

# **IBM Data Science Capstone Project, Battle of the Neighborhoods**

## **1. Introduction: Business Problem**

Bangkok is the capital city of Thailand with a population of over 10 million. Bangkok is the top 7th city in Asia from World's Best Awards survey, Travel + Leisure. Bangkok is a city that attracts investors who want to invest in Thailand. Specially, we will focus on restaurants and the foodservice industry. The purpose of this project is to help entrepreneurs for exploring ideas and cuisine styles for opening a restaurant. Specifically, this project will be targeted at stakeholders interested in opening a restaurant in Bangkok, Thailand.

It will help people making smart and efficient decisions on selecting a great district and cuisine style for opening a restaurant in Bangkok. Along the line of Business Strategies, it was decided that the Unsupervised Machine Learning technique could be applied to analyze and uncover insights valuable to influencing the formulation of the Client's business strategies. Specifically, K-Means clustering will be applied onto the relevant restaurants' geospatial data to cluster these entities and uncover insights such as viable restaurant themes and suitable restaurant locations.

## **2. Data acquisition and Collection**

### **2.1 Data Description.**

Data Link: [https://en.wikipedia.org/wiki/List\\_of\\_districts\\_of\\_Bangkok](https://en.wikipedia.org/wiki/List_of_districts_of_Bangkok)

We will use the list of districts of Bangkok data, which contains the list of districts, map nr, post-code, district's name in Thai, population, no. of sub-districts, latitude, and longitude.

We will need data about different venues in different districts. In order to gain that information, we will use "Foursquare" locational information. Foursquare is a location data provider with information about all manner of venues and events within an area of interest. Such information includes venue names, locations, menus, and even photos. As such, the foursquare location platform will be used as the sole data source since all the stated required information can be obtained through the API.

After finding the list of districts, we then connect to the Foursquare API to gather information about venues inside each and every district. For each district, we have chosen the radius to be 1000 meters. The data retrieved from Foursquare contained information of venues within a specified distance of the longitude and latitude of the postcodes. The information obtained per venue as follows:

1. Districts
2. District's Latitude
3. District's Longitude
4. Venues
5. Name of the venue e.g. the name of a store or restaurant
6. Venue's Latitude
7. Venue's Longitude
8. Venue's Category

## 2.2 Data Collection

1. Scraped from the internet [https://en.wikipedia.org/wiki/List\\_of\\_districts\\_of\\_Bangkok](https://en.wikipedia.org/wiki/List_of_districts_of_Bangkok)

District(Khet)	MapNr	Post-code	Thai	Popu-lation	No. of Subdis-tricts	Khwaeng	Latitude	Longitude
0	Bang Bon	50	บางบอน	105161		4	13.659200	100.399100
1	Bang Kapi	6	บางกะปิ	148465		2	13.765833	100.647778
2	Bang Khae	40	บางแค	191781		4	13.696111	100.409444
3	Bang Khen	5	บางเขน	189539		2	13.873889	100.596389
4	Bang Kho Laem	31	บางคอแหลม	94956		3	13.693333	100.502500

2. Foursquare API, use of foursquare is focused to fetch nearest venue locations so that we can use them to form a cluster. Foursquare API leverages the power of finding nearest venues in radius (in my case: 1,000 meters) and also corresponding coordinates, venue's location, and names. After calling, the following data frame is created.

District	District Latitude	District Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0 Bang Bon	13.6592	100.3991	ชาหมูบางหว้า	13.657136	100.395230	Thai Restaurant
1 Bang Bon	13.6592	100.3991	Irashaimase Japanese Restaurant	13.658358	100.401403	Japanese Restaurant
2 Bang Bon	13.6592	100.3991	ร้านตันไม้ริมถนนกาญจนากินเดก	13.654098	100.405054	Garden Center
3 Bang Bon	13.6592	100.3991	ส.สุขโภชนา	13.660358	100.404866	Chinese Restaurant
4 Bang Bon	13.6592	100.3991	เจ๊ไน ก๋วยเตี๋ยวเป็ดตุ๋น	13.654137	100.405323	Noodle House

### 2.3 Data Cleaning

After scraping the data, we dropped the unused columns which are MapNr, Thai, No. ofSubdis-trictsKhwaeng, and renamed the first column as District

	District	Post-code	Population	Latitude	Longitude
0	Bang Bon	10150	105161	13.659200	100.399100
1	Bang Kapi	10240	148465	13.765833	100.647778
2	Bang Khae	10160	191781	13.696111	100.409444
3	Bang Khen	10220	189539	13.873889	100.596389
4	Bang Kho Laem	10120	94956	13.693333	100.502500

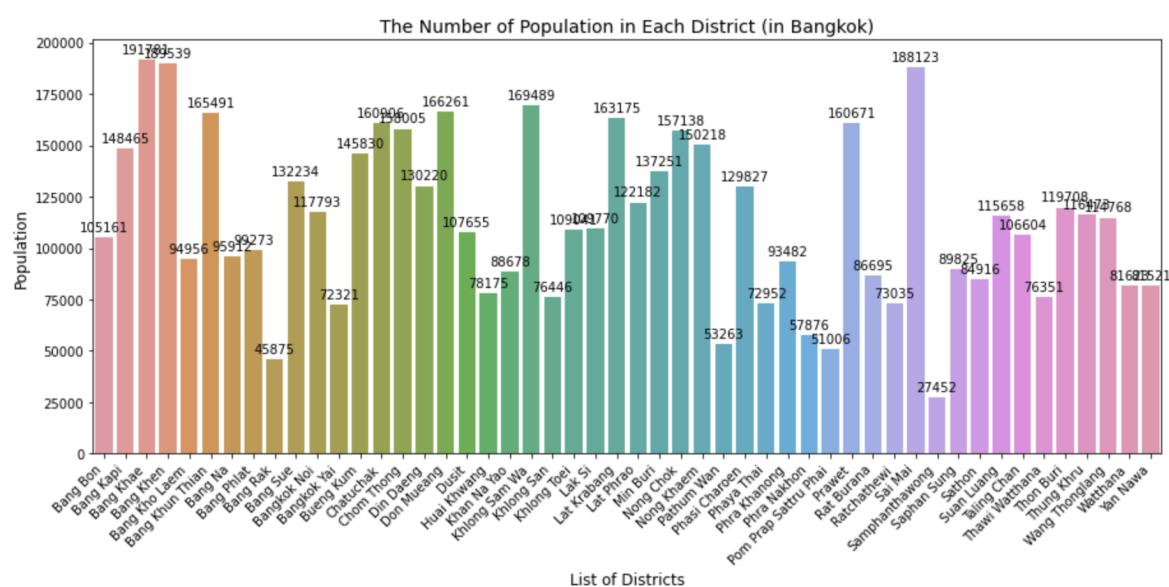
The data retrieved from Foursquare API, We need only the restaurant and noodle house category (noodle house is Thai's noodle restaurant), so we extract the restaurant and noodle house category.

