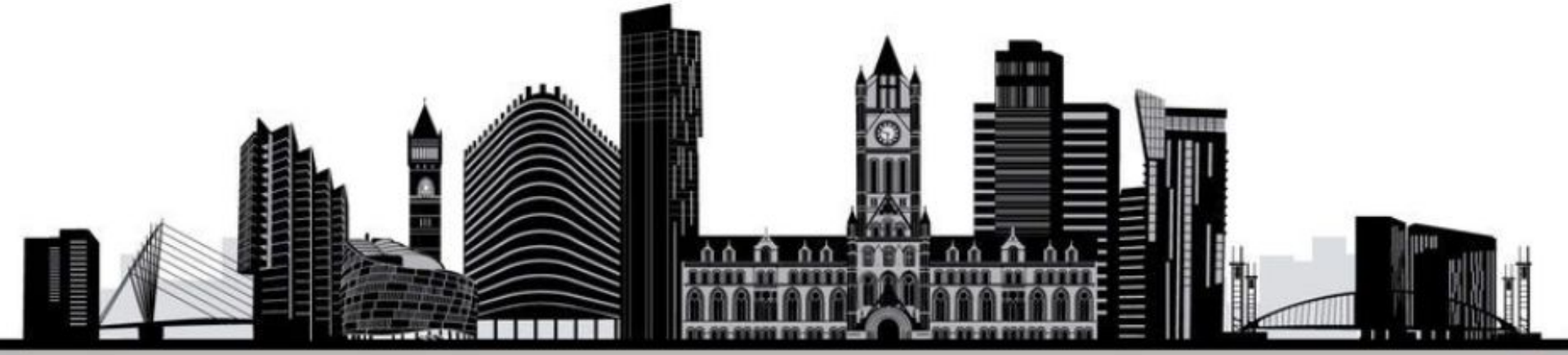
Moving to Greater Manchester



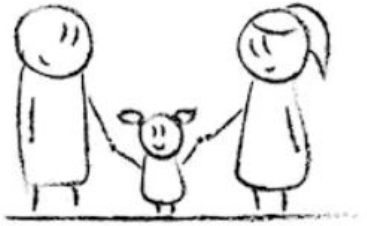
Ricky To | July 4th 2020

Image of Manchester Skyline courtesy of **vexels.com**

Introduction

- As part of life, people move around for many reasons, for career prospects, to be closer to better schools, for culture or to be closer to parents.
- The definition of a good neighbourhood can be opinionated and possibly be subjective as everyone has their own preferences.
- Data and Facts are the key components in determining what a Good Neighbourhood is and these are closely related to a person’s values.
- Having a non-biased approach to determining a good neighbourhood is also important in the selection process.

Problem Statement



- This project will focus on Mr Willis, Mr Willis is married to his Wife Mrs Willis for 9 years and they have one Daughter who is currently in Primary School.
- They are currently overseas residing in Singapore as expatriates and have been doing so for the past 5 years, however they wish to return to the United Kingdom but at the same time wish to move to one of the major UK cities. One of the major cities that they are targeting is Manchester
- They want to move to a location that is quiet, within budget and has restaurants and schools nearby.

Data

01

This project will be using the following datasets to help solve Mr Willis' problem.

The main criterion for the Willis Family in selecting a suitable borough will be based on:

- Crime and Safety
- Number of Restaurants
- Schools
- House within Budget

Key Libraries Utilised

Python packages and Dependencies:

• Pandas - Library for Data Analysis

• NumPy – Library to handle data in a vectorized manner

• Geopy – To retrieve Location Data

• Requests – Library to handle http requests

• Matplotlib – Python Plotting Module

• Sklearn – Python machine learning Library

• Folium – Map rendering Library

• Beautifulsoup - Webscraping tool

Data
General

Information on the boroughs of Greater Manchester and their locations are extracted from Wikipedia.

- List of Manchester Boroughs - https://en.wikipedia.org/wiki/List_of_places_in_Greater_Manchester ,and Manchester

- PostCodes - https://simple.wikipedia.org/wiki/M_postcode_area#:~:text=The%20M%20postcode%20area%2C%20also,Manchester%20boroughs%20except%20for%20Stockport.

