

# Introduction

India (ISO: Bhārat), also known as the Republic of India (ISO: Bhārat Gaṇarājya) is a country in South Asia. It is the seventh-largest country by area, the second-most populous country, and the most populous democracy in the world. According to the International Monetary Fund (IMF), the Indian economy in 2017 was nominally worth USD2.611 trillion; it is the sixth-largest economy by market exchange rates, and is, at USD9.459 trillion, the third-largest by purchasing power parity, or PPP. With its average annual GDP growth rate of 5.8% over the past two decades, and reaching 6.1% during 2011–12, India is one of the world's fastest-growing economies. However, the country ranks 140th in the world in nominal GDP per capita and 129th in GDP per capita at PPP. Until 1991, all Indian governments followed protectionist policies that were influenced by socialist economics. Widespread state intervention and regulation largely walled the economy off from the outside world. An acute balance of payments crisis in 1991 forced the nation to liberalise its economy; since then it has slowly moved towards a free-market system by emphasising both foreign trade and direct investment inflows. India has been a member of WTO since 1 January 1995.

With this economic growth and development and also high population rate, India is very promising country for construction and sanitaryware product business.

In this project, I will investigate the best location opportunity for sanitary business in India and I choose one of the major city of India, Mumbai for researching. Mumbai is capital city of Maharashtra and it is the most populous city in India with estimated population over 21 million as of 2016. It serves as an economic hub of India, contributing 10% of factory employment, 25% of industrial output, 33% of income tax collections, 60% of customs duty collections, 20% of central excise tax collections, 40% of India's foreign trade and ₹40 billion (US\$580 million) in corporate taxes. Along with the rest of India, Mumbai has witnessed an economic boom since the liberalisation of 1991, the finance boom in the mid-nineties and the IT, export, services and outsourcing boom in the 2000s.

## Goal of the project

the main aim of this project is investigate the business opportunities for sanitaryware business in Mumbai, India and find ideal location to set up office or show room in Mumbai. This project will be leveraged foursquare data and machine learning segmentation and clustering. In order to determine the location two location are searched from Foursquare data,

1. location of sanitaryware business in Mumbai
2. location of hotels in Mumbai hotels locations are chosen as both for place of attraction and also most of this sanitary products are contracted to hotel business so hotels are biggest projects for sanitaryware business.

later I will also check one of the top manufacturer of sanitaryware in the world, Vitra offices in the map and evaluate its strategic location according to developed concentration areas based on hotels and sanitaryware business areas.

## Data

The data is obtained from Wikipedia for Mumbai district and then coordinations are obtained by geocoder.arcgis code. later I use Foursquare data for segmentation and clustering. The dataframe has 17 Borough and 242 Area in Mumbai. Mumbai Borough has the highest number of areas with 146 number of areas. for sanitary business only 33 offices can be found due to data structure however i assume it is enough to locate the existing sanitary business areas concentration.

The dataset

	Postcode	District	Area	Taluka	PostalStatus	Latitude	Longitude
0	400001	Mumbai	Bazargate	Mumbai	Sub Office	18.938919	72.837470
1	400001	Mumbai	M P T	Mumbai	Sub Office	18.938919	72.837470
2	400001	Mumbai	Stock Exchange	Mumbai	Sub Office	18.938919	72.837470
3	400001	Mumbai	Tajmahal	Mumbai	Sub Office	18.938919	72.837470
4	400001	Mumbai	Town Hall Mumbai	Mumbai	Sub Office	18.938919	72.837470
5	400001	Mumbai	Mumbai G P O	Mumbai	Head Office	18.938919	72.837470
6	400002	Mumbai	Kalbadevi	Mumbai	Head Office	18.947760	72.826815
7	400002	Mumbai	Ramwadi	Mumbai	Sub Office	18.947760	72.826815
8	400002	Mumbai	S C Court	Mumbai	Sub Office	18.947760	72.826815
9	400002	Mumbai	Thakurdwar	Mumbai	Sub Office	18.947760	72.826815
10	400003	Mumbai	B P Lane	Mumbai East	Sub Office	18.951733	72.835129
11	400003	Mumbai	Mandvi Mumbai	Mumbai East	Sub Office	18.951733	72.835129

