

Capstone Project – The Battle of London Neighbourhoods

Sin Wee Lee

16/03/2019

1. Introduction

1.1 Background

London, capital and one of the largest city of both England and the United Kingdom, voted most attractive city to work for overseas worker in a global survey of 3666,000 people, beating New York, Berlin and Barcelona to take the top spot in 2018 (Total Jobs and Boston Consulting Group).

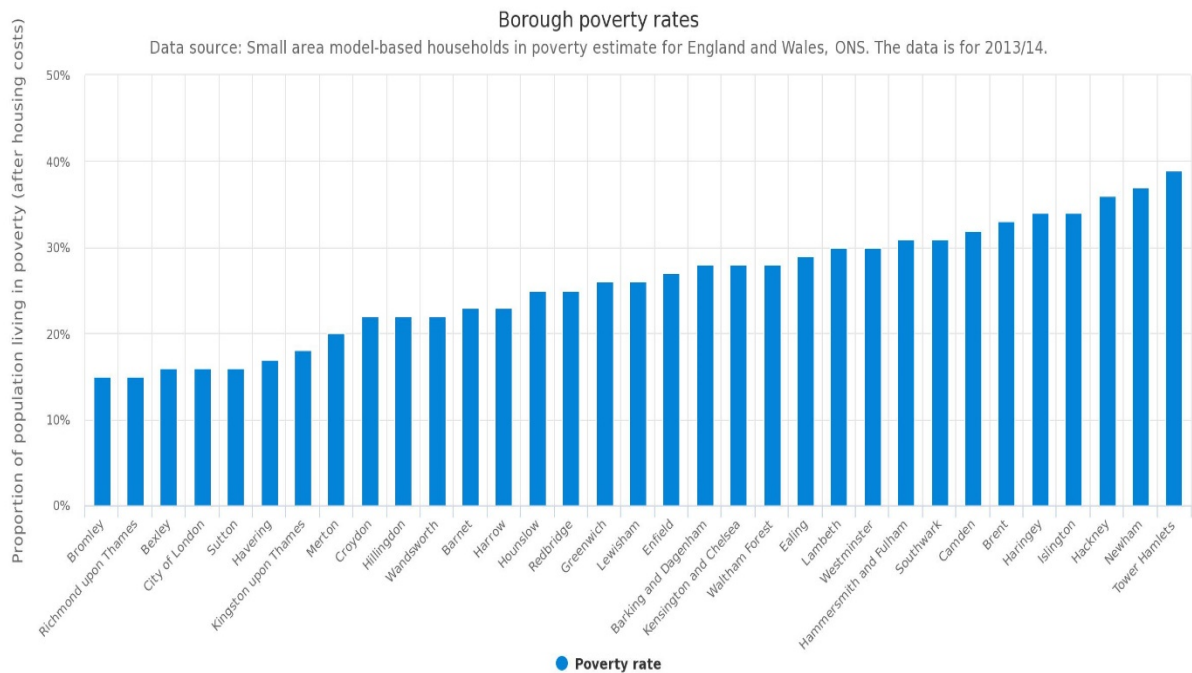
However, with Brexit fast approaching, there are not clear forecasts on the impacts of Brexit on the social, economic and the development of the city. To anticipate the impacts, local authorities (local government) are looking at ways to reduce cost and have more targeted development at borough level.

Although London as a whole has been booming for the last decade, the segregation of wealth across London are still visible since the 80s. Thus, it will be interesting to see how the social, economic impacts influence the facilities, venues and amenities available in the boroughs.

In order for the stakeholders, the local authorities and the business chamber of commerce to understand the social and economic impacts based on the facilities and amenities of certain borough and how this insights can provide targeting local and business development for London boroughs.

This project aims to address this by carried out a comparative study on the facilities and amenities between the two boroughs with the highest income rate and the lowest in London.

In London, there are 32 London boroughs and the City of London. Among them, Tower Hamlet have the highest poverty and Bromley has the lowest. Although the data are from 2013/14, the stats remained at the same level.



Notes:

London's Poverty profile is created by charitable funder, Trust for London, and the independent think tank, New Policy Institute.

Questions to answer:

1. What types of facilities (venues) and amenities are available in the area with different poverty line?
2. How venues changing based on the spending power?
3. What are the distinctive venues that represent in these boroughs
4. Suggestions and recommendations of development in these areas.

By answering the above questions, the findings can be used for the targeting development for the rest of the London Boroughs so that unnecessary development can be avoided and overall budget can be sustained.