District	District Latitude	District Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
1 Bang Bon	13.659200	100.399100	ชาหมามงหาร้า	13.657136	100.395230	Thai Restaurant
2 Bang Bon	13.659200	100.399100	Irashaimase Japanese Restaurant	13.658358	100.401403	Japanese Restaurant
3 Bang Bon	13.659200	100.399100	ส.สุช โภชนา	13.660358	100.404866	Chinese Restaurant
4 Bang Bon	13.659200	100.399100	เจ๊ไน ก๋วยเตี๋ยวเป็ดตุ๋น	13.654137	100.405323	Noodle House
5 Bang Bon	13.659200	100.399100	พิพารรณ์โอชา ก๋วยเตี๋ยวเนื้อตุ๋น	13.654004	100.405454	Noodle House

After this, we removed Venue category = Restaurant, because we do not know what is exactly the type of restaurant is.

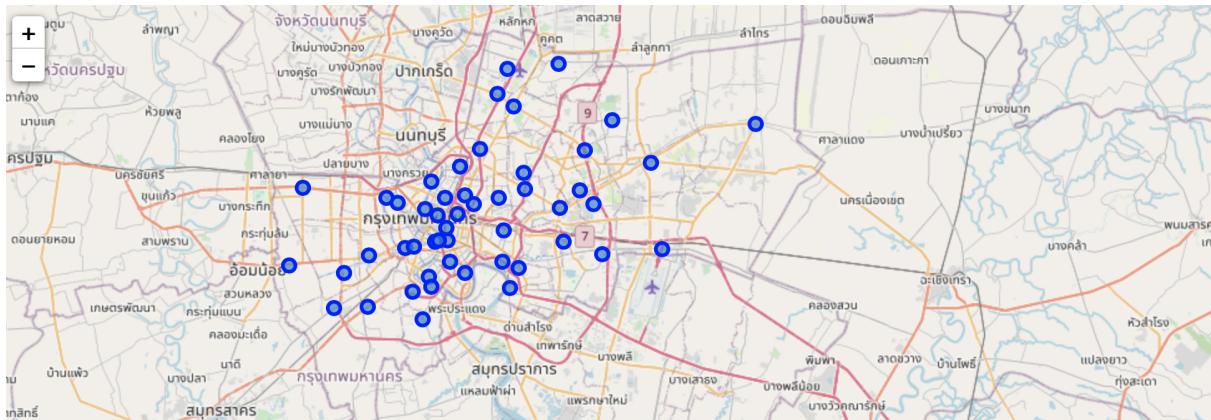
### 3. Data Visualization and Troubleshooting

We explored the population in each district



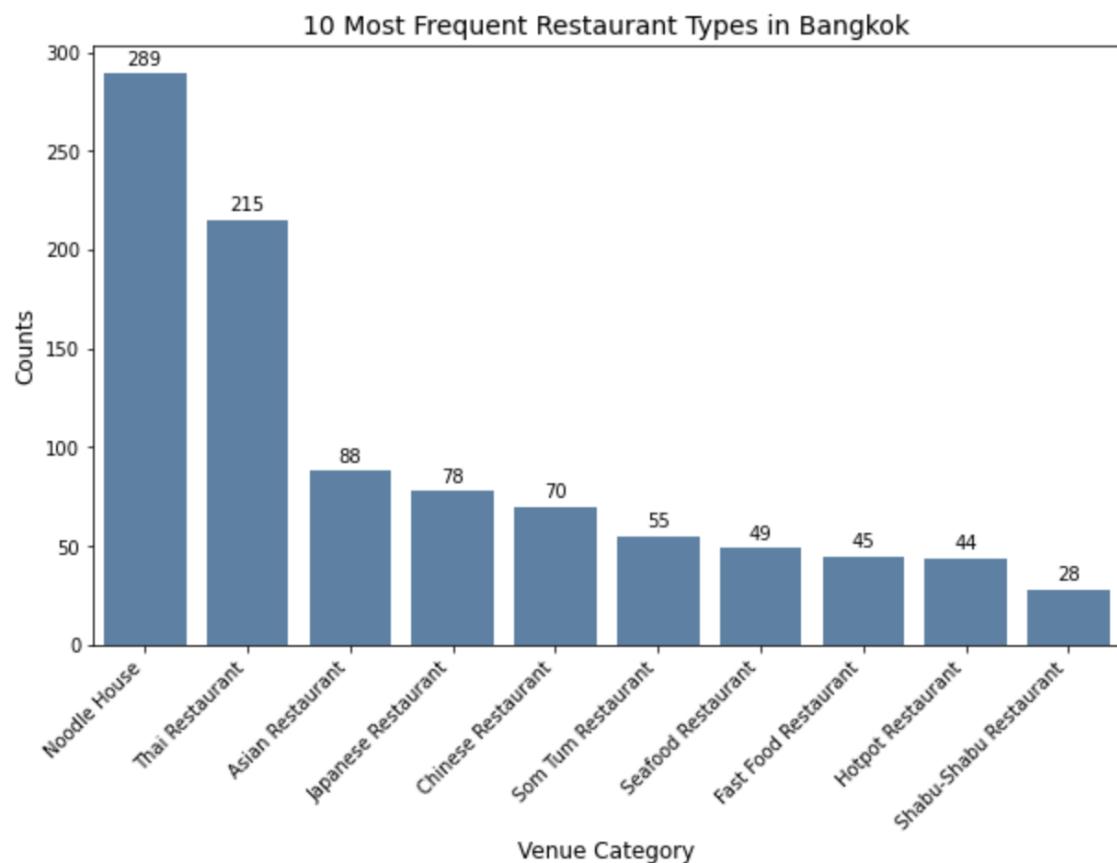
We can see that Bang Khea has the most population, followed by Bang Khen and Sai Mai.

Then Visualization of the Bangkok districts using the **folium** library.



#### 4. Exploratory Data Analysis

Foursquare API is then utilized to retrieve the data on restaurants in each of these districts. Specifying the criteria to return restaurants within a radius of 1,000 meters, the result is visualized below.



The most frequent type is Noodle House, followed by Thai restaurant.