Mumbai Taluka by areas

	Postcode	District	Area	PostalStatus	Latitude	Longitude
<b>Taluka</b>						
<b>Bandra</b>	1	1	1	1	1	1
<b>Borivali East</b>	5	5	5	5	5	5
<b>Borivali West</b>	3	3	3	3	3	3
<b>Dahisar East</b>	2	2	2	2	2	2
<b>Dahisar West</b>	1	1	1	1	1	1
<b>Goregaon East</b>	4	4	4	4	4	4
<b>Goregaon West</b>	4	4	4	4	4	4
<b>Jogeshwari East</b>	2	2	2	2	2	2
<b>Jogeshwari West</b>	2	2	2	2	2	2
<b>Kandivali East</b>	4	4	4	4	4	4
<b>Kandivali West</b>	2	2	2	2	2	2
<b>Malad East</b>	2	2	2	2	2	2
<b>Malad West</b>	6	6	6	6	6	6
<b>Mumbai</b>	146	146	146	146	146	146
<b>Mumbai East</b>	10	10	10	10	10	10
<b>Mumbai North East</b>	47	47	47	47	47	47
<b>Mumbai South</b>	1	1	1	1	1	1

sanitary ware business

	Area	Area Latitude	Area Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Dadar Colony	19.014497	72.847075	Darshan Sanitaryware	19.031814	72.841996	Office
1	Dadar	19.014497	72.847075	Darshan Sanitaryware	19.031814	72.841996	Office
2	Naigaon Mumbai	19.014497	72.847075	Darshan Sanitaryware	19.031814	72.841996	Office
3	Kapad Bazar	19.037595	72.842223	Darshan Sanitaryware	19.031814	72.841996	Office
4	Mahim Bazar	19.037595	72.842223	Darshan Sanitaryware	19.031814	72.841996	Office
5	Mahim East	19.037595	72.842223	Darshan Sanitaryware	19.031814	72.841996	Office
6	Mahim	19.037595	72.842223	Darshan Sanitaryware	19.031814	72.841996	Office
7	Mori Road	19.037595	72.842223	Darshan Sanitaryware	19.031814	72.841996	Office
8	Dharavi Road	19.042000	72.853199	Darshan Sanitaryware	19.031814	72.841996	Office
9	Dharavi	19.042000	72.853199	Darshan Sanitaryware	19.031814	72.841996	Office
10	Matunga	19.028438	72.853441	Darshan Sanitaryware	19.031814	72.841996	Office
11	Bhawani Shankar Rd	19.019476	72.835525	Darshan Sanitaryware	19.031814	72.841996	Office
12	Bhawani Shankar	19.019476	72.835525	Darshan Sanitaryware	19.031814	72.841996	Office
13	Gokhale Road Mumbai	19.019476	72.835525	Darshan Sanitaryware	19.031814	72.841996	Office
14	Ranade Road	19.019476	72.835525	Darshan Sanitaryware	19.031814	72.841996	Office
15	S V S Marg	19.019476	72.835525	Darshan Sanitaryware	19.031814	72.841996	Office
16	Shivaji Park Mumbai	19.019476	72.835525	Darshan Sanitaryware	19.031814	72.841996	Office
17	Andheri	19.138602	72.826590	Sunil Electric Hardware & Sanitary	19.146789	72.828610	Hardware Store
18	Andheri	19.138602	72.826590	Roca Bathroom Products Pvt Ltd	19.136219	72.831853	Professional & Other Places
19	Azad Nagar Mumbai	19.138602	72.826590	Sunil Electric Hardware & Sanitary	19.146789	72.828610	Hardware Store
20	Azad Nagar Mumbai	19.138602	72.826590	Roca Bathroom Products Pvt Ltd	19.136219	72.831853	Professional & Other Places