2. Data Descriptions

The data folder for this project will consists the following data set:

TH_neighbourhoods.csv

Number of Instances: 15

Sources: <https://www.distancesto.com/coordinates/gb/>

Date accessed: 11/03/2019

This dataset consists of three attributes:

- *Neighbourhood*: the neighbourhood name in Tower Hamlet
- *latitude*: latitude of the neighbourhood
- *longitude*: longitude of the neighbourhood

Sample data: *first 7 instances of the dataset*

neighbourhood	latitude	longitude
Bethnal Green	51.526962	-0.06674
Blackwall and Cubitt Town	51.495182	-0.009826
Bow East	51.528309	-0.019482
Bow West	51.528309	-0.019482
Canary Wharf	51.505219	-0.0189
Island Gardens	51.487061	-0.007988
Lansbury	51.513294	-0.027155

BROM_neighbourhoods.csv

Number of Instances: 20

Sources: <https://www.distancesto.com/coordinates/gb/>

Date accessed: 11/03/2019

This dataset consists of three attributes:

- *Neighbourhood*: the neighbourhood name in Tower Hamlet
- *latitude*: latitude of the neighbourhood
- *longitude*: longitude of the neighbourhood

Sample data: *first 9 instances of the dataset*

neighbourhood	latitude	longitude
Bickley	51.40174	0.043712
Biggin Hill	51.331959	0.029057
Bromley Common & Keston	51.375875	0.043819
Bromley Town	51.402805	0.014814
Chelsfield & Pratts Bottom	51.357943	0.127288
Chislehurst	51.411572	0.076955
Copers Cope	51.419348	-0.031502
Cray Valley East	51.401639	0.020742
Crystal Palace	51.419366	-0.071133

Based on the problem definition, factors that will influence the decision in this project will be:

- number and the type of venues and facilities available in the surrounding area of these boroughs
- the most frequent venues and facilities' for each boroughs

To define the surrounding area of the borough, we will be using:

- London Boroughs poverty information
from: <https://www.trustforlondon.org.uk/data/poverty-borough>. Accessed: 11/03/2019
- latitudes and longitudes of Tower Hamlet and Bromley obtained
from: <https://www.distance.to.com/coordinates/gb/>. Accessed: 11/03/2019
- venues, type and locations in every borough will be obtained
using Foursquare API

Further information of the boroughs can be found at:

- Bromley: https://en.wikipedia.org/wiki/London_Borough_of_Bromley
- Tower Hamlet: https://en.wikipedia.org/wiki/London_Borough_of_Tower_Hamlets

3. Methodology

In this project, we will be only concentrating the two boroughs with the largest poverty rate gaps.

In the first step, we will be looking into the top 5 most common venues for each of the borough, this will provide us with an overview of the types of venues popular in the boroughs.

Second steps we will be clustering the neighbourhood for each borough to investigate the cluster formations

in third and final steps, we will be drill into each of cluster to obtain the reviews of some of the venues to seek the quality of service at venues in this separate borough.

With this analysis, we will be able to draw some conclusions on how poverty rate in particular borough impacting the venues in the areas using Foursquare geospatial data.

