

Selecting A Location In Toronto For Starting An Indian Restaurant

1.0 Introduction

1.1 Background

A good restaurant is a good source of revenue. People go to restaurants not just to eat but also to hang-out with people, catch up on each other's lives and have fun. A restaurant with consistently high standards can attain a sense of loyalty from customers, that with time, can result in a constant revenue stream. The Indian subcontinent has so many different cuisines that it is not too difficult to identify one that is not prevalent in that area and capitalize on it. Toronto is the most populous city in Canada and in 2016, 47% of its population was international.

1.2 Problem

An Indian restaurant needs to be started in Toronto. There were six boroughs in Toronto out of which one needed to be identified for the location of the restaurant. The six boroughs were East York, Etobicoke, North York, Old City of Toronto, Scarborough and York. The analysis could then be drilled down to locate a neighborhood within the borough.

1.3 Target Audience

The target audience for this analysis is a restaurateur or an organization that is planning on starting an Indian restaurant in Toronto.

2.0 Data

The demographics of Toronto neighborhoods that was readily available in Wikipedia (https://en.wikipedia.org/wiki/Demographics_of_Toronto_neighbourhoods) was scraped for use as factors needed to identify a suitable location for an Indian restaurant. There were 174 neighborhoods in Toronto with information on each of them. Borough code, neighborhood, population and income for every neighborhood in Toronto were extracted and loaded into a dataframe. Population and income were the first 2 factors that were used in the location selection. The borough code was replaced with the borough name. Below was the resulting dataframe sorted by borough.

	Neighborhood	Borough	Population	Income
0	Old East York	East York	52220	33172
1	Crescent Town	East York	8157	23021
2	Governor's Bridge/Bennington Heights	East York	2112	129904
3	O'Connor-Parkview	East York	17740	33517
4	Thorncliffe Park	East York	17949	25340
5	Leaside	East York	13876	82670
6	Kingsview Village	Etobicoke	16254	32004
7	Clairville	Etobicoke	8506	26610
8	The Kingsway	Etobicoke	8780	110944
9	The Elms	Etobicoke	9437	28014
10	Markland Wood	Etobicoke	10240	51695
11	Sunnylea	Etobicoke	17602	51398
12	Smithfield	Etobicoke	34996	24387
13	Eringate	Etobicoke	8008	34789
14	Richview	Etobicoke	26053	34579
15	Princess Gardens	Etobicoke	9288	80607
16	The Queensway	Etobicoke	6207	38944
17	Humber Bay Shores	Etobicoke	10775	39186
18	Humber Heights	Etobicoke	4674	39738
19	Humber Valley Village	Etobicoke	14453	80618
20	Humberwood	Etobicoke	7319	29576
21	Mimico	Etobicoke	14198	47011
22	Islington – Six Points	Etobicoke	16508	43570
23	New Toronto	Etobicoke	10455	33415
24	Eatonville	Etobicoke	19131	36206
25	Long Branch	Etobicoke	9625	37288
26	Centennial	Etobicoke	12565	34867
27	Thistletown	Etobicoke	16790	28955
28	Alderwood	Etobicoke	11656	35239
29	Westmount	Etobicoke	5857	35183
30	West Deane Park	Etobicoke	4395	41582
31	Graydon Hall	North York	4714	23350
32	Pelmo Park	North York	4402	32002
33	Parkwoods	North York	26533	34811
34	Parkway Forest	North York	8498	24333
35	Henry Farm	North York	2790	56395
36	Hillcrest	North York	18327	33465
37	Hoggs Hollow	North York	3123	222560
38	Willowdale	North York	43144	39895
39	Bayview Woods – Steeles	North York	13298	41485
40	Humber Summit	North York	12766	26117
41	Bayview Village	North York	12280	46752