District		Bang Kho Laem	23
Buong Kum	1	Wang Thonglang	24
Khlong Toei	2	Bang Khen	25
Min Buri	2	Lat Phrao	29
Nong Khaem	3	Rat Burana	29
Prawet	5	Phra Nakhon	29
Nong Chok	5	Ratchathewi	30
Chom Thong	6	Khan Na Yao	30
Bang Phlat	7	Suan Luang	31
Sai Mai	7	Pom Prap Sattru Phai	32
Don Mueang	8	Chatuchak	33
Thawi Watthana	8	Dusit	34
Bang Khae	10	Samphanthawong	34
Bang Na	10	Khlong San	34
Din Daeng	11	Watthana	37
Bang Bon	11	Bang Sue	38
Taling Chan	15	Phaya Thai	38
Khlong Sam Wa	15	Bang Kapi	40
Thon Buri	17	Sathon	41
Lak Si	17	Bang Rak	44
Thung Khru	18	Pathum Wan	44
Lat Krabang	18	Yan Nawa	44
Saphan Sung	19	Huai Khwang	47
Bangkok Noi	20		
Bangkok Yai	21		
Phasi Charoen	21		
Bang Khun Thian	22		
Phra Khanong	22		

Compared with the other districts, **Bang Kapi, Sathon, Bang Rak, Pathum Wan, Yan Nawa, and Huai Khwang** have a higher density of restaurants (more than 40 in its area).

Next, we Print each district along with the top 5 most common venues.

#### ----Bang Bon----

	venue	freq
0	Noodle House	0.45
1	Thai Restaurant	0.18
2	Japanese Restaurant	0.09
3	Som Tum Restaurant	0.09
4	Asian Restaurant	0.09

#### ----Bang Khae----

	venue	freq
0	Noodle House	0.5
1	Japanese Restaurant	0.2
2	Fast Food Restaurant	0.1
3	Shabu-Shabu Restaurant	0.1
4	Asian Restaurant	0.1

#### ----Bang Kapi----

	venue	freq
0	Som Tum Restaurant	0.18
1	Japanese Restaurant	0.15
2	Noodle House	0.12
3	Fast Food Restaurant	0.10
4	Hotpot Restaurant	0.08

#### ----Bang Khen----

	venue	freq
0	Fast Food Restaurant	0.24
1	Hotpot Restaurant	0.12
2	Noodle House	0.12
3	Asian Restaurant	0.12
4	Vietnamese Restaurant	0.08

**----Bang Kho Laem----**

	venue	freq
0	Thai Restaurant	0.26
1	Noodle House	0.22
2	Chinese Restaurant	0.13
3	Seafood Restaurant	0.13
4	Vietnamese Restaurant	0.04

**----Bang Na----**

	venue	freq
0	Noodle House	0.4
1	Asian Restaurant	0.2
2	Thai Restaurant	0.2
3	Chinese Restaurant	0.1
4	Seafood Restaurant	0.1

**----Bang Khun Thian----**

	venue	freq
0	Thai Restaurant	0.18
1	Japanese Restaurant	0.14
2	Seafood Restaurant	0.14
3	Noodle House	0.09
4	Asian Restaurant	0.09

**----Bang Phlat----**

	venue	freq
0	Fast Food Restaurant	0.29
1	Japanese Restaurant	0.14
2	Ramen Restaurant	0.14
3	Thai Restaurant	0.14
4	Hotpot Restaurant	0.14

**----Bang Rak----**

	venue	freq
0	Noodle House	0.30
1	Chinese Restaurant	0.16
2	Thai Restaurant	0.16
3	Seafood Restaurant	0.07
4	Japanese Restaurant	0.05

**----Bangkok Noi----**

	venue	freq
0	Noodle House	0.65
1	Som Tum Restaurant	0.15
2	Asian Restaurant	0.10
3	Shabu-Shabu Restaurant	0.05
4	Dim Sum Restaurant	0.05

**----Bang Sue----**

	venue	freq
0	Noodle House	0.34
1	Thai Restaurant	0.32
2	Asian Restaurant	0.11
3	Fast Food Restaurant	0.05
4	Hotpot Restaurant	0.05

**----Bangkok Yai----**

	venue	freq
0	Noodle House	0.57
1	Asian Restaurant	0.24
2	Chinese Restaurant	0.05
3	Dim Sum Restaurant	0.05
4	Thai Restaurant	0.05

**----Bueng Kum----**

	venue	freq
0	Thai Restaurant	1.0
1	American Restaurant	0.0
2	Shabu-Shabu Restaurant	0.0
3	Mexican Restaurant	0.0
4	Middle Eastern Restaurant	0.0

**----Chom Thong----**

	venue	freq
0	Thai Restaurant	0.67
1	Asian Restaurant	0.33
2	Seafood Restaurant	0.00
3	Mediterranean Restaurant	0.00
4	Mexican Restaurant	0.00

**----Chatuchak----**

	venue	freq
0	Thai Restaurant	0.36
1	Japanese Restaurant	0.12
2	Fast Food Restaurant	0.12
3	Noodle House	0.09
4	Ramen Restaurant	0.06

**----Din Daeng----**

	venue	freq
0	Noodle House	0.55
1	Thai Restaurant	0.18
2	Chinese Restaurant	0.09
3	Satay Restaurant	0.09
4	Seafood Restaurant	0.09

**----Don Mueang----**

	venue	freq
0	Noodle House	0.38
1	Thai Restaurant	0.25
2	Seafood Restaurant	0.12
3	Chinese Restaurant	0.12
4	Som Tum Restaurant	0.12

**----Huai Khwang----**

	venue	freq
0	Thai Restaurant	0.26
1	Noodle House	0.17
2	Japanese Restaurant	0.13
3	Asian Restaurant	0.09
4	Hotpot Restaurant	0.06

**----Dusit----**

	venue	freq
0	Noodle House	0.41
1	Thai Restaurant	0.21
2	Asian Restaurant	0.12
3	Som Tum Restaurant	0.09
4	Chinese Restaurant	0.06

**----Khan Na Yao----**

	venue	freq
0	Japanese Restaurant	0.20
1	Thai Restaurant	0.20
2	Noodle House	0.10
3	Som Tum Restaurant	0.10
4	Hotpot Restaurant	0.07

**----Khlong Sam Wa----**

	venue	freq
0	Noodle House	0.27
1	Thai Restaurant	0.20
2	Japanese Restaurant	0.13
3	Chinese Restaurant	0.13
4	French Restaurant	0.07