3.1 Boroughs Locations

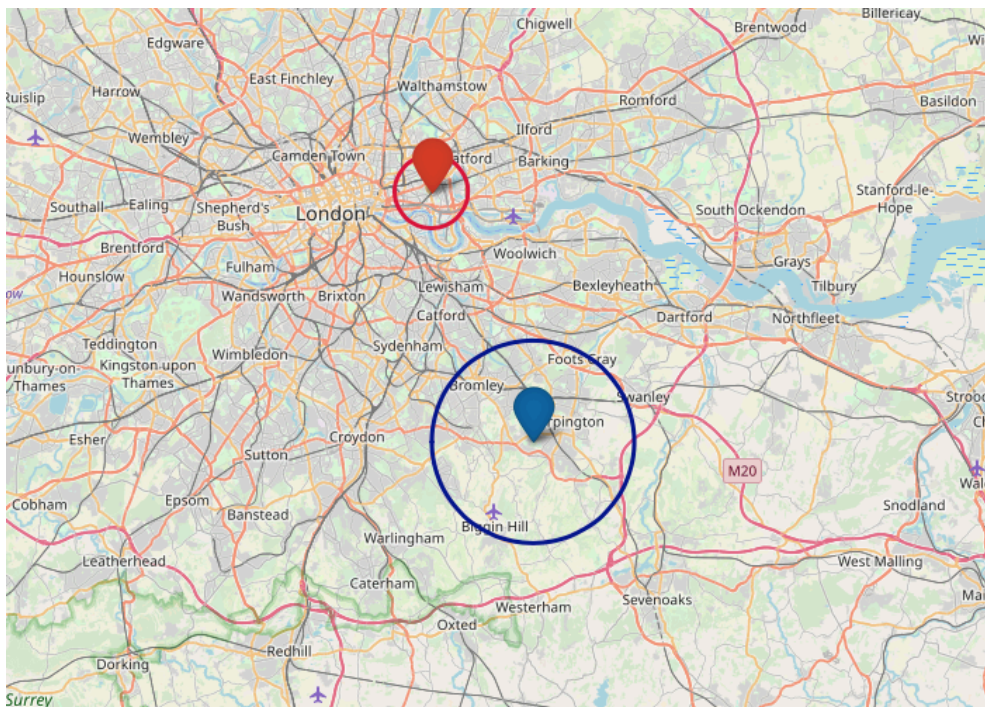


Figure 1: Boroughs Locations in London

Preliminary observations from the above map show that based on the locations for the two boroughs, Tower Hamlet is located very near to the London centre, where as Bromley borough located at the boundary of the M25 Ring road, which is about 2 hours' drive from London centre. In terms of area size, Tower Hamlet covers about 19.77km² and Bromley is about 150.2km². Based on this information, we can use

them as distance references when retrieving venues, type and locations using Foursquare API.

3.2 Data generations

Now that we have our location candidates, let's use Foursquare API to get info on venues in each of the wards within each borough

As an exploratory project, we will retrieve the venues based on the areas of each borough. We will then do the necessary manipulations and analysis to achieve our objectives.

We began by retrieving 100 venues with a radius of 500 meters of each of the neighbourhood:

Tower Hamlet:

	Neighbourhood	Neighbourhood Latitude	Neighbourhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Bethnal Green	51.526962	-0.06674	The King's Arms	51.525754	-0.065868	Pub
1	Bethnal Green	51.526962	-0.06674	Sam's Cafe	51.526424	-0.065056	Café
2	Bethnal Green	51.526962	-0.06674	Woolidando	51.526377	-0.066518	Café
3	Bethnal Green	51.526962	-0.06674	Jonestown	51.526092	-0.067936	Coffee Shop
4	Bethnal Green	51.526962	-0.06674	E Pellicci	51.526516	-0.063426	Café

Bromley:

	Neighbourhood	Neighbourhood Latitude	Neighbourhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Bickley	51.401740	0.043712	Bickley Railway Station (BKL)	51.400032	0.045351	Train Station
1	Bickley	51.401740	0.043712	Bickley Park Cricket Club	51.401508	0.046263	Cricket Ground
2	Bickley	51.401740	0.043712	J Henry Flooring	51.401227	0.040652	Home Service
3	Bickley	51.401740	0.043712	Village Sandwich Bar	51.399301	0.047951	Café
4	Biggin Hill	51.331959	0.029057	Biggin Hill Airport (BQH) (Biggin Hill Airport)	51.331794	0.028845	Airport

Using the data, we successfully retrieved the following:

- Total venues in Tower Hamlet neighbourhoods returned by Foursquare: **520**
- Total venues in Bromley neighbourhoods returned by Foursquare: **193**
- Total unique venue categories in Tower Hamlet = **156**
- Total unique venue categories in Bromley = **76**
- Tower Hamlet venues dataframe is called: **TH_venues**
- Bromley venues dataframe is called: **BROM_venues**

4. Analysis of Results and Discussions

We begin our analysis of neighbourhood by seeking the top 10 most common venues at each boroughs.