42	Humbermede	North York	14778	24297
43	Wilson Heights	North York	13732	37978
44	Bathurst Manor	North York	14945	34169
45	North York City Centre	North York	10427	34330
46	Banbury	North York	6641	92319
47	Newtonbrook	North York	36046	33428
48	Armour Heights	North York	4384	116651
49	Amesbury	North York	17318	27546
50	York University Heights	North York	26140	24432
51	Lawrence Heights	North York	3769	29867
52	Lawrence Manor	North York	13750	36361
53	York Mills	North York	17564	92099
54	Ledbury Park	North York	12360	83853
55	Maple Leaf	North York	20313	27611
56	Humberlea	North York	4327	30907
57	Westminster	North York	16386	27826
58	Pleasant View	North York	16615	29250
59	Don Valley Village	North York	29740	30442
60	Caribou Park	North York	4097	103703
61	Cricket Club	North York	5504	104362
62	Victoria Village	North York	17047	29657
63	Don Mills	North York	21372	47515
64	Glen Park	North York	18426	35022
65	Downsview	North York	36613	26751
66	Bridle Path	North York	1540	314107
67	Elia (Jane and Finch)	North York	48003	22691
68	Lansing	North York	10052	46631
69	Branson	North York	8017	27156
70	Flemingdon Park	North York	21287	23471
71	Roncesvalles	Old City of Toronto	15996	46820
72	Toronto Islands	Old City of Toronto	627	43344
73	Trinity–Bellwoods	Old City of Toronto	8687	31106
74	The Junction	Old City of Toronto	11391	34906
75	Regal Heights	Old City of Toronto	2719	36652
76	Wychwood	Old City of Toronto	4182	53613
77	The Danforth	Old City of Toronto	7849	44979
78	Upper Beaches	Old City of Toronto	19830	44346
79	Moore Park	Old City of Toronto	4474	154825
80	The Beaches	Old City of Toronto	20416	67536
81	The Annex	Old City of Toronto	15602	63636
82	Swansea	Old City of Toronto	11133	58681
83	Niagara	Old City of Toronto	6524	44611
84	Playter Estates	Old City of Toronto	3968	44557

85	Summerhill	Old City of Toronto	5100	88937
86	Regent Park/Trefann Court	Old City of Toronto	10387	19521
87	Wallace Emerson	Old City of Toronto	10338	25029
88	St. James Town	Old City of Toronto	14666	22341
89	South Hill	Old City of Toronto	6218	120453
90	Riverdale	Old City of Toronto	31007	40139
91	Seaton Village	Old City of Toronto	5259	41506
92	Rosedale	Old City of Toronto	7672	213941
93	Lytton Park	Old City of Toronto	6494	127356
94	Parkdale	Old City of Toronto	28367	26314
95	Port Lands	Old City of Toronto	571	36243
96	Yorkville	Old City of Toronto	6045	105239
97	Garden District	Old City of Toronto	8240	37614
98	Cabbagetown	Old City of Toronto	11120	50398
99	Fort York/Liberty Village	Old City of Toronto	3821	46086
100	Forest Hill	Old City of Toronto	24056	101631
101	Financial District	Old City of Toronto	548	63952
102	Fashion District	Old City of Toronto	4642	63282
103	Carleton Village	Old City of Toronto	6544	23301
104	Casa Loma	Old City of Toronto	3597	82203
105	Chaplin Estates	Old City of Toronto	4906	81288
106	East Danforth	Old City of Toronto	21440	33847
107	Christie Pits	Old City of Toronto	5124	30556
108	Church and Wellesley	Old City of Toronto	13397	37653
109	Little Portugal	Old City of Toronto	5013	29224
110	Earls court	Old City of Toronto	17240	26672
111	Corktown	Old City of Toronto	4484	54681
112	Dufferin Grove	Old City of Toronto	9875	27961
113	Dovercourt Park	Old City of Toronto	8497	28311
114	Davenport	Old City of Toronto	8781	28335
115	Davisville	Old City of Toronto	23727	55735
116	Distillery District/West Don Lands	Old City of Toronto	6378	40617
117	Discovery District	Old City of Toronto	7262	41998
118	Grange Park	Old City of Toronto	9007	35277
119	Deer Park	Old City of Toronto	15165	80704
120	Harbord Village	Old City of Toronto	5906	45792
121	Harbourfront / CityPlace	Old City of Toronto	14368	69232
122	Bracondale Hill	Old City of Toronto	5343	41605
123	High Park North	Old City of Toronto	22746	46437
124	Bloor West Village	Old City of Toronto	5175	55578
125	Little Italy	Old City of Toronto	7917	31231
126	Leslieville	Old City of Toronto	23567	30886
127	Alexandra Park	Old City of Toronto	4355	19687