Data

>Crime Statistics
>Property Prices
>Restaurant
>Schools

- Recorded crime rates in Greater Manchester are from the UK police database - https://data.police.uk/
- Property Prices Paid in Greater Manchester are from - https://mappinggm.org.uk/metadata/
- Venue locations and information are extracted by using the Foursquare API
- The information source for schools are from the gov.uk website: https://www.compare-school-performance.service.gov.uk/download-data?currentstep=year&regiontype=beforeStep&la=&downloadYear=2018-2019

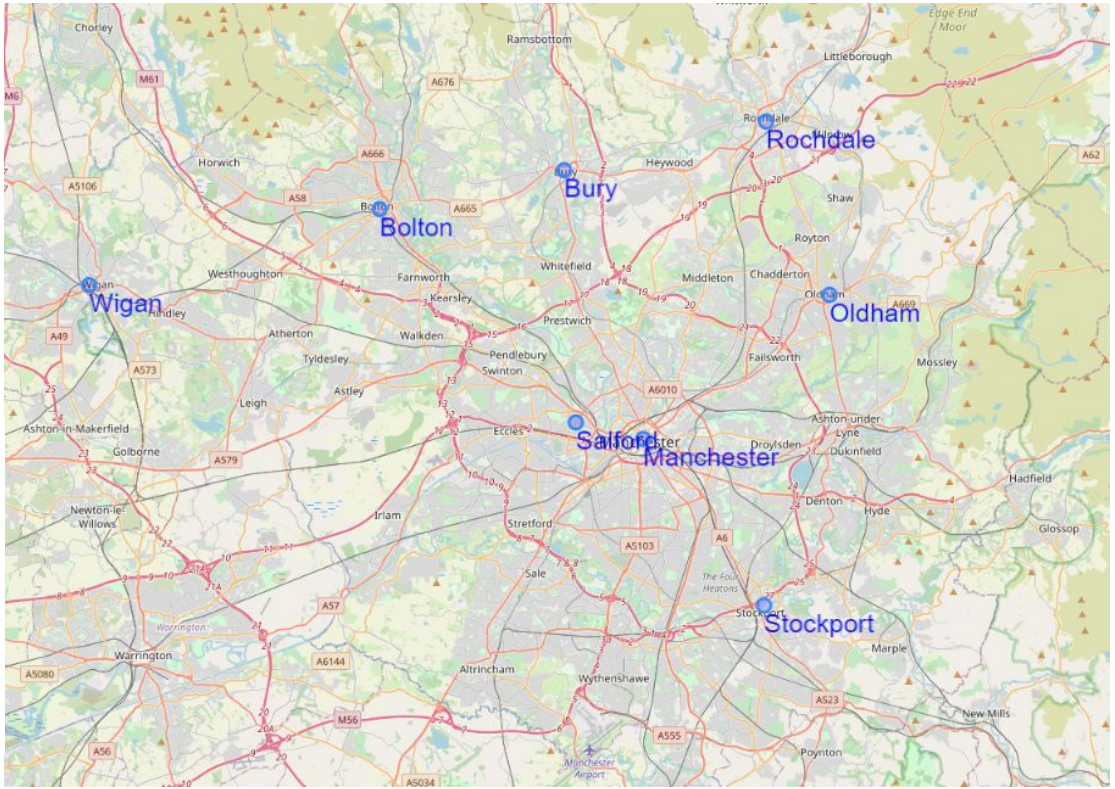
Any data fields that were not useful and not relevant to the key criteria of the project were dropped. For example some data sources included information for all of UK's cities.

The remaining features that were used was 20.

Methodology

02

The coordinates of each borough from List of Greater Manchester Boroughs were obtained, and using this we could visualize each borough on the map to know where they are.