4.1 Ten most common venues in Tower Hamlet

		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	Bethnal Green	Coffee Shop	Pub	Café	Park	Bagel Shop	Restaurant	Wine Bar	Print Shop	Music Store	Pizza Place
1	Blackwall and Cubitt Town	Indian Restaurant	Park	Harbor / Marina	Pizza Place	Grocery Store	Pub	Café	Soccer Field	Light Rail Station	Dim Sum Restaurant
2	Bow East	Pub	Bike Rental / Bike Share	Hotel	Gym	Metro Station	Office	Fast Food Restaurant	Convenience Store	Coffee Shop	Burger Joint
3	Bow West	Pub	Bike Rental / Bike Share	Hotel	Gym	Metro Station	Office	Fast Food Restaurant	Convenience Store	Coffee Shop	Burger Joint
4	Canary Wharf	Coffee Shop	Burger Joint	Sandwich Place	Plaza	Café	Sushi Restaurant	Italian Restaurant	Bakery	Food Truck	Shopping Mall
5	Island Gardens	Pub	History Museum	Boat or Ferry	Park	Art Gallery	Church	Burger Joint	Bus Stop	Café	Chinese Restaurant
6	Lansbury	Indian Restaurant	Grocery Store	Beer Garden	Café	Food & Drink Shop	Pakistani Restaurant	Supermarket	Park	Fast Food Restaurant	Canal
7	Limehouse	Pub	Chinese Restaurant	Indian Restaurant	Café	Italian Restaurant	Pizza Place	Park	Bus Stop	Gastropub	Light Rail Station
8	Poplar	Park	Fried Chicken Joint	Grocery Store	Chinese Restaurant	Steakhouse	Coffee Shop	Café	Light Rail Station	Tunnel	English Restaurant
9	Shadwell	Grocery Store	Hotel	Pizza Place	Dive Bar	Burger Joint	Fast Food Restaurant	Coffee Shop	Park	Market	Event Space
10	Spitalfields and Banglatown	Coffee Shop	Pub	Vegetarian / Vegan Restaurant	Food Truck	Art Gallery	Indian Restaurant	Flea Market	Thai Restaurant	Beer Bar	Bookstore
11	St Katharine's and Wapping	Pub	Bus Stop	Metro Station	Chinese Restaurant	Persian Restaurant	Bar	Middle Eastern Restaurant	Thrift / Vintage Store	Grocery Store	Breakfast Spot
12	Stepney Green	Park	Pub	Chinese Restaurant	Fried Chicken Joint	Thai Restaurant	Farm	Sandwich Place	Movie Theater	Supermarket	Grocery Store
13	Weavers	Pub	Supermarket	Portuguese Restaurant	Thrift / Vintage Store	Movie Theater	Sandwich Place	Burger Joint	Brewery	Coffee Shop	Recreation Center
14	Whitechapel	Pub	Hotel	Sandwich Place	Coffee Shop	Indian Restaurant	Ice Cream Shop	Café	Fast Food Restaurant	North Indian Restaurant	Burger Joint

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Pub 7
Coffee Shop 3
Indian Restaurant 2
Name: 1st Most Common Venue, dtype: int64
Pub 3
Hotel 2
Bike Rental / Bike Share 2
Name: 2nd Most Common Venue, dtype: int64
Hotel 2
Sandwich Place 2
Boat or Ferry 1
Name: 3rd Most Common Venue, dtype: int64

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4.2 Ten most common venues in Bromley

	Neighbourhood	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	Bickley	Cricket Ground	Train Station	Café	Home Service	Women's Store	Fast Food Restaurant	Department Store	Diner	Donut Shop	Electronics Store
1	Biggin Hill	Airport	Airport Service	Pub	Massage Studio	Farm	Cricket Ground	Department Store	Diner	Donut Shop	Electronics Store
2	Bromley Common & Keston	Pub	Bar	Indian Restaurant	Bus Station	Fast Food Restaurant	Women's Store	Farm	Cricket Ground	Department Store	Diner
3	Bromley Town	Coffee Shop	Clothing Store	Gym / Fitness Center	Pub	Pizza Place	Burger Joint	Department Store	Irish Pub	Ice Cream Shop	Furniture / Home Store
4	Chelsfield & Pratts Bottom	Health & Beauty Service	Pub	Fishing Store	Women's Store	Farm	Cosmetics Shop	Cricket Ground	Department Store	Diner	Donut Shop
5	Chislehurst	Pub	Italian Restaurant	Gastropub	Pizza Place	Indian Restaurant	Women's Store	Cosmetics Shop	Cricket Ground	Department Store	Diner
6	Copers Cope	Athletics & Sports	Soccer Field	Indoor Play Area	Cricket Ground	Department Store	Diner	Donut Shop	Electronics Store	Farm	Fast Food Restaurant
7	Cray Valley East	Coffee Shop	Clothing Store	Gym / Fitness Center	Sandwich Place	Gastropub	Café	Ice Cream Shop	Electronics Store	Movie Theater	Burger Joint
8	Crystal Palace	Platform	Breakfast Spot	Park	Sculpture Garden	Wine Shop	Gym / Fitness Center	Farm	History Museum	Outdoor Sculpture	Café
9	Darwin	History Museum	Bar	Farm	Women's Store	Fast Food Restaurant	Cricket Ground	Department Store	Diner	Donut Shop	Electronics Store
10	Farnborough & Crofton	Pub	American Restaurant	Theater	Coffee Shop	Women's Store	Farm	Cosmetics Shop	Cricket Ground	Department Store	Diner
11	Hayes & Coney Hall	Park	Grocery Store	Hardware Store	Pub	Farm	Cosmetics Shop	Cricket Ground	Department Store	Diner	Donut Shop
12	Kelsey & Eden Park	Café	Tennis Court	Park	Women's Store	Farm	Cosmetics Shop	Cricket Ground	Department Store	Diner	Donut Shop
13	Mottingham & Chislehurst North	Pizza Place	Fish & Chips Shop	Pub	Grocery Store	Garden Center	Garden	Furniture / Home Store	Fishing Store	Gastropub	Fast Food Restaurant
14	Orpington	Fast Food Restaurant	Italian Restaurant	Supermarket	Chinese Restaurant	Memorial Site	Movie Theater	Pharmacy	Pizza Place	Café	Portuguese Restaurant
15	Penge & Cator	Pub	Supermarket	Pizza Place	Park	Shopping Mall	Furniture / Home Store	Hardware Store	Fast Food Restaurant	Italian Restaurant	Convenience Store
16	Petts Wood & Knoll	Convenience Store	Gift Shop	Home Service	Farm	Cosmetics Shop	Cricket Ground	Department Store	Diner	Donut Shop	Electronics Store