128	Allenby	Old City of Toronto	2513	245592
129	Junction Triangle	Old City of Toronto	6666	28067
130	Kensington Market	Old City of Toronto	3740	23335
131	Lawrence Park	Old City of Toronto	6653	214110
132	Brockton	Old City of Toronto	9039	27260
133	Bay Street Corridor	Old City of Toronto	4787	40598
134	Bedford Park	Old City of Toronto	13749	80827
135	Woburn	Scarborough	48507	26190
136	Clairlea	Scarborough	11104	33392
137	Cliffcrest	Scarborough	14531	38182
138	Wexford	Scarborough	17844	28556
139	Bendale	Scarborough	28945	29723
140	Birch Cliff	Scarborough	12266	48965
141	West Rouge	Scarborough	9300	44605
142	West Hill	Scarborough	25632	27936
143	Cliffside	Scarborough	9386	32701
144	Malvern	Scarborough	44324	25677
145	Scarborough Village	Scarborough	12796	24413
146	Steeles	Scarborough	24696	26660
147	Maryvale	Scarborough	8800	30944
148	Milliken	Scarborough	26272	25243
149	L'Amoreaux	Scarborough	45862	26375
150	Morningside	Scarborough	11472	27139
151	Ionview	Scarborough	13025	25078
152	Oakridge	Scarborough	13368	21155
153	Highland Creek	Scarborough	12853	33640
154	Tam O'Shanter – Sullivan	Scarborough	27235	27717
155	Guildwood	Scarborough	12820	40806
156	Port Union	Scarborough	12450	48117
157	Agincourt	Scarborough	44577	25750
158	Eglinton East	Scarborough	22387	25307
159	Rouge	Scarborough	22724	29230
160	Rouge Hill	Scarborough	11167	32858
161	Scarborough Junction	Scarborough	25780	25405
162	Scarborough City Centre	Scarborough	16403	26756
163	Dorset Park	Scarborough	14189	26525
164	Rockcliffe–Smythe	York	4681	28723
165	Old Mill/Baby Point	York	4010	110372
166	Humewood–Cedarvale	York	27515	40404
167	Runnymede	York	4382	42635
168	Weston	York	16476	27446
169	Lambton	York	9654	30920
170	Mount Dennis	York	21284	23910

171	Silverthorn	York	17757	26291
172	Fairbank	York	34121	28403
173	Harwood	York	3375	22136

Coordinates for all the boroughs in Toronto were compiled for use in their visualization on a map. Below was the dataframe that contained the coordinates.

	Borough	Latitude	Longitude
0	East York	43.6912	-79.3417
1	Etobicoke	43.6205	-79.5132
2	North York	43.7615	-79.4111
3	Old City of Toronto	43.6516	-79.3705
4	Scarborough	43.7764	-79.2318
5	York	43.6957	-79.4504

Foursquare API was used to extract the Indian restaurants in all the Toronto boroughs. One of the results was found to be incorrect and removed from the dataframe. Below was the resulting dataframe that contained the restaurants in all the boroughs.

	Restaurant_Name	Latitude	Longitude	Borough
0	Maharani Indian Cuisine/The Queens Arms	43.622106	-79.521814	Etobicoke
1	Indian Crown	43.760076	-79.412153	North York
2	Butterchick Indian kitchen	43.7626	-79.410304	North York
3	Markham Danforth West Indian Food Market	43.76739883	-79.2281723	Scarborough
4	Spice Indian Bistro	43.653948	-79.369143	Old City of Toronto
5	Indian Bazaar	43.6556533	-79.36415293	Old City of Toronto
6	Bindia Indian Bistro	43.64855917	-79.37181601	Old City of Toronto
7	Chadani Indian Cuisine	43.649153	-79.374814	Old City of Toronto
8	Indian Biryani House	43.65005028	-79.38066244	Old City of Toronto
9	Indian Flavour	43.65564911	-79.38411938	Old City of Toronto
10	Touch - Indian Cuisine	43.649869	-79.37821833	Old City of Toronto
11	Tamarind: The Indian Kitchen	43.646859	-79.378707	Old City of Toronto
12	Ram's Indian kitchen	43.64802584	-79.37981889	Old City of Toronto
13	Joe's Indian Restaurant	43.65814977	-79.38156264	Old City of Toronto
14	Mami's Indian Cuisine	43.65698562	-79.38584033	Old City of Toronto
15	House of Indian Roti	43.694887	-79.449981	York
16	Roti King West Indian Restaurant	43.69659147	-79.44578414	York

The restaurants got from the Foursquare API query were counted for every borough. The number of restaurants was the third and final factor that was used for determining the location of the new restaurant.