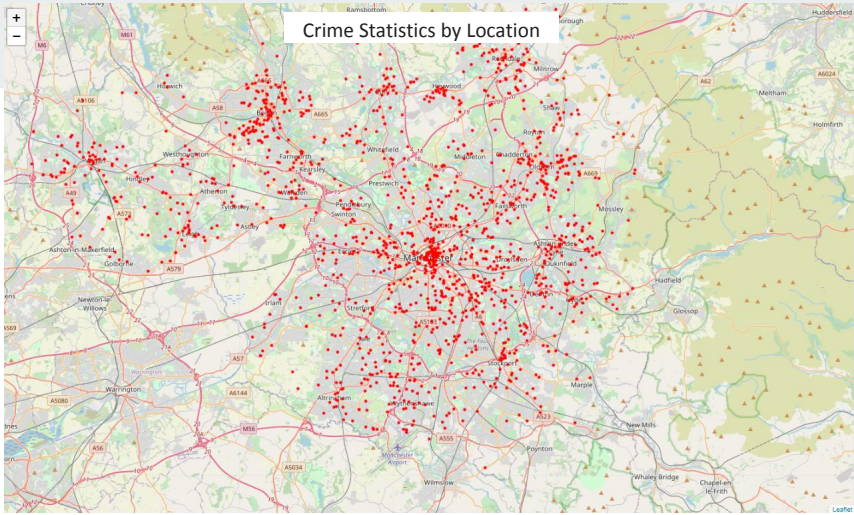
Methodology
Crime & Safety

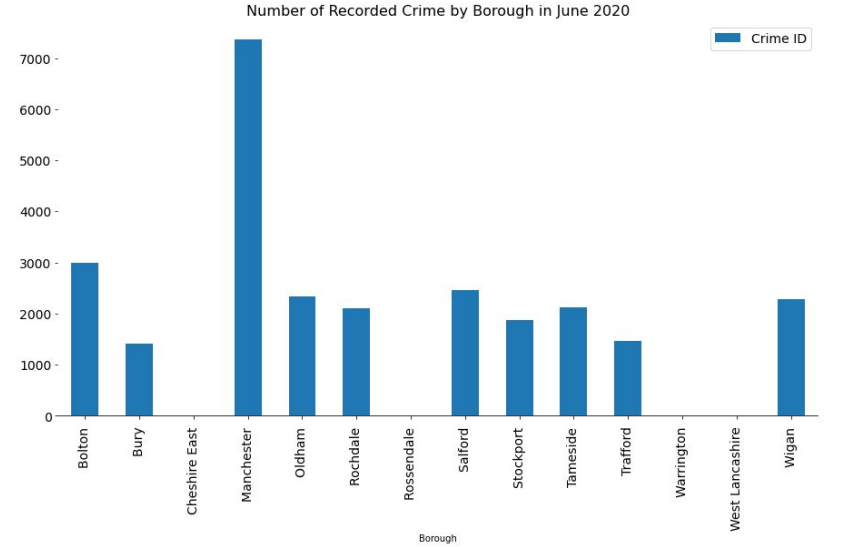
32,058 rows of Crime Data came from the original source were grouped by Boroughs using Pandas as shown on the right.

	Borough	Number
0	Bolton	3609
1	Bury	1822
2	Cheshire East	6
3	Manchester	8828
4	Oldham	2842
5	Rochdale	2510
6	Rossendale	1
7	Salford	2771
8	Stockport	2424
9	Tameside	2548
10	Trafford	1764
11	Warrington	5
12	West Lancashire	3
13	Wigan	2924

Methodology
Crime & Safety

From the dataframe we were able to then generate visualisations to indicate the crime count by Borough and their specific locations.