**----Khlong Toei----**

	venue	freq
0	Noodle House	0.5
1	Thai Restaurant	0.5
2	American Restaurant	0.0
3	Shabu-Shabu Restaurant	0.0
4	Mexican Restaurant	0.0

**----Khlong San----**

	venue	freq
0	Noodle House	0.24
1	Chinese Restaurant	0.21
2	Thai Restaurant	0.15
3	Seafood Restaurant	0.06
4	Shabu-Shabu Restaurant	0.06

**----Lak Si----**

	venue	freq
0	Thai Restaurant	0.41
1	Fast Food Restaurant	0.18
2	Japanese Restaurant	0.12
3	Asian Restaurant	0.06
4	Noodle House	0.06

**----Lat Krabang----**

	venue	freq
0	Noodle House	0.28
1	Thai Restaurant	0.28
2	Som Tum Restaurant	0.17
3	Korean Restaurant	0.11
4	Vietnamese Restaurant	0.06

**----Min Buri----**

	venue	freq
0	Noodle House	0.5
1	Thai Restaurant	0.5
2	American Restaurant	0.0
3	Shabu-Shabu Restaurant	0.0
4	Mexican Restaurant	0.0

**----Lat Phrao----**

	venue	freq
0	Noodle House	0.24
1	Thai Restaurant	0.17
2	Japanese Restaurant	0.10
3	Asian Restaurant	0.10
4	Som Tum Restaurant	0.10

**----Nong Chok----**

	venue	freq
0	Halal Restaurant	0.2
1	Asian Restaurant	0.2
2	Noodle House	0.2
3	Thai Restaurant	0.2
4	Fast Food Restaurant	0.2

**----Nong Khaem----**

	venue	freq
0	Chinese Restaurant	0.33
1	Thai Restaurant	0.33
2	Som Tum Restaurant	0.33
3	American Restaurant	0.00
4	Seafood Restaurant	0.00

**----Phasi Charoen----**

	venue	freq
0	Thai Restaurant	0.19
1	Japanese Restaurant	0.14
2	Asian Restaurant	0.14
3	Fast Food Restaurant	0.14
4	Shabu-Shabu Restaurant	0.10

**----Pathum Wan----**

	venue	freq
0	Noodle House	0.27
1	Thai Restaurant	0.16
2	Asian Restaurant	0.14
3	Chinese Restaurant	0.11
4	Seafood Restaurant	0.09

**----Phaya Thai----**

	venue	freq
0	Thai Restaurant	0.29
1	Sushi Restaurant	0.13
2	Noodle House	0.13
3	Japanese Restaurant	0.11
4	Som Tum Restaurant	0.11

**----Phra Khanong----**

	venue	freq
0	Noodle House	0.27
1	Chinese Restaurant	0.14
2	Italian Restaurant	0.14
3	Fast Food Restaurant	0.14
4	Hotpot Restaurant	0.09

**----Pom Prap Sattru Phai----**

	venue	freq
0	Noodle House	0.28
1	Thai Restaurant	0.22
2	Chinese Restaurant	0.12
3	Asian Restaurant	0.12
4	Mediterranean Restaurant	0.03

**----Phra Nakhon----**

	venue	freq
0	Thai Restaurant	0.28
1	Noodle House	0.21
2	Asian Restaurant	0.14
3	Vegetarian / Vegan Restaurant	0.10
4	Italian Restaurant	0.07

**----Prawet----**

	venue	freq
0	Noodle House	0.6
1	Thai Restaurant	0.2
2	Halal Restaurant	0.2
3	American Restaurant	0.0
4	Seafood Restaurant	0.0

----Rat Burana----

	venue	freq
0	Noodle House	0.21
1	Fast Food Restaurant	0.14
2	Hotpot Restaurant	0.10
3	Thai Restaurant	0.10
4	Chinese Restaurant	0.10

----Sai Mai----

	venue	freq
0	Noodle House	0.57
1	Thai Restaurant	0.43
2	American Restaurant	0.00
3	Shabu-Shabu Restaurant	0.00
4	Mexican Restaurant	0.00

----Ratchathewi----

	venue	freq
0	Noodle House	0.27
1	Japanese Restaurant	0.17
2	Thai Restaurant	0.17
3	Sushi Restaurant	0.07
4	Halal Restaurant	0.03

----Samphanthawong----

	venue	freq
0	Noodle House	0.29
1	Thai Restaurant	0.15
2	Chinese Restaurant	0.12
3	Japanese Restaurant	0.06
4	Seafood Restaurant	0.06

----Saphan Sung----

	venue	freq
0	Thai Restaurant	0.47
1	Noodle House	0.26
2	Japanese Restaurant	0.21
3	Asian Restaurant	0.05
4	Tonkatsu Restaurant	0.00

----Suan Luang----

	venue	freq
0	Noodle House	0.52
1	Asian Restaurant	0.13
2	Thai Restaurant	0.10
3	Som Tum Restaurant	0.06
4	Vietnamese Restaurant	0.03

----Sathon----

	venue	freq
0	Noodle House	0.37
1	Asian Restaurant	0.17
2	Chinese Restaurant	0.15
3	Thai Restaurant	0.12
4	Hotpot Restaurant	0.07

----Taling Chan----

	venue	freq
0	Noodle House	0.47
1	Asian Restaurant	0.13
2	Seafood Restaurant	0.13
3	Fast Food Restaurant	0.07
4	Som Tum Restaurant	0.07

----Thawi Watthana----

	venue	freq
0	Noodle House	0.50
1	Asian Restaurant	0.38
2	Chinese Restaurant	0.12
3	Shabu-Shabu Restaurant	0.00
4	Mexican Restaurant	0.00

----Thung Khru----

	venue	freq
0	Noodle House	0.33
1	Thai Restaurant	0.28
2	Som Tum Restaurant	0.17
3	Shabu-Shabu Restaurant	0.11
4	Japanese Curry Restaurant	0.06

----Thon Buri----

	venue	freq
0	Noodle House	0.41
1	Thai Restaurant	0.24
2	Asian Restaurant	0.18
3	Seafood Restaurant	0.12
4	Chinese Restaurant	0.06

----Wang Thonglang----

	venue	freq
0	Noodle House	0.25
1	Thai Restaurant	0.17
2	Asian Restaurant	0.12
3	Fast Food Restaurant	0.12
4	Som Tum Restaurant	0.08

----Watthana----

	venue	freq
0	Thai Restaurant	0.22
1	Japanese Restaurant	0.16
2	Noodle House	0.14
3	Asian Restaurant	0.11
4	Shabu-Shabu Restaurant	0.08

----Yan Nawa----

	venue	freq
0	Japanese Restaurant	0.18
1	Thai Restaurant	0.18
2	Seafood Restaurant	0.09
3	Hotpot Restaurant	0.09
4	Som Tum Restaurant	0.07

## 5. Clustering

### Cluster Neighborhoods

The intuition behind K-means is clustering data points or observations into specified clusters, such that the total within-cluster Sum of Squared Errors is minimum. The Squared Error for each point is the square of the distance of the point from its predicted cluster center (centroid). To determine the optimum number of k for clustering, there are several methods, such as the Elbow method and the Silhouette method.