3.0 Methodology

The model assumed 3 factors to influence the location of the restaurant. They were population, income and number of currently existing Indian restaurants in each borough.

The Wikipedia page containing the demographics of Toronto neighborhoods was scraped. There were 174 neighborhoods. Neighborhood, borough code, population and income were extracted and loaded into a dataframe. Population and income were considered positive factors for the analysis. The more money a person has, the more he/she is inclined to go to restaurants frequently. Higher the population, higher the probability of a person dining at a restaurant. Hence, population and income are positively correlated to restaurant demand that in turn is positively correlated to starting a restaurant in that area. The dataframe got from scraping the web page was grouped and sorted by Borough. Coordinates of the 6 boroughs were compiled into a dataframe and merged with this dataframe. Below was the resulting dataframe.

	Borough	Population	Income	Latitude	Longitude
0	East York	112054	54604	43.6912	-79.3417
1	Etobicoke	313772	43056	43.6205	-79.5132
2	North York	621068	54389	43.7615	-79.4111
3	Old City of Toronto	624910	58409	43.6516	-79.3705
4	Scarborough	600715	30518	43.7764	-79.2318
5	York	143255	38124	43.6957	-79.4504

The number of currently existing restaurants was considered to be a negative factor in the model. This was because the demand for a new restaurant could decrease with a large number of restaurants already in the borough. There could be a lower inclination to go to a new restaurant if there were others already serving the same cuisine in the borough. All factors were considered to have an equal weight in the model.

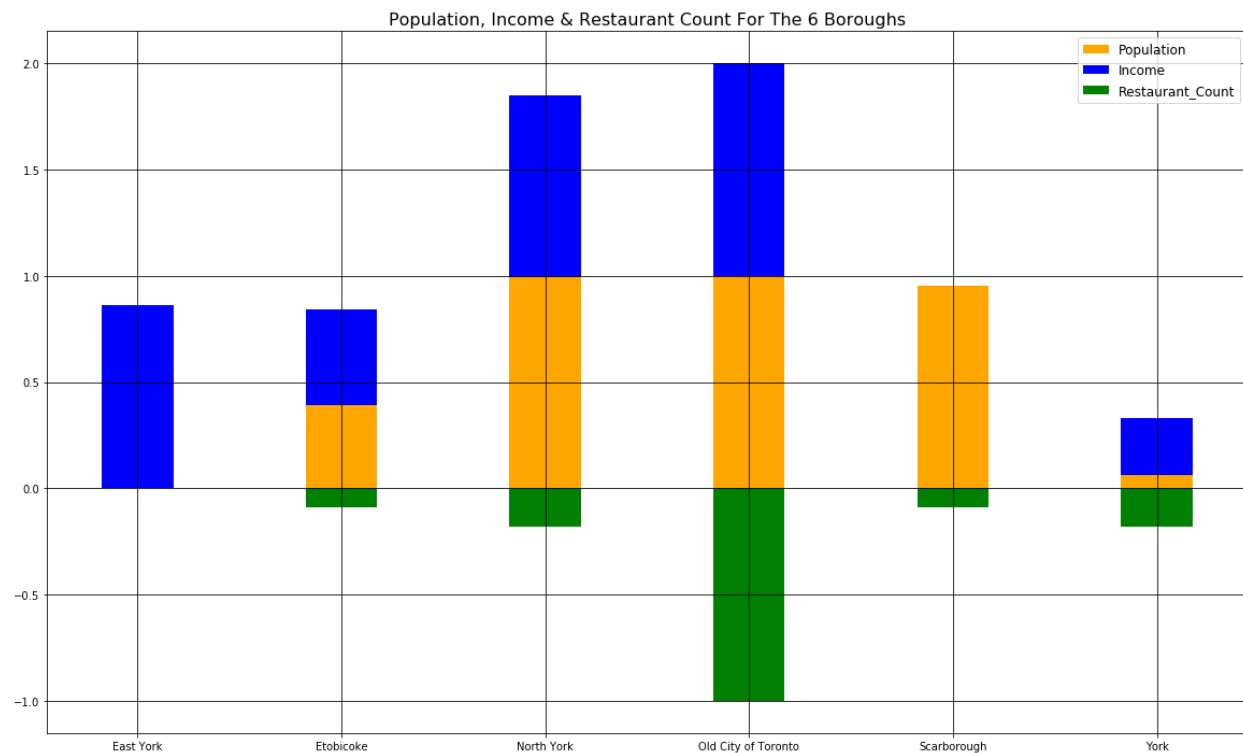
Foursquare API was used to query for Indian restaurants within a distance of 1000 meters from the center of each of the 6 boroughs. The query results had an incorrect row that was removed. The resulting dataframe was presented in the 'Data' section. The number of restaurants got from the query was counted for each borough and stored in another dataframe. Boroughs with no Indian restaurants were added to this dataframe with a restaurant count of zero, since there were 2 other factors that could influence the restaurant location selection. Below was the dataframe with the restaurant counts.

