data frame had all the neighbourhoods, zone names all under one column "Area", this had to be sliced according to each zone. Also,

the price of both residential and commercial land was given. Data had to be cleaned and moulded according to our neighbourhood dataset.

Instead of land prices at each neighbourhood, the average price of each zone is calculated since this was easy to map into the parent data frame and the land price dataset is created as below:

	Zone	Average Price per Sq/Ft
0	Central	11428.571429
1	Eastern	4516.666667
2	North-Eastern	5447.368421
3	Northern	8176.470588
4	South-Eastern	7285.714286
5	Southern	6763.157895
6	Southern Suburbs	7285.714286
7	Western	4850.000000

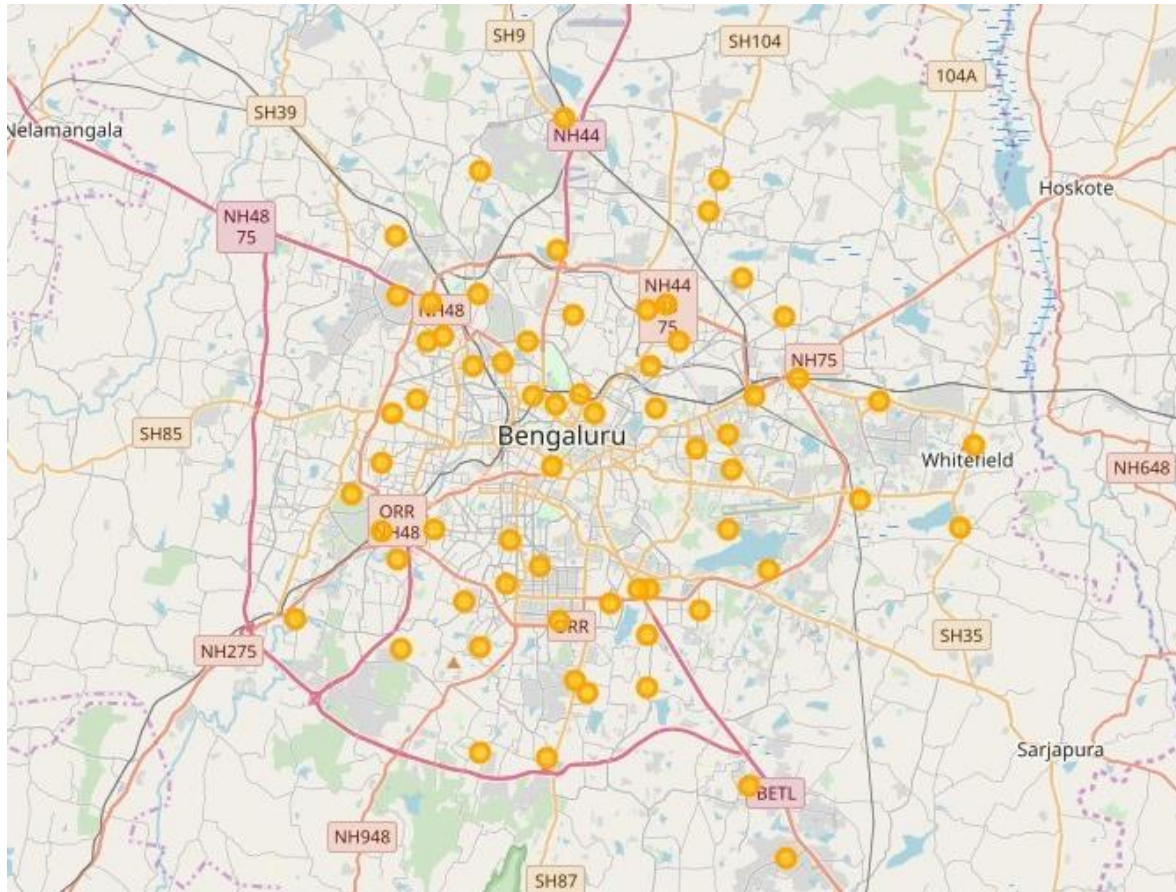
Then the geo-coordinates (latitude and longitude) of the neighbourhoods were obtained by using the Python geocoder package. These were also added to the data frame and the final data frame to work with is set up.