### Elbow Method

In this approach, the approach is to calculate the Within-Cluster-Sum of Squared Errors (WSS) for different values of k, and choose the k for which WSS becomes first starts to diminish. If the dataset is not well clustered (i.e. overlapping clusters), the elbow from the elbow method may potentially not be distinct.

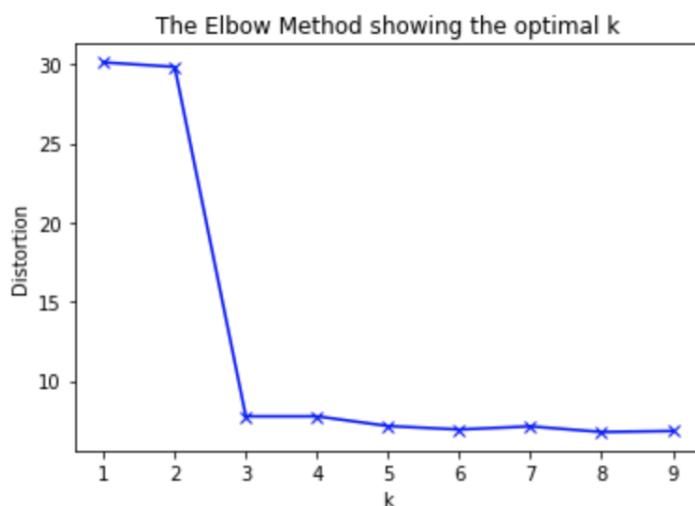
### Silhouette Method

The Silhouette method measures the similarity of a point to its own cluster, compared to other clusters. The range of the Silhouette coefficients is between a positive one and a negative one.

A positive coefficient tending close to a positive one indicates the particular point is assigned in the ideal cluster. It also implies point is as practically distanced from the neighboring clusters as possible. A coefficient of zero indicates that the particular point is on or very close to the decision boundary between two neighboring clusters. A negative coefficient indicates that the point has been assigned to the wrong cluster.

In this project, I will try both methods to find an optimal  $k$ .

Firstly, I will try on the Elbow method.



From the elbow method, it suggests us to use  $k = 3$ .

Secondly, I run the Silhouette method for finding the best  $k$ .

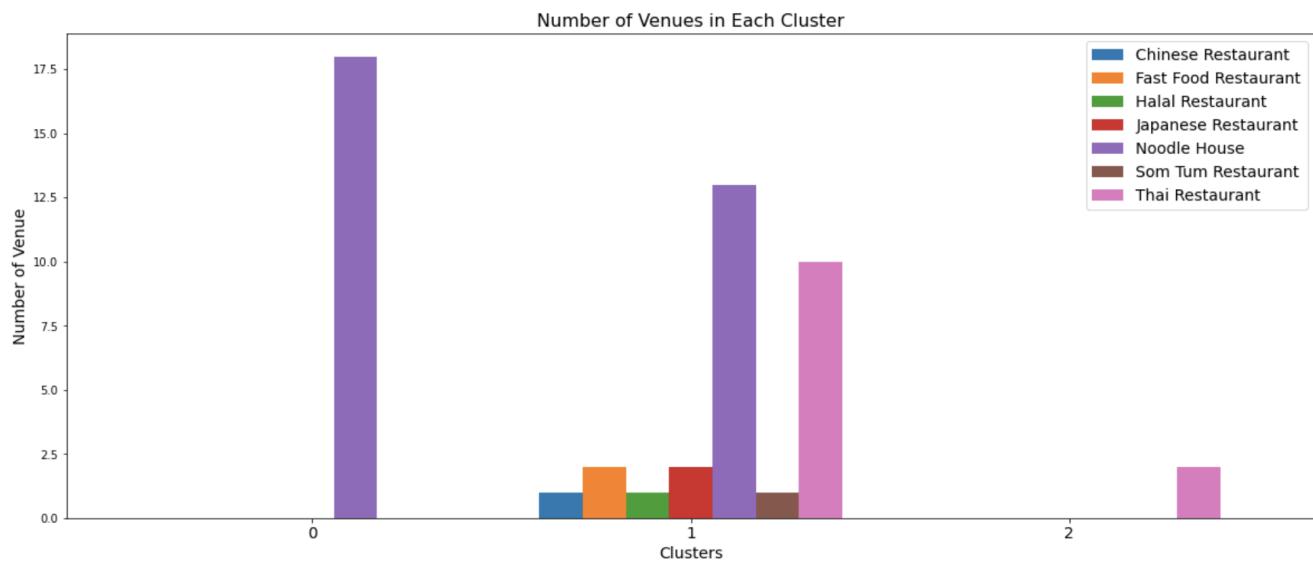
```
For n_clusters: 2, average silhouette score: 0.220
For n_clusters: 3, average silhouette score: 0.251
For n_clusters: 4, average silhouette score: 0.168
For n_clusters: 5, average silhouette score: 0.219
For n_clusters: 6, average silhouette score: 0.214
For n_clusters: 7, average silhouette score: 0.156
For n_clusters: 8, average silhouette score: 0.192
For n_clusters: 9, average silhouette score: 0.157
For n_clusters: 10, average silhouette score: 0.152
```

From the Silhouette Method, the optimal  $k$  is 3. Since both two methods are consistent, we consider using  $k = 3$ .

Next, create a new data frame that includes the cluster as well as the top 10 venues for each district.