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Pub          4
Coffee Shop  2
Park         2
Name: 1st Most Common Venue, dtype: int64
Italian Restaurant    2
Train Station        2
Clothing Store        2
Name: 2nd Most Common Venue, dtype: int64
Park                  2
Gym / Fitness Center  2
Pub                   2
Name: 3rd Most Common Venue, dtype: int64

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Let's analyse the most common venue between the two boroughs:

- Tower Hamlet: referring to the first 3 most common venues in Tower Hamlet, we can easily identify that most venues are food and beverage venues, with 84% of the venues. It is seeming that in most of the Tower Hamlet venues are for essential sustenance providers. Furthermore, due to the location of the borough, the boroughs have provided bike rental and bike share venues for the residents to commute within the area.
- Bromley: However, in Bromley, although also includes food and beverage venues, the venues also includes clothing stores, gyms, parks and Italian restaurants, as such that these are life style luxuries that are mostly common for area that have low poverty rates.

If we look at the big pictures between the two boroughs, we can somehow identity that in general, majority of the venues in Tower Hamlets are food and beverage or sustenance venues, such as cafe, pubs restaurant, grocery stores etc. However, Bromley provides more lifestyle venues such as Gyms, massage studios, health and beauty studio, golf course, theatre and garden centre just to name a few.

In summary, currently, there are clear discrepancies between venues in these two boroughs based on the poverty rate in these two boroughs.

Now that we know the discrepancies between the two boroughs, are there any similarities between two boroughs?

4.3 Examine the clusters

The next step is to cluster all the neighbourhoods in Tower Hamlet and Bromley to find out the similarities between the neighbourhood. This is done by applying K-mean clustering. Following are the clusters formed using $k = 5$.

Cluster 1:

Cluster Label	Neighbourhood	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
16	0	Hayes & Coney Hall	Park	Pub	Hardware Store	Grocery Store	Yoga Studio	Falafel Restaurant	Flower Shop	Flea Market	Fishing Store
18	0	Kelsey & Eden Park	Café	Tennis Court	Park	Yoga Studio	Fast Food Restaurant	Food Court	Food & Drink Shop	Flower Shop	Flea Market
25	0	Plaistow & Sunbridge	Chinese Restaurant	Diner	Supermarket	Other Repair Shop	Fast Food Restaurant	Food Court	Food & Drink Shop	Flower Shop	Flea Market
26	0	Poplar	Park	Steakhouse	Pizza Place	Light Rail Station	Café	Fried Chicken Joint	Intersection	Tunnel	Chinese Restaurant
31	0	Stepney Green	Park	Chinese Restaurant	Pub	Dessert Shop	Thrift / Vintage Store	Sandwich Place	Fried Chicken Joint	Farm	Supermarket
33	0	West Wickham	Park	Furniture / Home Store	Business Service	Food Truck	Food Court	Food & Drink Shop	Flower Shop	Flea Market	Fishing Store

Let's examine cluster 1. Based on the data from both boroughs, in cluster 1, only poplar is located at Tower Hamlet. Further investigation indicates that Poplar is located at the boundary of the financial hub of London, canary wharf, where most financial sector employees are resided with low poverty rate. Due to this reason, the venues are similar with the venues in cluster in Bromley.