Final working Data set:

	Zone	Neighborhood	Average Price per Sq/Ft	Latitude	Longitude
0	Central	Cantonment area	11428.571429	12.99435	77.598390
1	Central	Domlur	11428.571429	12.94330	77.656030
2	Central	Indiranagar	11428.571429	12.97393	77.643900
3	Central	Jeevanbheemanagar	11428.571429	12.96605	77.657650
4	Central	Malleswaram	11428.571429	13.00630	77.568289

3.2 Data Visualization

The map of Bengaluru city, with the neighbourhoods superimposed on top, is created using folium library from python.



The Foursquare API is used to extract venue data of these locations in Bengaluru city. Foursquare has one of the largest databases of 105+ million places and is used by over 125,000 developers. Foursquare API will provide venue data according to categories.

Each neighbourhood is analysed and the top 10 venues are found using one-hot coding. The average land price of each zone is added to this analysis data frame and a new data frame is made as below.

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Anjanapura	ATM	Pool	Women's Store	Diner	Falafel Restaurant	Event Space	Electronics Store	Eastern European Restaurant	Donut Shop	Dessert Shop
1	Arekere	Sporting Goods Shop	Indian Restaurant	Gym / Fitness Center	Mughlai Restaurant	Department Store	Chinese Restaurant	Pizza Place	Business Service	Bus Line	Bar
2	BTM Layout	Indian Restaurant	Bakery	Ice Cream Shop	Fast Food Restaurant	Café	Snack Place	Sandwich Place	Chinese Restaurant	Vegetarian / Vegan Restaurant	Restaurant
3	Banashankari	Diner	Ice Cream Shop	Bakery	Indian Restaurant	Seafood Restaurant	Café	Asian Restaurant	Performing Arts Venue	Fast Food Restaurant	Dim Sum Restaurant
4	Banaswadi	Indian Restaurant	Jewelry Store	Liquor Store	South Indian Restaurant	Kids Store	Juice Bar	Karnataka Restaurant	Pizza Place	Clothing Store	Halal Restaurant
5	Basavanagudi	Indian Restaurant	Fast Food Restaurant	Breakfast Spot	Sandwich Place	Restaurant	Department Store	Bakery	Plaza	Donut Shop	Electronic Store

This is used for running the Clustering Machine learning model, K-Means to cluster the neighbourhoods to find the ample location for our business/tech park.

3.3 K-Means Clustering

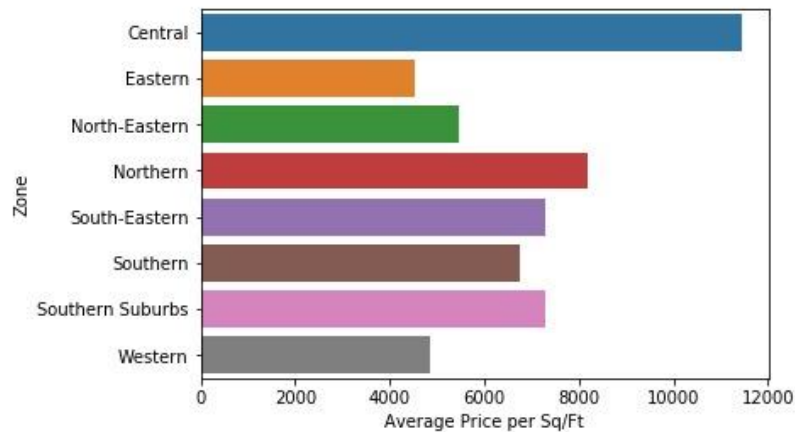
The machine learning model for clustering, K-Means is used to cluster the neighbourhoods. The value of k, is found using the silhouette method, since the elbow method didn't work out well and was not able to return the optimum value of k.