	Borough	Restaurant_Count
0	East York	0
1	Etobicoke	1
2	North York	2
3	Old City of Toronto	11
4	Scarborough	1
5	York	2

A heat map was created to visualize the centers of the boroughs. Another heat map was created to visualize the locations of all the restaurants. K- means clustering with 5 clusters was run on the coordinates of all the restaurants, with number of clusters representing the number of boroughs that have

Indian restaurants. This was done for visualizing how close the restaurant clusters stay within the boroughs. If the clusters were around the locations of the borough centers, then the restaurants don't exist along the boundaries of the boroughs.

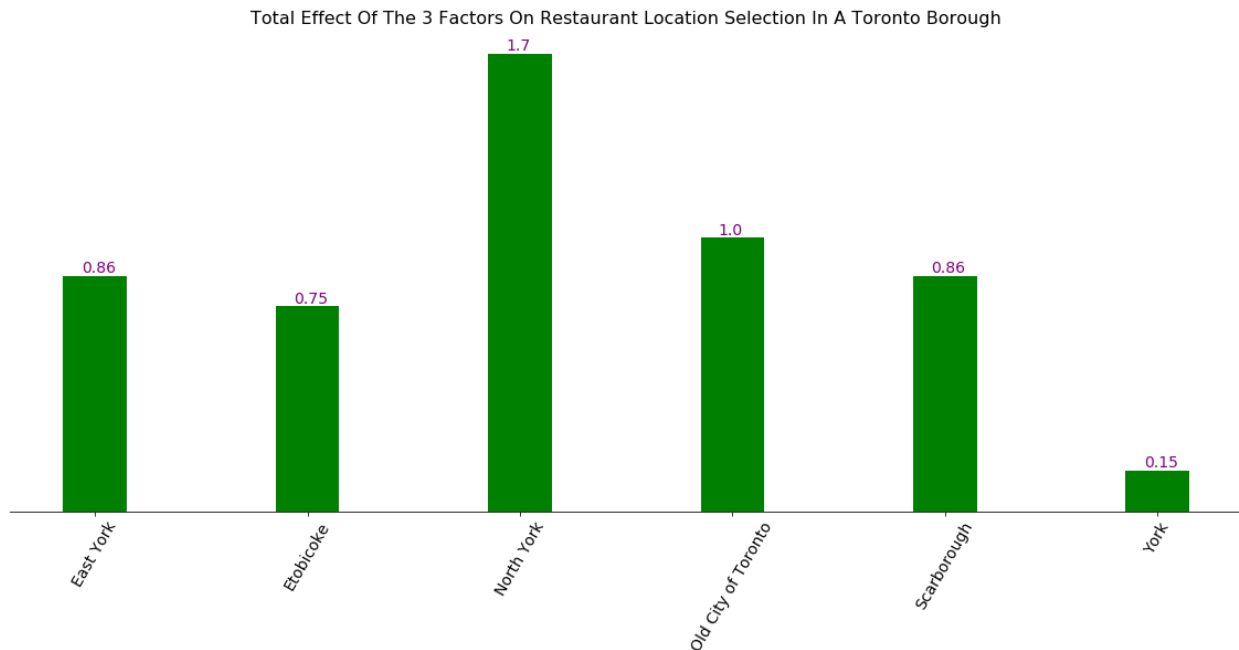
Since population, income and restaurant count had ranges of values that varied by orders of magnitude, each of these factors was scaled to have values between 0 and 1. A bar graph was created to display the 3 scaled factors of population, income and number of restaurants for each borough, with number of restaurants used as a negative factor. Below was the graph.