Cluster 2:

Cluster Label	Neighbourhood	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
14	1	Darwin	Farm	History Museum	Bar	Yoga Studio	Food Stand	Food Court	Food & Drink Shop	Flower Shop	Flea Market

Cluster 2 only have one neighbourhood, which is Darwin, located in Bromley. Analysing the venues shows that the area are leisure areas where more lifestyle venues are located, such as yoga studio, flower shop, bars etc.

Cluster 4:

Cluster Label	Neighbourhood	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
11	3	Copers Cope	Athletics & Sports	Soccer Field	Indoor Play Area	Yoga Studio	Farm	Food Court	Food & Drink Shop	Flower Shop	Flea Market

Cluster 4 only have one neighbourhood, which is Copers, located in Bromley. Analysing the venues shows that the area are leisure areas where more sport lifestyle venues are located, such as athletics & sports, soccer field, indoor play area and yoga studio.

Cluster 5:

Cluster Label	Neighbourhood	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	
2	4	Biggin Hill	Airport	Airport Service	Pub	Massage Studio	Farm	Food Court	Food & Drink Shop	Flower Shop	Flea Market	Fishing Store
4	4	Bow East	Pub	Hotel	Bar	Burger Joint	Metro Station	Office	Fast Food Restaurant	Bike Rental / Bike Share	Convenience Store	Gym
5	4	Bow West	Pub	Hotel	Bar	Burger Joint	Metro Station	Office	Fast Food Restaurant	Bike Rental / Bike Share	Convenience Store	Gym
6	4	Bromley Common & Keston	Bus Station	Indian Restaurant	Pub	Bar	Fast Food Restaurant	Farm	Food Stand	Food Court	Food & Drink Shop	Flower Shop
9	4	Chelsfield & Pratts Bottom	Pub	Health & Beauty Service	Fishing Store	Yoga Studio	Falafel Restaurant	Food Court	Food & Drink Shop	Flower Shop	Flea Market	Fish Market
10	4	Chislehurst	Pub	Indian Restaurant	Pizza Place	Italian Restaurant	Gastropub	Yoga Studio	Farm	Food & Drink Shop	Flower Shop	Flea Market
15	4	Farnborough & Croftton	Pub	American Restaurant	Coffee Shop	Theater	Yoga Studio	Farm	Food Court	Food & Drink Shop	Flower Shop	Flea Market
17	4	Island Gardens	Pub	History Museum	Boat or Ferry	Park	Portuguese Restaurant	Church	Restaurant	Rugby Pitch	Chinese Restaurant	Food & Drink Shop
20	4	Limehouse	Pub	Chinese Restaurant	Café	Indian Restaurant	Italian Restaurant	Park	Bus Stop	Convenience Store	Light Rail Station	Gastropub
21	4	Mottingham & Chislehurst North	Pub	Pizza Place	Fish & Chips Shop	Grocery Store	Yoga Studio	Falafel Restaurant	Food & Drink Shop	Flower Shop	Flea Market	Fishing Store
23	4	Penge & Cator	Pub	Pizza Place	Supermarket	Convenience Store	Shopping Mall	Fast Food Restaurant	Furniture / Home Store	Garden Center	Coffee Shop	Italian Restaurant
28	4	Shortlands	Chinese Restaurant	Pub	Café	Train Station	Golf Course	Yoga Studio	Food & Drink Shop	Flower Shop	Flea Market	Fishing Store
30	4	St Katharine's and Wapping	Pub	Bus Stop	Middle Eastern Restaurant	Sandwich Place	Coffee Shop	Thrift / Vintage Store	Bar	Grocery Store	Breakfast Spot	Metro Station
32	4	Weavers	Pub	Supermarket	Ice Cream Shop	Portuguese Restaurant	Burger Joint	Brewery	Sandwich Place	Chinese Restaurant	Recreation Center	Thrift / Vintage Store

Finally, cluster 5 have even split between two boroughs. Generally, this cluster consists of the food and drinks venues in both boroughs. From this cluster, we can clearly identify that pubs are the favourite leisure venues for all residents in both areas, regardless of the poverty rate.

5. Conclusions

In conclusion, based on the poverty rate, we can clearly see there are discrepancies in terms of the venues at each borough. At Tower Hamlet, it is clearly shown that most venues provided are essential venues for day-to-day life as in Bromley, much of the venues are lifestyle venues and required certain level of incomes.