The silhouette method returned the optimum value of k and is used to run the K-mean clustering algorithm. Once the clustering is done a new data frame is formed with the cluster labels, along with the venue data of each neighbourhood and is used to visualize the clusters over the map of Bengaluru city

To make the final dataset to represent the result of this investigation, the average prices of the land is binned into 5 different levels and a new column "Price Categories" is added to the dataset.

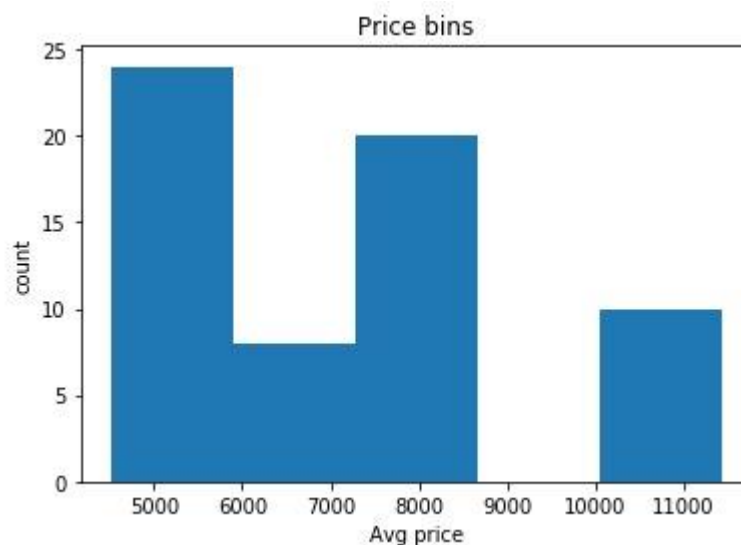
4. Results and Discussion:

- There are **65 neighbourhoods** as listed in the Wikipedia page of Bengaluru City. The city is divided into **8 administrative zones**. There is **no borough system** in the city division here in Bengaluru. These 65 neighbourhoods were mapped to their respective zones and their respective average land prices too. The commercial land prices are taken into consideration, since we are finding a location for a commercial construction purpose.
- The following bar graph of Average land price and zones clearly shows that the central zone is quite expensive almost Rs.12000 per sq/Ft and **Eastern, Western zones have the lowest land price** almost Rs 5000 per sq/Ft. **The central zone is expensive** since it's one of the busiest places in the city. Surrounded by all amenities, this makes the zone very much favourable as the location for our business/tech park. But the price is quite high and must be reconsidered.



	Zone	Average Price per Sq/Ft
0	Central	11428.571429
1	Eastern	4516.666667
2	North-Eastern	5447.368421
3	Northern	8176.470588
4	South-Eastern	7285.714286
5	Southern	6763.157895
6	Southern Suburbs	7285.714286
7	Western	4850.000000

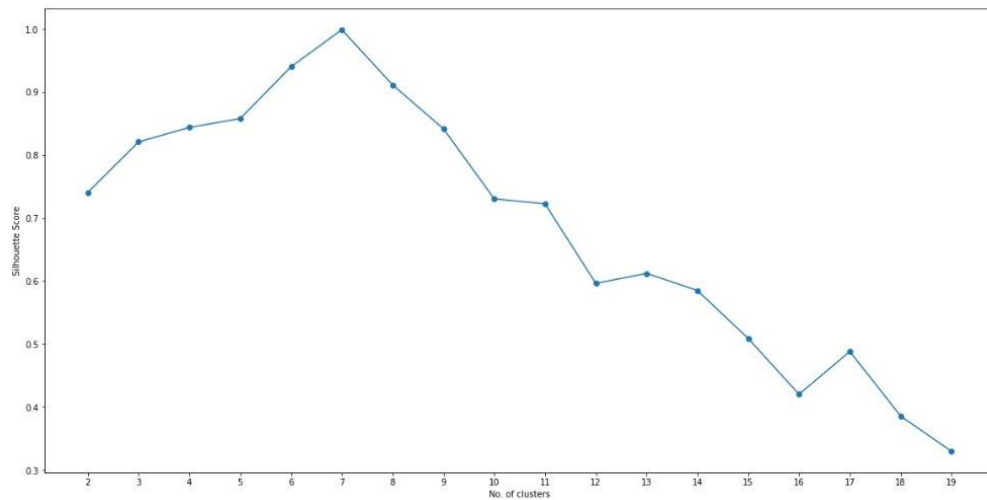
- The average price is binned into **5 categories: Low level, below average, Average level, above average and high level**. It can be seen that there is no land price range in the above-average region and most of the land prices are at the low range as shown by the plot below.