District	Post-code	Population	Latitude	Longitude	Cluster Labels	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 N Comr Ve	
0	Bang Bon	10150	105161	13.659200	100.399100	0	Noodle House	Thai Restaurant	Japanese Restaurant	Som Tum Restaurant	Asian Restaurant	Chinese Restaurant	Tonkatsu Restaurant	Udon Restaurant	S Restau
1	Bang Kapi	10240	148465	13.765833	100.647778	1	Som Tum Restaurant	Japanese Restaurant	Noodle House	Fast Food Restaurant	Hotpot Restaurant	Thai Restaurant	Shabu-Shabu Restaurant	Ramen Restaurant	S Restau
2	Bang Khae	10160	191781	13.696111	100.409444	0	Noodle House	Japanese Restaurant	Fast Food Restaurant	Shabu-Shabu Restaurant	Asian Restaurant	Thai Restaurant	Sushi Restaurant	Tonkatsu Restaurant	Som Restau
3	Bang Khen	10220	189539	13.873889	100.596389	1	Fast Food Restaurant	Hotpot Restaurant	Noodle House	Asian Restaurant	Vietnamese Restaurant	Som Tum Restaurant	Ramen Restaurant	Thai Restaurant	Shabu Sh Restau
4	Bang Kho Laem	10120	94956	13.693333	100.502500	1	Thai Restaurant	Noodle House	Chinese Restaurant	Seafood Restaurant	Vietnamese Restaurant	Asian Restaurant	Fast Food Restaurant	Som Tum Restaurant	F Restau

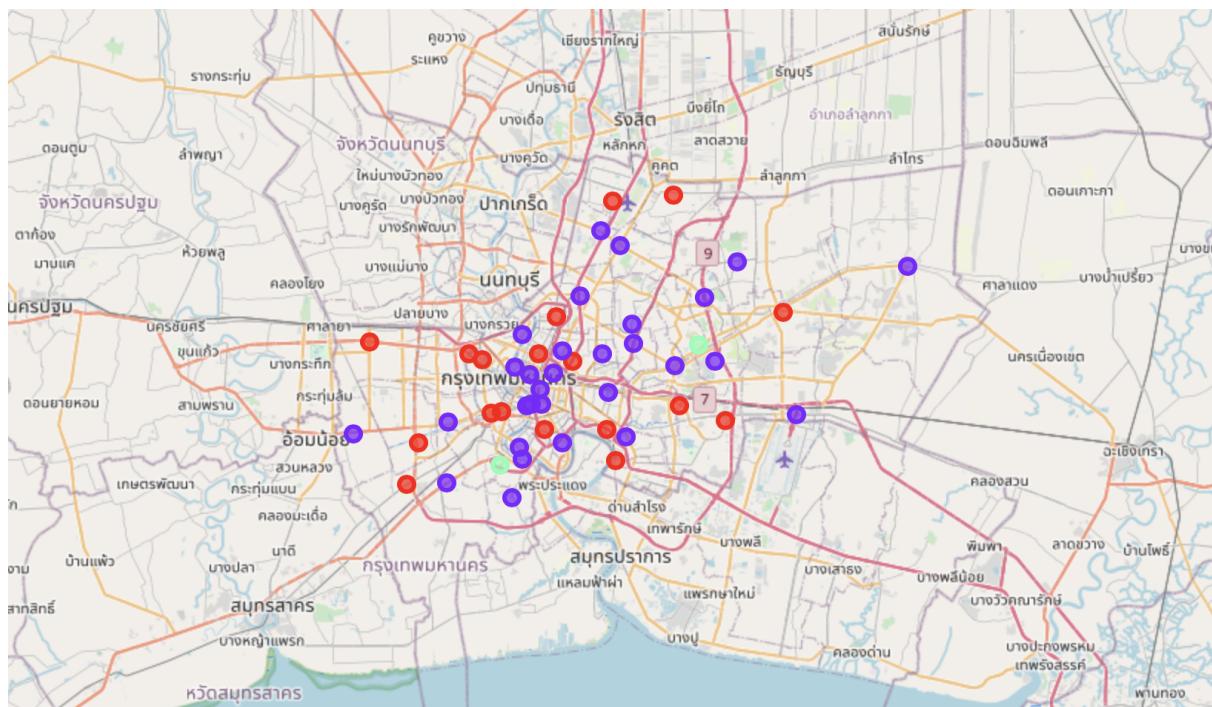
We can also estimate the number of **1st Most Common Venue** in each cluster. Thus, we can create a bar chart that may help us to find proper labels for each cluster.



When we examine above graph we can label each cluster as follows:

- Cluster 0 : "Noodle House"
- Cluster 1 : "Multiple Types of Restaurant"
- Cluster 2 : "Thai Restaurant"

### let's visualize the resulting clusters



## 6. Evaluation & Recommendations

Examining each cluster based on venue categories, the following observations are derived.

**Cluster 1:** Noodle House is predominantly prevalent in cluster 1. This is followed by a mix of either Thai or Asian restaurants.