A factor of zero for any of the boroughs in the above bar plot wouldn't mean the unscaled factor was zero but just that the borough has a relatively low value of that factor compared to the other boroughs, since all factors were scaled between 0 and 1. Assuming the same weight across the 3 scaled factors, and adopting a linear model, the total factor was the algebraic sum of the 3 factors. This total factor was the single value used to determine an ideal borough for a new Indian restaurant. This factor was not scaled implying this value need not be less than one. Below was the dataframe that contained the total factor for each borough.

Borough	Total_Factor
East York	0.86
Etobicoke	0.75
North York	1.67
Old City of Toronto	1
Scarborough	0.86
York	0.15

The total factor was plotted against every borough in a bar plot and the borough with the highest total factor would be the ideal borough for the restaurant location. Below was the graph.



As shown in the graph above, North York has the highest total factor and was deemed the best borough to host a new Indian restaurant. Since North York had only 2 Indian restaurants, as shown in the dataframe below, K-means clustering was not done but their locations were visualized on a map.

	Restaurant_Name	Latitude	Longitude	Borough
0	Indian Crown	43.760076	-79.41215	North York
1	Butterchick Indian kitchen	43.7626	-79.4103	North York

The map showed that the 2 restaurants were found to be close to each other, and were determined to be in the neighborhoods of Lansing and Willowdale. Since these 2 neighborhoods had one restaurant each, using the scaling standard as before, these neighborhoods were given a value of 1 for 'Restaurant_Count' and the rest were given a value of zero. Below was the resulting dataframe.

	Neighborhood	Population(Scaled)	Income (Scaled)	Restaurant_Count
0	Graydon Hall	0.068312421	0.002261372	0
1	Pelmo Park	0.0615974	0.031950888	0
2	Parkwoods	0.537911887	0.041590029	0
3	Parkway Forest	0.149753567	0.005634557	0
4	Henry Farm	0.026903127	0.115655969	0
5	Hillcrest	0.361298237	0.036971203	0
6	Hoggs Hollow	0.03407012	0.685854586	0
7	Willowdale	0.895422164	0.05903588	1

8	Bayview Woods – Steeles	0.253061576	0.064491998	0
9	Humber Summit	0.241611605	0.011756389	0
10	Bayview Village	0.231151669	0.082565817	0
11	Humbermede	0.284914879	0.005511022	0
12	Wilson Heights	0.262402342	0.052457655	0
13	Bathurst Manor	0.288509136	0.039386993	0
14	North York City Centre	0.191270473	0.039939468	0
15	Banbury	0.109786282	0.238929915	0
16	Newtonbrook	0.742655446	0.036844236	0
17	Armour Heights	0.061209995	0.322425673	0
18	Amesbury	0.339582033	0.016660032	0
19	York University Heights	0.529453544	0.005974277	0
20	Lawrence Heights	0.047973656	0.024624592	0
21	Lawrence Manor	0.262789747	0.046908886	0
22	York Mills	0.344876568	0.23817498	0
23	Ledbury Park	0.232873469	0.209878661	0
24	Maple Leaf	0.404041926	0.016883081	0
25	Humberlea	0.059983212	0.028193373	0
26	Westminster	0.319523061	0.017620858	0
27	Pleasant View	0.324451714	0.022507343	0
28	Don Valley Village	0.60693455	0.026597716	0
29	Caribou Park	0.055033037	0.277994345	0
30	Cricket Club	0.085315197	0.280255717	0
31	Victoria Village	0.333749435	0.023903972	0
32	Don Mills	0.426834255	0.085184067	0
33	Glen Park	0.363428965	0.04231408	0
34	Downsview	0.754858705	0.013931974	0
35	Bridle Path	0	1	0
36	Elia (Jane and Finch)	1	0	0
37	Lansing	0.183199535	0.082150603	1
38	Branson	0.139401244	0.015321739	0
39	Flemingdon Park	0.425004843	0.002676586	0

Since the objective of this study was to determine the best location, or for comparison, only the top few locations, plotting the 40 neighborhoods was deemed unnecessary and only the top 10 ordered by 'Total_Factor' were plotted. Below was the graph.