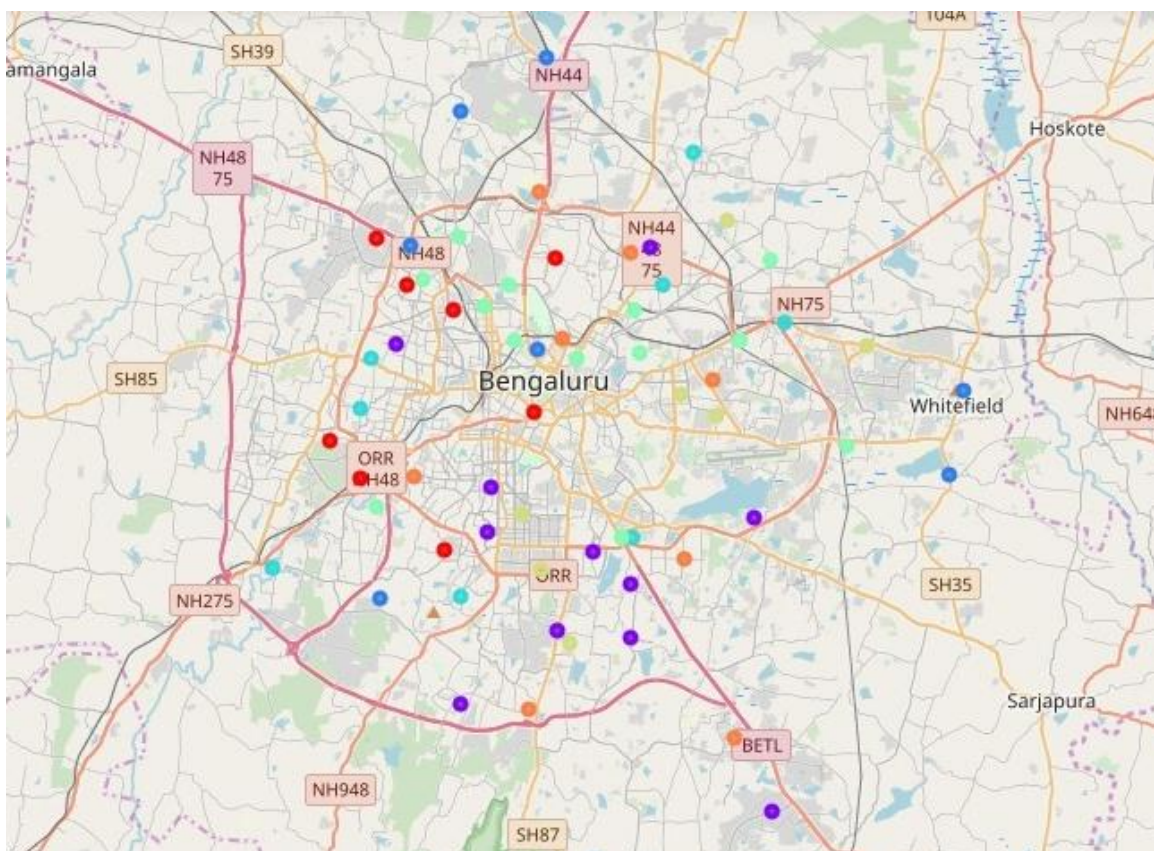
- The Foursquare API was set to return **100 venues in a 500m radius** of each neighbourhood. The returned venues along with average price

data are made to a new data frame and are prepared for clustering, **using the one-hot coding method.**

- The **silhouette method showed k=7** for the K-Means clustering algorithm as shown below.