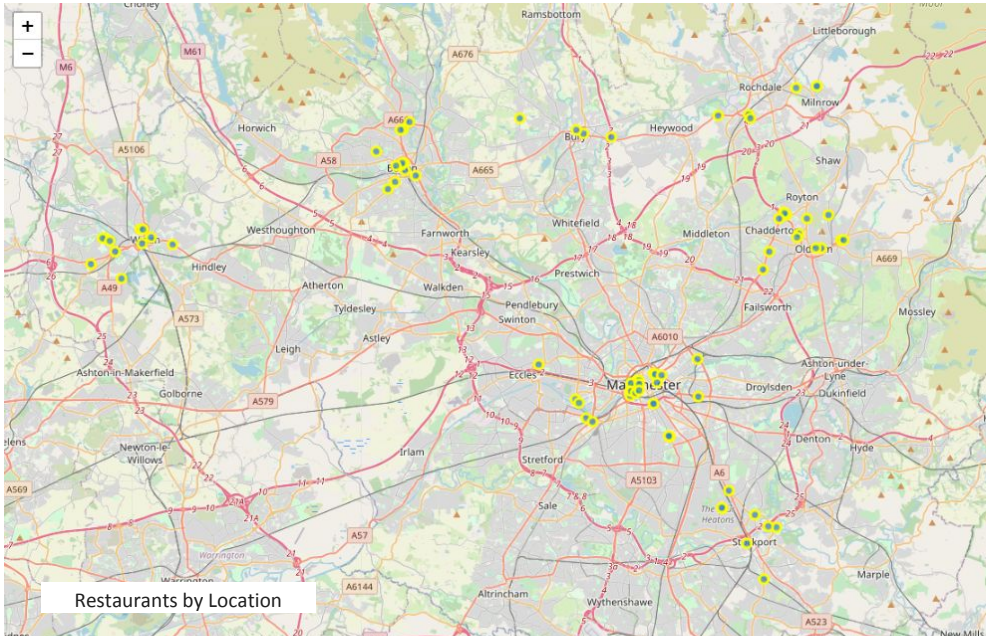
Methodology
Number of Restaurants

The Restaurant information was derived from the List of Venues extracted by using Foursquare.

The restaurant information could then be plotted on the map.

Venue Datafrane from Foursquare

	BoroughName	Borough Latitude	Borough Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Manchester	53.480759	-2.242631	Café Beermoth	53.481359	-2.241902	Bar
1	Manchester	53.480759	-2.242631	Royal Exchange Theatre	53.482555	-2.244770	Theater
2	Manchester	53.480759	-2.242631	Manchester Art Gallery	53.478882	-2.241817	Art Gallery
3	Manchester	53.480759	-2.242631	Northern Soul • Grilled Cheese	53.483074	-2.238303	Sandwich Place
4	Manchester	53.480759	-2.242631	Hotel Gotham	53.480767	-2.242235	Hotel

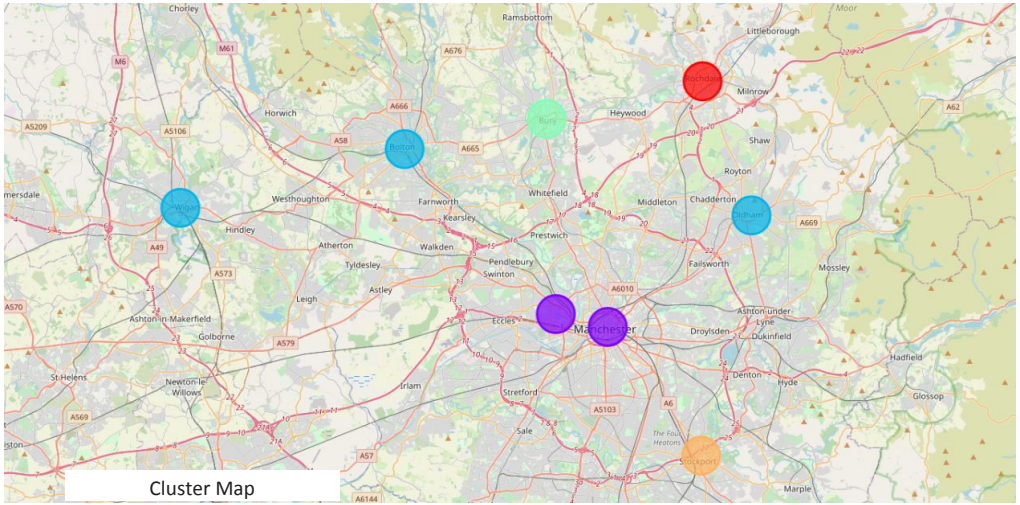


Methodology
Number of Restaurants

	BoroughName	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	Bolton	Pub	Clothing Store	Fast Food Restaurant	Supermarket	Pizza Place	Coffee Shop	Grocery Store	Furniture / Home Store	Sandwich Place	Gym / Fitness Center
1	Bury	Pub	Discount Store	Coffee Shop	Clothing Store	Hotel	Department Store	Grocery Store	Supermarket	Fast Food Restaurant	Pharmacy
2	Manchester	Coffee Shop	Pub	Indian Restaurant	Beer Bar	Hotel	Café	Park	Museum	Bar	Dessert Shop
3	Oldham	Supermarket	Fast Food Restaurant	Indian Restaurant	Grocery Store	Clothing Store	Pub	Discount Store	Italian Restaurant	Pizza Place	Sandwich Place
4	Rochdale	Supermarket	Pub	Grocery Store	Gastropub	Pizza Place	Sandwich Place	Clothing Store	Discount Store	Gym / Fitness Center	Coffee Shop

By using K-Means Clustering we able to Categorise the Boroughs into 5 different types of Clusters.