District	Cluster Labels	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	Bang Bon	0	Noodle House	Thai Restaurant	Japanese Restaurant	Som Tum Restaurant	Asian Restaurant	Chinese Restaurant	Tonkatsu Restaurant	Udon Restaurant	Sushi Restaurant	Mediterranean Restaurant
2	Bang Khae	0	Noodle House	Japanese Restaurant	Fast Food Restaurant	Shabu-Shabu Restaurant	Asian Restaurant	Thai Restaurant	Sushi Restaurant	Tonkatsu Restaurant	Som Tum Restaurant	Mediterranean Restaurant
6	Bang Na	0	Noodle House	Asian Restaurant	Thai Restaurant	Chinese Restaurant	Seafood Restaurant	Shabu-Shabu Restaurant	Mexican Restaurant	Middle Eastern Restaurant	Ramen Restaurant	Satay Restaurant
9	Bang Sue	0	Noodle House	Thai Restaurant	Asian Restaurant	Fast Food Restaurant	Hotpot Restaurant	Japanese Restaurant	Shabu-Shabu Restaurant	Chinese Restaurant	Ramen Restaurant	Seafood Restaurant
10	Bangkok Noi	0	Noodle House	Som Tum Restaurant	Asian Restaurant	Shabu-Shabu Restaurant	Dim Sum Restaurant	Mexican Restaurant	Middle Eastern Restaurant	Ramen Restaurant	Satay Restaurant	Seafood Restaurant
11	Bangkok Yai	0	Noodle House	Asian Restaurant	Chinese Restaurant	Dim Sum Restaurant	Thai Restaurant	Seafood Restaurant	American Restaurant	Shabu-Shabu Restaurant	Middle Eastern Restaurant	Ramen Restaurant
15	Din Daeng	0	Noodle House	Thai Restaurant	Chinese Restaurant	Satay Restaurant	Seafood Restaurant	American Restaurant	Shabu-Shabu Restaurant	Mexican Restaurant	Middle Eastern Restaurant	Ramen Restaurant
16	Don Mueang	0	Noodle House	Thai Restaurant	Seafood Restaurant	Chinese Restaurant	Som Tum Restaurant	American Restaurant	Mexican Restaurant	Middle Eastern Restaurant	Ramen Restaurant	Satay Restaurant
17	Dusit	0	Noodle House	Thai Restaurant	Asian Restaurant	Som Tum Restaurant	Chinese Restaurant	Italian Restaurant	Vietnamese Restaurant	Shabu-Shabu Restaurant	Satay Restaurant	Middle Eastern Restaurant
22	Khlong Toei	0	Noodle House	Thai Restaurant	American Restaurant	Shabu-Shabu Restaurant	Mexican Restaurant	Middle Eastern Restaurant	Ramen Restaurant	Satay Restaurant	Seafood Restaurant	Shanghai Restaurant
26	Min Buri	0	Noodle House	Thai Restaurant	American Restaurant	Shabu-Shabu Restaurant	Mexican Restaurant	Middle Eastern Restaurant	Ramen Restaurant	Satay Restaurant	Seafood Restaurant	Shanghai Restaurant
35	Prawet	0	Noodle House	Thai Restaurant	Halal Restaurant	American Restaurant	Seafood Restaurant	Mexican Restaurant	Middle Eastern Restaurant	Ramen Restaurant	Satay Restaurant	Shabu-Shabu Restaurant
38	Sai Mai	0	Noodle House	Thai Restaurant	American Restaurant	Shabu-Shabu Restaurant	Mexican Restaurant	Middle Eastern Restaurant	Ramen Restaurant	Satay Restaurant	Seafood Restaurant	Shanghai Restaurant
41	Sathon	0	Noodle House	Asian Restaurant	Chinese Restaurant	Thai Restaurant	Hotpot Restaurant	Seafood Restaurant	Japanese Restaurant	Vegetarian / Vegan Restaurant	Shabu-Shabu Restaurant	Middle Eastern Restaurant
42	Suan Luang	0	Noodle House	Asian Restaurant	Thai Restaurant	Som Tum Restaurant	Vietnamese Restaurant	Italian Restaurant	Satay Restaurant	Seafood Restaurant	German Restaurant	Chinese Restaurant
43	Taling Chan	0	Noodle House	Asian Restaurant	Seafood Restaurant	Fast Food Restaurant	Som Tum Restaurant	Japanese Restaurant	Thai Restaurant	Sushi Restaurant	Tonkatsu Restaurant	Mediterranean Restaurant
44	Thawi Watthana	0	Noodle House	Asian Restaurant	Chinese Restaurant	Shabu-Shabu Restaurant	Mexican Restaurant	Middle Eastern Restaurant	Ramen Restaurant	Satay Restaurant	Seafood Restaurant	American Restaurant
45	Thon Buri	0	Noodle House	Thai Restaurant	Asian Restaurant	Seafood Restaurant	Chinese Restaurant	Shabu-Shabu Restaurant	Mexican Restaurant	Middle Eastern Restaurant	Ramen Restaurant	Satay Restaurant

**Cluster 2:** Noodle House is predominantly prevalent in cluster 2. This is closely followed by restaurants offering Asian-styled cuisine such as Thai, Chinese and Japanese.