- The neighbourhoods are divided into **7 clusters**:



- Cluster 1:

The Average Commercial Land Price = 6743.083812472358

	Zone	Neighborhood	Average Price per Sq/Ft	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	Price-Categories
4	Central	Pete area	11428.571429	12.96687	77.58734	0	Indian Restaurant	Electronics Store	Rajasthani Restaurant	Bagel Shop	Breakfast Spot	High level
27	Northern	Peenya	8176.470588	13.03184	77.52677	0	Café	Women's Store	Flea Market	Cupcake Shop	Deli / Bodega	Average level
28	Northern	R. T. Nagar	8176.470588	13.02447	77.59587	0	Indian Restaurant	Pizza Place	Food Truck	Chinese Restaurant	Resort	Average level
45	Southern	Padmanabhanagar	6763.157895	12.91547	77.55311	0	Indian Restaurant	Bakery	Convenience Store	Fast Food Restaurant	Snack Place	Below Average
57	Western	Nagarbhavi	4850.000000	12.95624	77.50933	0	Gym	Women's Store	Diner	Fast Food Restaurant	Falafel Restaurant	Low level
58	Western	Nandini Layout	4850.000000	13.01480	77.53890	0	Indian Restaurant	Pool	Café	Park	ATM	Low level
59	Western	Nayandahalli	4850.000000	12.94205	77.52101	0	ATM	Miscellaneous Shop	Women's Store	Donut Shop	Fast Food Restaurant	Low level
60	Western	Rajajinagar	4850.000000	13.00543	77.55682	0	Women's Store	Italian Restaurant	Pizza Place	Pub	Electronics Store	Low level

Restaurants and cafes are the most common venue in this cluster. There are some ATMs, Pubs, Gyms and other stores. A Bus station or any other public transport facility is not present in the top 5 venues of this cluster. The average land price of this cluster is **Rs. 6742 per sq/Ft.**

➤ Cluster 2:

The Average Commercial Land Price = 6550.421508316243

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	Zone	Neighborhood	Average Price per Sq/Ft	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	Price-Categories
10	Eastern	Bellandur	4516.666667	12.927350	77.671840	1	Indian Restaurant	Fast Food Restaurant	Café	Pizza Place	Kerala Restaurant	Low level
18	North-Eastern	Banaswadi	5447.368421	13.028473	77.631892	1	Indian Restaurant	Jewelry Store	Liquor Store	South Indian Restaurant	Kids Store	Low level
32	South-Eastern	Bommanahalli	7285.714286	12.903070	77.624410	1	Indian Restaurant	Department Store	Flea Market	Convenience Store	Cupcake Shop	Average level
33	South-Eastern	Bommasandra	7285.714286	12.817540	77.678790	1	Indian Restaurant	ATM	Donut Shop	Film Studio	Fast Food Restaurant	Average level
34	South-Eastern	BTM Layout	7285.714286	12.914890	77.610040	1	Indian Restaurant	Bakery	Ice Cream Shop	Fast Food Restaurant	Café	Average level
39	Southern	Banashankari	6763.157895	12.922280	77.569860	1	Diner	Ice Cream Shop	Bakery	Indian Restaurant	Seafood Restaurant	Below Average
40	Southern	Basavanagudi	6763.157895	12.939000	77.571350	1	Indian Restaurant	Fast Food Restaurant	Breakfast Spot	Sandwich Place	Restaurant	Below Average
47	Southern Suburbs	Anjanapura	7285.714286	12.858100	77.559060	1	ATM	Pool	Women's Store	Diner	Falafel Restaurant	Average level
48	Southern Suburbs	Arekere	7285.714286	12.885640	77.596690	1	Sporting Goods Shop	Indian Restaurant	Gym / Fitness Center	Mughlai Restaurant	Department Store	Average level
49	Southern Suburbs	Begur	7285.714286	12.882490	77.624750	1	Badminton Court	Lake	Women's Store	Eastern European Restaurant	Fast Food Restaurant	Average level
53	Western	Basaveshwaranagar	4850.000000	12.992260	77.534410	1	Indian Restaurant	Gym	Pizza Place	Fast Food Restaurant	Ice Cream Shop	Low level