	Area	Area Latitude	Area Longitude	Venue	Venue Latitude	Venue Longitude
Venue Category						
Furniture / Home Store	2	2	2	2	2	2
Hardware Store	8	8	8	8	8	8
Office	17	17	17	17	17	17
Professional & Other Places	6	6	6	6	6	6

## Hotel Venues

	Area	Area Latitude	Area Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Bazargate	18.938919	72.83747	Hotel Landmark Fort	18.938528	72.837998	Bed & Breakfast
1	Bazargate	18.938919	72.83747	hotel kalapi	18.938184	72.837802	Motel
2	Bazargate	18.938919	72.83747	Hotel Traveller's Inn	18.936039	72.838000	Bed & Breakfast
3	Bazargate	18.938919	72.83747	Hotel Landmark Annexe	18.938030	72.838844	Hotel
4	Bazargate	18.938919	72.83747	Hotel Windsor	18.936808	72.838327	Hostel

## Hotel venues by category

	Area	Area Latitude	Area Longitude	Venue	Venue Latitude	Venue Longitude	cluster_
Venue Category							
Afghan Restaurant	33	33	33	33	33	33	33
Arepa Restaurant	7	7	7	7	7	7	7
Asian Restaurant	23	23	23	23	23	23	23
Assisted Living	63	63	63	63	63	63	63
Athletics & Sports	7	7	7	7	7	7	7
BBQ Joint	7	7	7	7	7	7	7
Bakery	1	1	1	1	1	1	1
Bar	17	17	17	17	17	17	17
Bed & Breakfast	220	220	220	220	220	220	220
Bengali Restaurant	20	20	20	20	20	20	20
Boarding House	78	78	78	78	78	78	78

## Target Group

Target group is all international and local sanitaryware business owners and manufacturers who would like to pursue a business in this top location Mumbai, India. this report is also specially check the location of Eczacıbaşı Vitra, the Turkish manufacturer, which is top manufacturer and expanded its business in India recently.

### Methodology

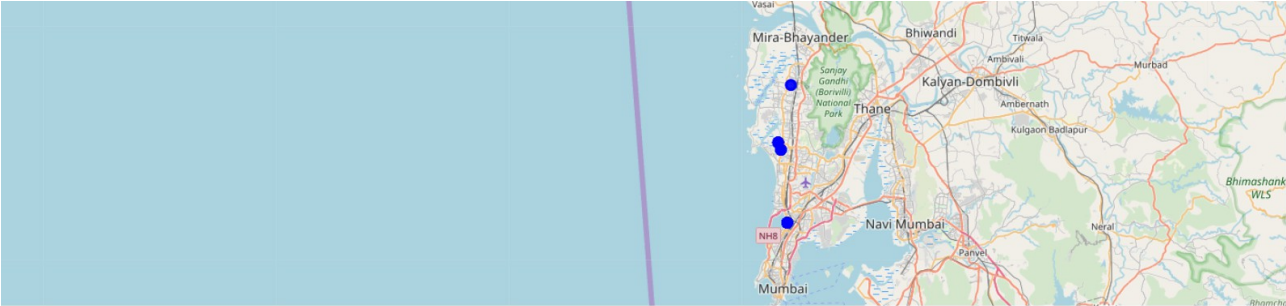
In this firstly I will use Wiki to extract district data of Mumbai. later I will obtain coordinates by using code, `g = geocoder.arcgis('{}', India'.format(row.Postcode))`. I believe it is reliable and fast option for retrieving location data. Later I use pandas for establishing dataframes. The Foursquare API was then used to query each of the neighborhood for the keywords. The resulting locations for each venue were tabulated and stored in a new dataframe and visualised using Folium. To see concentration hierarchical clustering was developed for two data groups. Hierarchical clustering gave an advantage as it does not require to set cluster number initially. later for better visualization center of clusters are obtained by calculating mean values of both groups and plotted on Folium map. Later I also searched for Vitra offices in Mumbai and located this office compared to this clusters.