4.0 Results

K-means clustering grouped the restaurants into clusters that were comparable to the actual borough centers, implying the restaurants were not along the boundaries of the boroughs but around the centers. **North York** was the best borough to host the restaurant. The best neighborhoods within North York to host the new Indian restaurant were found to be **Bridle Path** and **Elia (Jane and Finch)**.

5.0 Discussion

Five clusters were used for the K-means clustering since only 5 boroughs had Indian restaurants. The process was able to cluster the restaurants into groups that were similar to the actual boroughs. This meant that the restaurants were not along the boundaries of the boroughs but around the centers.

According to this model, population and income were positive factors and restaurant count was a negative factor. The algebraic sum of the scaled 3 factors yielded the total factor. North York was the best borough to host the restaurant since it had the highest total factor. Since North York had only 2 Indian restaurants, K-means clustering was deemed unnecessary.

After the analysis was drilled down, it was seen that the only 2 Indian restaurants present in North York were close to each other. After applying the 3 factors to the neighborhoods within North York, the top 2 neighborhoods that had the same score of 1 were Bridle Path and Elia (Jane and Finch). Hence, these 2 neighborhoods were deemed to be the best boroughs to host a new Indian restaurant.

The results can be influenced by factors not considered in the model. Other factors could be added to this model like restaurant popularity, diversity index and land value. If there were many unpopular restaurants in the borough, it's possible that a new restaurant in that borough may still be a good idea since it may be

able to beat out the competition and consume a majority of the demand. Diversity index, if available, could positively influence the location selection since an international population could be more inclined to going to international restaurants. A higher land value would increase the investment cost but that could be offset by an increase in demand for the new restaurant.

Land value could push Old City of Toronto, that was the second- best borough location, to be the best borough for the restaurant location, only if its land value is much lower than that of North York. If this is the case, since there were many Indian restaurants in Old City of Toronto, as shown in the dataframe below, K-means clustering would need to be done and any neighborhood in this borough that is outside any of the clusters would be a good location for the restaurant. Staying outside of the clusters would mean that the new restaurant would not compete with existing restaurants.

	Restaurant_Name	Latitude	Longitude	Borough
0	Spice Indian Bistro	43.653948	-79.369143	Old City of Toronto
1	Bindia Indian Bistro	43.64855917	-79.37181601	Old City of Toronto
2	Indian Bazaar	43.6556533	-79.36415293	Old City of Toronto
3	Chadani Indian Cuisine	43.649153	-79.374814	Old City of Toronto
4	Indian Biryani House	43.65005028	-79.38066244	Old City of Toronto
5	Touch - Indian Cuisine	43.649869	-79.37821833	Old City of Toronto
6	Indian Flavour	43.65564911	-79.38411938	Old City of Toronto
7	Tamarind: The Indian Kitchen	43.646859	-79.378707	Old City of Toronto
8	Ram's Indian kitchen	43.64802584	-79.37981889	Old City of Toronto
9	Joe's Indian Restaurant	43.65814977	-79.38156264	Old City of Toronto
10	Mami's Indian Cuisine	43.65698562	-79.38584033	Old City of Toronto

6.0 Conclusion

Using the factors of population, income and restaurant count with the last factor being considered a negative influence, and allocating equal weight to the 3 factors, the best borough in Toronto to host a new Indian restaurant was **North York** and the best neighborhoods to host the restaurant in North York would be **Bridle Path** and **Elia (Jane and Finch)**. Other factors like diversity index, restaurant popularity and land value can influence the model results. If including these factors moved the best borough to one that has several Indian restaurants, K-means clustering would need to be done within the borough and any neighborhood outside any of the clusters would be the best neighborhood to start the restaurant.