- Pub and Grocery Stores (Green) - Cluster 0
- Bars, Restaurants, Hotels (Red) - Cluster 1
- Coffee shops, Restaurants, Grocery stores (Purple) - Cluster 2
- Pubs, Small Stores and Shops (Orange) - Cluster 3
- Grocery Stores, Restaurants and Shops (Blue) - Cluster 4



Cluster Map

Methodology
Property Prices

- From the Prices paid data source we filter out only the Boroughs that are related to Greater Manchester and append the information to their geo locations.
- The Median and Mean Property Prices Paid are then generated.

Property Prices Paid

	Price_Paid	District
0	266000	YORK
1	315000	SELBY
2	136000	SELBY
3	155000	HAMBLETON
4	261000	HAMBLETON
...	...	...
112455	225000	SOUTH GLOUCESTERSHIRE
112456	278000	SOUTH GLOUCESTERSHIRE
112457	312000	NORTH SOMERSET
112458	327000	SOUTH GLOUCESTERSHIRE
112459	140000	SOUTH GLOUCESTERSHIRE

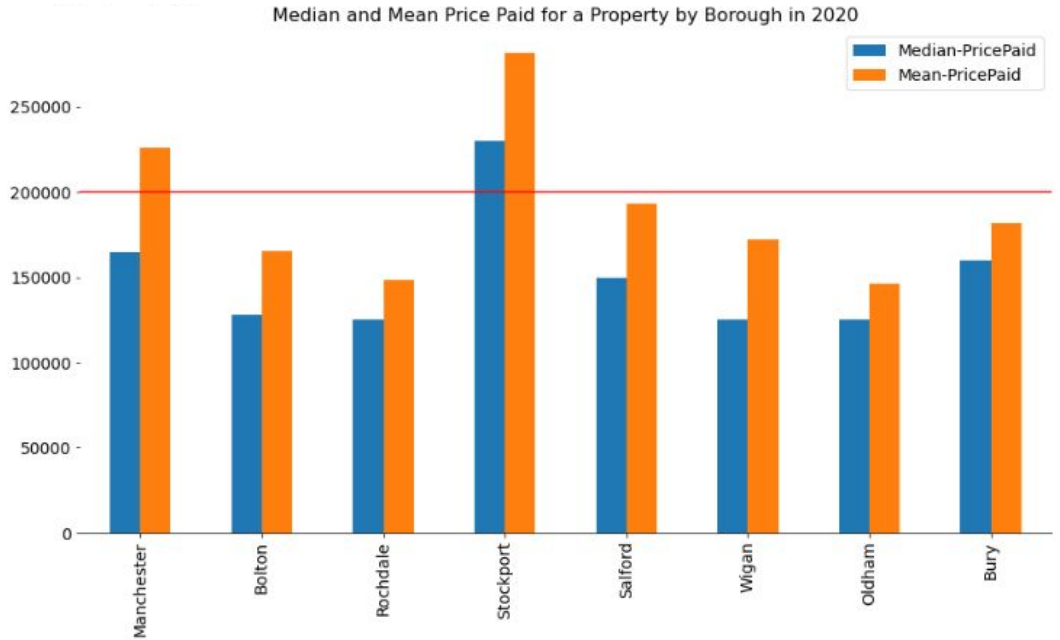
112460 rows × 2 columns

Property Prices Median and Mean

	Borough	Population	Latitude	Longitude	Median-PricePaid	Mean-PricePaid
0	Manchester	510,746	53.480759	-2.242631	165000.0	226208.930079
1	Bolton	194,189	53.576866	-2.428219	128000.0	165499.729730
2	Rochdale	107,926	53.613600	-2.156100	125000.0	148055.183024
3	Stockport	105,878	53.410600	-2.157500	230050.0	282065.896332
4	Salford	103,886	53.487500	-2.290100	150010.0	193393.930185
5	Wigan	103,608	53.545100	-2.632500	125000.0	172105.265248
6	Oldham	96,555	53.540932	-2.111366	125000.0	146423.039216
7	Bury	77,211	53.593460	-2.298540	160000.0	181432.515850

Methodology
Property Prices

- From the Mean and Median Prices generated we plot the information in a Bar Chart and apply the Budget threshold of 200,000GBP to the graph.