## Results

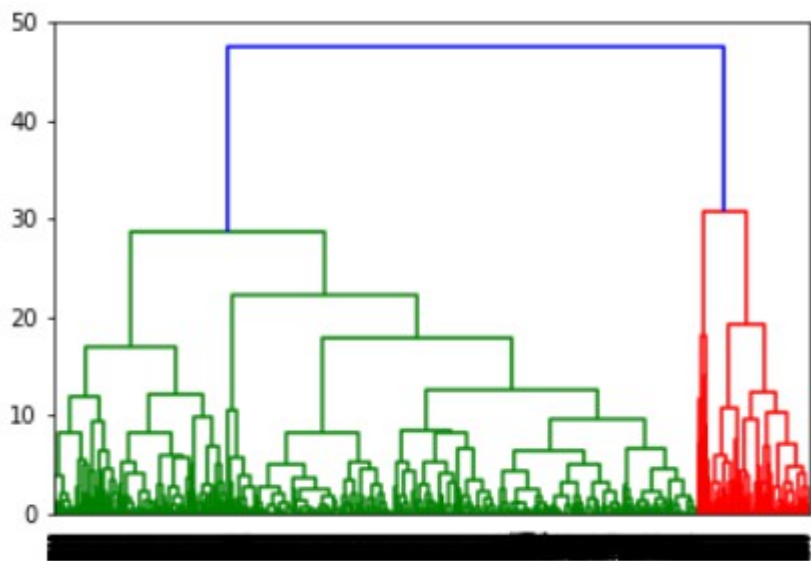
Expected outcome is that with clustering algorithm, a suitable locations for sanitaryware business can be located on the map thanks to foursquare data.

The dataframe has 17 Borough and 242 Area in Mumbai. A total of 33 sanitaryware offices and 6029 hotels were found after performing the query on Foursquare API around these neighborhoods. due to limit on the number of sanitaryware office, only 3 cluster can be obtained. and concentration of this clusters are show on the map by blue and red color palette. (blue: hotel, red:sanitary) later Vitra is showed as yellow color. according to map best place of concentration is Matunga West as it is highly populated both for sanitaryware business and hotel business.

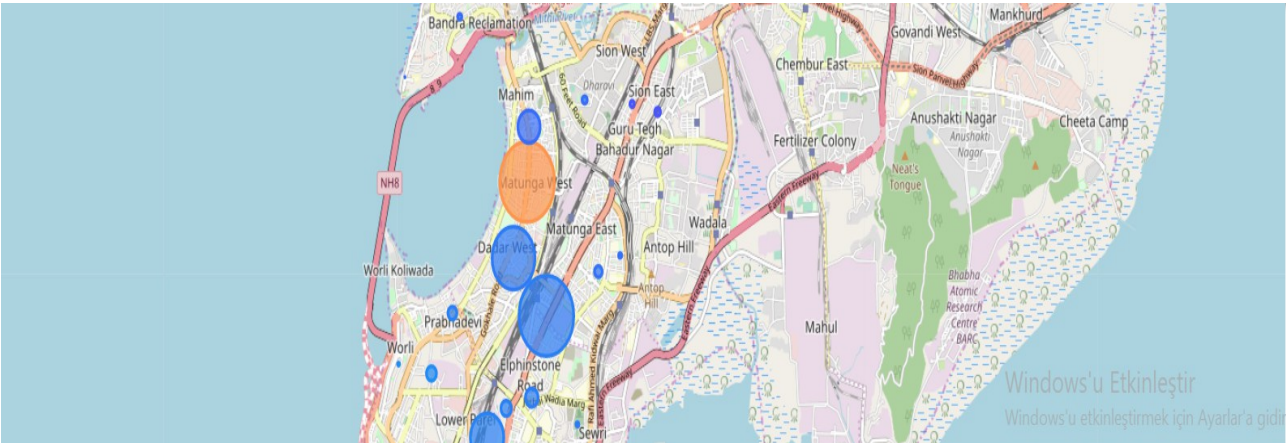
Sanitary venues on map



Hierarchical clustering



center cluster map



center cluster mapping with Vitra locations