	District	Cluster Labels	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
1	Bang Kapi	1	Som Tum Restaurant	Japanese Restaurant	Noodle House	Fast Food Restaurant	Hotpot Restaurant	Thai Restaurant	Shabu-Shabu Restaurant	Ramen Restaurant	Sushi Restaurant	Korean Restaurant
3	Bang Khen	1	Fast Food Restaurant	Hotpot Restaurant	Noodle House	Asian Restaurant	Vietnamese Restaurant	Som Tum Restaurant	Ramen Restaurant	Thai Restaurant	Shabu-Shabu Restaurant	Seafood Restaurant
4	Bang Kho Laem	1	Thai Restaurant	Noodle House	Chinese Restaurant	Seafood Restaurant	Vietnamese Restaurant	Asian Restaurant	Fast Food Restaurant	Som Tum Restaurant	Halal Restaurant	Hotpot Restaurant
5	Bang Khun Thian	1	Thai Restaurant	Japanese Restaurant	Seafood Restaurant	Noodle House	Asian Restaurant	Hotpot Restaurant	Som Tum Restaurant	Fast Food Restaurant	Sushi Restaurant	Chinese Restaurant
7	Bang Phlat	1	Fast Food Restaurant	Japanese Restaurant	Ramen Restaurant	Thai Restaurant	Hotpot Restaurant	Seafood Restaurant	Shabu-Shabu Restaurant	Middle Eastern Restaurant	Noodle House	Satay Restaurant
8	Bang Rak	1	Noodle House	Chinese Restaurant	Thai Restaurant	Seafood Restaurant	Japanese Restaurant	Ramen Restaurant	French Restaurant	Hotpot Restaurant	Shanghai Restaurant	Satay Restaurant
13	Chatuchak	1	Thai Restaurant	Japanese Restaurant	Fast Food Restaurant	Noodle House	Ramen Restaurant	Som Tum Restaurant	Shabu-Shabu Restaurant	Chinese Restaurant	Asian Restaurant	Japanese Curry Restaurant
18	Huai Khwang	1	Thai Restaurant	Noodle House	Japanese Restaurant	Asian Restaurant	Hotpot Restaurant	Chinese Restaurant	Som Tum Restaurant	Seafood Restaurant	Korean Restaurant	Shabu-Shabu Restaurant
19	Khan Na Yao	1	Japanese Restaurant	Thai Restaurant	Noodle House	Som Tum Restaurant	Hotpot Restaurant	Sushi Restaurant	Seafood Restaurant	Shabu-Shabu Restaurant	Japanese Curry Restaurant	Ramen Restaurant
20	Khlong Sam Wa	1	Noodle House	Thai Restaurant	Japanese Restaurant	Chinese Restaurant	French Restaurant	Shabu-Shabu Restaurant	Vietnamese Restaurant	Dim Sum Restaurant	Fast Food Restaurant	Dumpling Restaurant
21	Khlong San	1	Noodle House	Chinese Restaurant	Thai Restaurant	Seafood Restaurant	Shabu-Shabu Restaurant	Indian Restaurant	Hotpot Restaurant	Japanese Restaurant	French Restaurant	Dim Sum Restaurant
23	Lak Si	1	Thai Restaurant	Fast Food Restaurant	Japanese Restaurant	Asian Restaurant	Noodle House	Hotpot Restaurant	Som Tum Restaurant	Dumpling Restaurant	Sushi Restaurant	Mexican Restaurant
24	Lat Krabang	1	Noodle House	Thai Restaurant	Som Tum Restaurant	Korean Restaurant	Vietnamese Restaurant	Sushi Restaurant	Asian Restaurant	Tonkatsu Restaurant	Shanghai Restaurant	Udon Restaurant
25	Lat Phrao	1	Noodle House	Thai Restaurant	Japanese Restaurant	Asian Restaurant	Som Tum Restaurant	Seafood Restaurant	Chinese Restaurant	Fast Food Restaurant	Sushi Restaurant	Shabu-Shabu Restaurant
27	Nong Chok	1	Halal Restaurant	Asian Restaurant	Noodle House	Thai Restaurant	Fast Food Restaurant	American Restaurant	Middle Eastern Restaurant	Ramen Restaurant	Satay Restaurant	Seafood Restaurant
28	Nong Khaem	1	Chinese Restaurant	Thai Restaurant	Som Tum Restaurant	American Restaurant	Seafood Restaurant	Mexican Restaurant	Middle Eastern Restaurant	Noodle House	Ramen Restaurant	Satay Restaurant
29	Pathum Wan	1	Noodle House	Thai Restaurant	Asian Restaurant	Chinese Restaurant	Seafood Restaurant	Satay Restaurant	Korean Restaurant	Hotpot Restaurant	Vegetarian / Vegan Restaurant	Sushi Restaurant
30	Phasi Charoen	1	Thai Restaurant	Japanese Restaurant	Asian Restaurant	Fast Food Restaurant	Shabu-Shabu Restaurant	Hotpot Restaurant	Noodle House	Ramen Restaurant	Donburi Restaurant	Seafood Restaurant
31	Phaya Thai	1	Thai Restaurant	Sushi Restaurant	Noodle House	Japanese Restaurant	Som Tum Restaurant	Seafood Restaurant	Hotpot Restaurant	Vegetarian / Vegan Restaurant	Mexican Restaurant	Asian Restaurant
32	Phra Khanong	1	Noodle House	Chinese Restaurant	Italian Restaurant	Fast Food Restaurant	Hotpot Restaurant	Vegetarian / Vegan Restaurant	Japanese Restaurant	Ramen Restaurant	Som Tum Restaurant	Mexican Restaurant
33	Phra Nakhon	1	Thai Restaurant	Noodle House	Asian Restaurant	Vegetarian / Vegan Restaurant	Italian Restaurant	Halal Restaurant	Vietnamese Restaurant	Dim Sum Restaurant	Sushi Restaurant	Israeli Restaurant
34	Pom Prap Sattru Phai	1	Noodle House	Thai Restaurant	Chinese Restaurant	Asian Restaurant	Mediterranean Restaurant	Japanese Curry Restaurant	Italian Restaurant	Satay Restaurant	American Restaurant	Dumpling Restaurant
36	Rat Burana	1	Noodle House	Fast Food Restaurant	Hotpot Restaurant	Thai Restaurant	Chinese Restaurant	Seafood Restaurant	Asian Restaurant	Japanese Restaurant	Som Tum Restaurant	Ramen Restaurant
37	Ratchathewi	1	Noodle House	Japanese Restaurant	Thai Restaurant	Sushi Restaurant	Halal Restaurant	Som Tum Restaurant	Seafood Restaurant	Korean Restaurant	Asian Restaurant	Italian Restaurant
39	Samphanthawong	1	Noodle House	Thai Restaurant	Chinese Restaurant	Japanese Restaurant	Seafood Restaurant	Asian Restaurant	Indian Restaurant	Italian Restaurant	Cantonese Restaurant	Dim Sum Restaurant
40	Saphan Sung	1	Thai Restaurant	Noodle House	Japanese Restaurant	Asian Restaurant	Tonkatsu Restaurant	Udon Restaurant	Sushi Restaurant	Som Tum Restaurant	Shanghai Restaurant	Korean Restaurant
46	Thung Khru	1	Noodle House	Thai Restaurant	Som Tum Restaurant	Shabu-Shabu Restaurant	Japanese Curry Restaurant	Fast Food Restaurant	American Restaurant	Seafood Restaurant	Middle Eastern Restaurant	Ramen Restaurant

47	Wang Thonglang	1	Noodle House	Thai Restaurant	Asian Restaurant	Fast Food Restaurant	Som Tum Restaurant	Chinese Restaurant	Hotpot Restaurant	Shabu-Shabu Restaurant	Vietnamese Restaurant	Mexican Restaurant
48	Watthana	1	Thai Restaurant	Japanese Restaurant	Noodle House	Asian Restaurant	Shabu-Shabu Restaurant	Italian Restaurant	Sushi Restaurant	Middle Eastern Restaurant	Korean Restaurant	Indian Restaurant
49	Yan Nawa	1	Japanese Restaurant	Thai Restaurant	Seafood Restaurant	Hotpot Restaurant	Som Tum Restaurant	Noodle House	Fast Food Restaurant	Sushi Restaurant	Dim Sum Restaurant	Shabu-Shabu Restaurant

**Cluster 3:** Thai restaurant is predominantly prevalent in cluster 3. This is followed by American and Asian restaurants.

District	Cluster Labels	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	
12	Buong Kum	2	Thai Restaurant	American Restaurant	Shabu-Shabu Restaurant	Mexican Restaurant	Middle Eastern Restaurant	Noodle House	Ramen Restaurant	Satay Restaurant	Seafood Restaurant	Shanghai Restaurant
14	Chom Thong	2	Thai Restaurant	Asian Restaurant	Seafood Restaurant	Mediterranean Restaurant	Mexican Restaurant	Middle Eastern Restaurant	Noodle House	Ramen Restaurant	Satay Restaurant	American Restaurant

## Recommendations

Exploring the districts in Bangkok, Bang Kapi, Sathon, Bang Rak, Pathum Wan, Yan Nawa, and Huai Khwang have a higher density of restaurants (more than 40 in its area). The higher restaurant density could imply these areas as being more popular with visitors with more tourist attractions in their vicinity.

Preliminary recommended locations are Bangkok Noi and Sathon for market entry. Bangkok Noi is assigned to cluster 1; a restaurant offering Noodles could have a higher chance of success with the visitors. Sathon is assigned to cluster 1; a restaurant offering Noodles could have a higher chance of success with the visitors.

Regardless of the above recommendations, the other fundamentals of F&B service such as quality food & services and strict hygiene practices are not to be overlooked.