Indian Restaurant is the most common venue of this cluster. This cluster does have a **variety of venues** proving to the fact that it has more members. Again this cluster **doesn't have a public transport station** in its topmost venues. The average land price is about **Rs.6550 per sq/ft**

➤ Cluster 3:

The Average Commercial Land Price = 7393.496345906785

	Zone	Neighborhood	Average Price per Sq/Ft	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	Price-Categories
9	Central	Vasanth Nagar	11428.571429	12.99073	77.58856	2	Coffee Shop	Hotel	Restaurant	Café	Indian Restaurant	High level
16	Eastern	Varthur	4516.666667	12.94348	77.74703	2	Indian Restaurant	Department Store	Lake	Donut Shop	Fast Food Restaurant	Low level
17	Eastern	Whitefield	4516.666667	12.97517	77.75227	2	Hotel	Indian Restaurant	Chinese Restaurant	Market	Eastern European Restaurant	Low level
29	Northern	Vidyananyapura	8176.470588	13.07927	77.55912	2	Pizza Place	Indian Restaurant	Bus Station	Chinese Restaurant	Department Store	Average level
30	Northern	Yelahanka	8176.470588	13.09932	77.59260	2	Smoke Shop	Ice Cream Shop	American Restaurant	Train Station	Chinese Restaurant	Average level
31	Northern	Yeshwanthpur	8176.470588	13.02954	77.54022	2	Indian Restaurant	Spa	Wine Bar	Food Court	Light Rail Station	Average level
46	Southern	Uttarahalli	6763.157895	12.89760	77.52822	2	Park	Film Studio	Tailor Shop	Convenience Store	Cupcake Shop	Below Average

Even though in this cluster also the restaurant is the most common venue, this cluster does have a **variety of other venues like a park, lake, hotel, Spa etc.** This cluster does **have a Bus station and a train station** as one of its top venue. This makes this cluster a **valid candidate for the location of our Business/tech park.** The average land price is about **Rs.7393 per sq/Ft.**

➤ Cluster 4:

The Average Commercial Land Price = 5805.748746867167

	Zone	Neighborhood	Average Price per Sq/Ft	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	Price-Categories
13	Eastern	Krishnarajapuram	4516.666667	13.00040	77.68378	3	Ice Cream Shop	Intersection	Bus Station	Diner	Falafel Restaurant	Low level
21	North-Eastern	Kalyan Nagar	5447.368421	12.96819	77.52114	3	Indian Restaurant	Nightclub	Bus Station	Café	Supermarket	Low level
22	North-Eastern	Kammanahalli	5447.368421	13.01428	77.63675	3	Kerala Restaurant	Indian Restaurant	Burger Joint	Juice Bar	Fast Food Restaurant	Low level
37	South-Eastern	Koramangala	7285.714286	12.92005	77.62543	3	Indian Restaurant	Park	Film Studio	Convenience Store	Cupcake Shop	Average level
44	Southern	Kumaraswamy Layout	6763.157895	12.89818	77.55929	3	Market	Fast Food Restaurant	Bakery	Chaat Place	Café	Below Average
52	Southern Suburbs	Kothnur	7285.714286	13.06434	77.64853	3	Convenience Store	Gym / Fitness Center	Pizza Place	Italian Restaurant	Coffee Shop	Average level
54	Western	Kamakshipalya	4850.000000	12.98699	77.52482	3	Hotel	Bus Station	Women's Store	Donut Shop	Fast Food Restaurant	Low level
55	Western	Kengeri	4850.000000	12.90872	77.48719	3	Indian Restaurant	Bar	Sports Club	Flea Market	Fast Food Restaurant	Low level

Even though this cluster does have **2-3 Bus stations** as the top venues, it **doesn't have ATMs.** Still, this cluster also makes it to the prospective location list since it has all other amenities like restaurants, cafes, gyms,

parks etc. The average land price is the **lowest of the entire clusters Rs. 5805 per Sq/Ft**

➤ Cluster 5:

The Average Commercial Land Price = 7864.08553249641												
	Zone	Neighborhood	Average Price per Sq/Ft	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	Price-Categories
3	Central	Malleswaram	11428.571429	13.00630	77.568289	4	Ice Cream Shop	Indian Restaurant	Coffee Shop	Café	South Indian Restaurant	High level
5	Central	Sadashivanagar	11428.571429	13.01482	77.577710	4	Hotel	Bed & Breakfast	Playground	Liquor Store	Women's Store	High level
6	Central	Seshadripuram	11428.571429	12.99357	77.579890	4	Art Gallery	Indian Restaurant	Chaat Place	Lounge	Asian Restaurant	High level
7	Central	Shivajinagar	11428.571429	12.98719	77.604000	4	Indian Restaurant	Tea Room	Café	Cupcake Shop	Deli / Bodega	High level
8	Central	Ulsoor	11428.571429	12.98916	77.627990	4	Café	Paper / Office Supplies Store	Department Store	Women's Store	Film Studio	High level
14	Eastern	Mahadevapura	4516.666667	12.99410	77.666350	4	Pizza Place	Shopping Mall	Snack Place	Department Store	Dessert Shop	Low level
15	Eastern	Marathahalli	4516.666667	12.95467	77.707520	4	Indian Restaurant	Sports Bar	Pizza Place	Bakery	Department Store	Low level
23	North-Eastern	Lingarajapuram	5447.368421	13.00555	77.625970	4	Convenience Store	New American Restaurant	Café	Hotel	Cupcake Shop	Low level
24	North-Eastern	Ramamurthy Nagar	5447.368421	13.02378	77.677870	4	Indian Restaurant	Supermarket	Bakery	IT Services	ATM	Low level
26	Northern	Mathikere	8176.470588	13.03236	77.558650	4	Indian Restaurant	Fast Food Restaurant	Diner	Bus Station	Bakery	Average level
38	South-Eastern	Madiwala	7285.714286	12.92050	77.620900	4	Indian Restaurant	Café	Sandwich Place	Indie Movie Theater	Intersection	Average level
56	Western	Mahalakshmi Layout	4850.000000	13.01636	77.544810	4	Bar	Café	Smoke Shop	Women's Store	Eastern European Restaurant	Low level
61	Western	Rajarajeshwari Nagar	4850.000000	12.93162	77.526990	4	Coffee Shop	Flea Market	Convenience Store	Cupcake Shop	Deli / Bodega	Low level

This is the **highest land priced** cluster of all with an average land price of **about Rs. 7864 per sq/Ft**. This cluster has all the amenities like the Bus station, ATMs, gyms etc. This cluster even has a **shopping mall and an IT service** venue too. Overall the best prospective location for our Business/Tech park but very pricey.

➤ Cluster 6:

The average land price of this cluster is about **Rs. 7661 per sq/Ft**. This cluster also has a restaurant as the most common venue. Even though these clusters have a variety of venues from Cafes to IT services, **it doesn't have a public transport venue**.

The Average Commercial Land Price = 7661.88686000716

	Zone	Neighborhood	Average Price per Sq/Ft	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	Price-Categories
1	Central	Indiranagar	11428.571429	12.97393	77.64390	5	Indian Restaurant	Café	Pub	Lounge	Ice Cream Shop	High level
2	Central	Jeevanbheemanagar	11428.571429	12.96605	77.65765	5	Indian Restaurant	Dessert Shop	Bakery	Café	Department Store	High level
12	Eastern	Hoodi	4516.666667	12.99197	77.71504	5	Indian Restaurant	Furniture / Home Store	Yoga Studio	Vegetarian / Vegan Restaurant	IT Services	Low level
20	North-Eastern	Horamavu	5447.368421	13.03868	77.66187	5	Warehouse Store	Women's Store	Diner	Fast Food Restaurant	Falafel Restaurant	Low level
42	Southern	J. P. Nagar	6763.157895	12.90831	77.59017	5	Indian Restaurant	Fast Food Restaurant	Coffee Shop	Café	Bakery	Below Average
43	Southern	Jayanagar	6763.157895	12.92870	77.58279	5	Indian Restaurant	Café	Juice Bar	Fast Food Restaurant	Sandwich Place	Below Average
51	Southern Suburbs	Hulimavu	7285.714286	12.88063	77.60146	5	Halal Restaurant	Women's Store	Diner	Fast Food Restaurant	Falafel Restaurant	Average level

➤ Cluster 7

The Average Commercial Land Price = 7273.672232050714

	Zone	Neighborhood	Average Price per Sq/Ft	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	Price-Categories
0	Central	Cantonment area	11428.571429	12.994350	77.598390	6	Indian Restaurant	Tea Room	Pub	Music Venue	Event Space	High level
11	Eastern	CV Raman Nagar	4516.666667	12.978898	77.656129	6	Indian Restaurant	Office	Food Truck	Sandwich Place	Coffee Shop	Low level
19	North-Eastern	HBR Layout	5447.368421	13.026420	77.624320	6	Indian Restaurant	Shopping Mall	Optical Shop	Department Store	Donut Shop	Low level
25	Northern	Hebbal	8176.470588	13.049690	77.589510	6	Café	Food Court	Fast Food Restaurant	Bakery	Women's Store	Average level
35	South-Eastern	Electronic City	7285.714286	12.845470	77.664300	6	Indian Restaurant	Hotel	Food Court	Bakery	Ice Cream Shop	Average level
36	South-Eastern	HSR Layout	7285.714286	12.912160	77.644900	6	Indian Restaurant	Café	Pizza Place	Bakery	Gym / Fitness Center	Average level
41	Southern	Girinagar	6763.157895	12.942780	77.541210	6	Smoke Shop	Fast Food Restaurant	Breakfast Spot	Park	Donut Shop	Below Average
50	Southern Suburbs	Gottigere	7285.714286	12.855660	77.585500	6	Indian Restaurant	Department Store	Pharmacy	Accessories Store	Flea Market	Average level

Again in this last cluster, too **restaurant is the most common venue**. This venue has a **pharmacy, shopping mall** and other amenities but **lacks an ATM and a public transport** venue as its top 5 venues. The average land price is **Rs. 7273 per sq/Ft**.

5. Conclusion:

The data used for this analysis is very much limited and thus arriving at a solid conclusion is very much difficult. Only the tip of the problem is been dealt with in this project. The unavailability of up to date spatial data of the city made it impossible to do the choropleth map of the same.

Coming to the problem at hand, out of 7 clusters, the ample location is preferably in cluster 5, but the land price is the highest for this cluster.

The next best option is in cluster 3. Since we have only taken into consideration the top 5 venues, we can't reject this location based on not having a public transport. Maybe there will be one top 10. The price of land is also on the fair side here.

Following up with the above point, clusters 4, 6 and 7 also comes in the prospective location list. They all lack one amenity or the other. But the price is also on a fair side.

The preference list for the location can be listed as follows:

1. Cluster 5
2. Cluster 3
3. Cluster 7
4. Cluster 4
5. Cluster 6

This analysis is performed on limited data. This may be right or maybe wrong. But if a good amount of data is available there is scope to come up with better results.