Methodology
Schools

	SCHNAME	TOWN	PCON_NAME	READ_AVERAGE	MAT_AVERAGE
0	Bringhurst Primary School	Market Harborough	Rutland and Melton	110	110
1	Buckminster Primary School	Grantham	Rutland and Melton	106	103
2	Great Dalby School	Melton Mowbray	Rutland and Melton	108	108
3	Burton-on-the-Wolds Primary School	Loughborough	Loughborough	109	110
4	Belvoirdale Community Primary School	Coalville	North West Leicestershire	99	100
...	...	...	...	...	...
16503	Surrey			106	106
16504	Warwickshire			105	105
16505	West Sussex			105	104
16506				104	105
16507				104	105

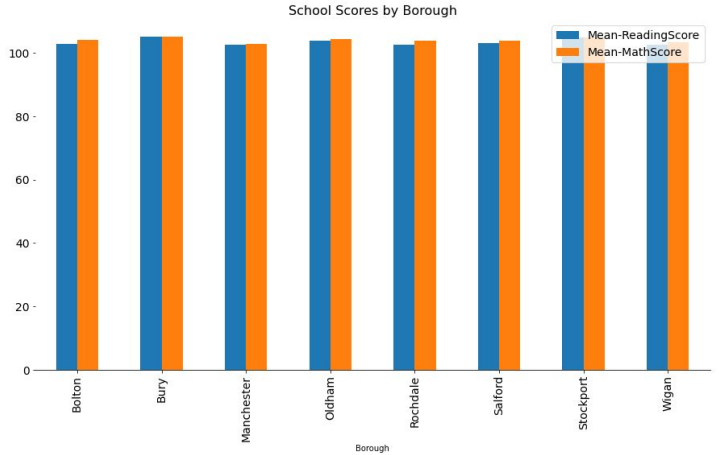
16508 rows × 5 columns

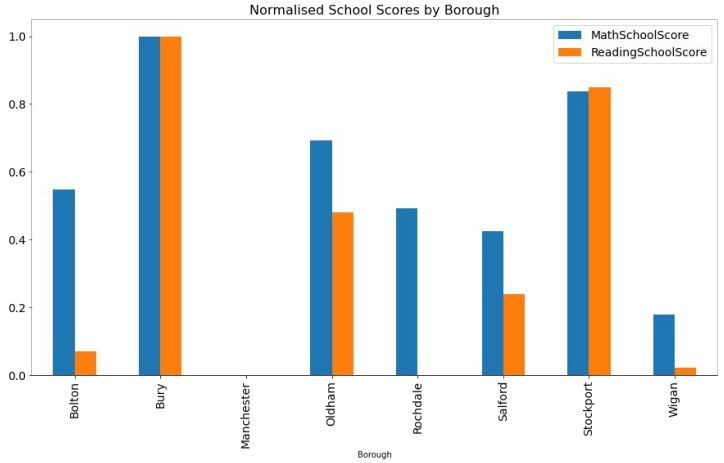
- From the School data source we filter out only the Boroughs that are related to Greater Manchester.
- The filtered list is then used to Generate the Mean School Score for Reading and Mathematics for each Borough.

Borough	Mean-ReadingScore	Mean-MathScore
Bolton	102.720000	104.090000
Bury	105.200000	105.175000
Manchester	102.535836	102.774744
Oldham	103.812500	104.437500
Rochdale	102.534884	103.953488
Salford	103.172414	103.793103
Stockport	104.800000	104.785714
Wigan	102.594595	103.202703

Methodology
Schools

- We plot out the actual data from the School Scores by borough in a barchart
- For further insight we also plot out the normalised data to visualise the information more clearly.





Results

1 **Crime Data (Least Crime ascending)**

	Borough	Number	NormalizedScore
6	Rossendale	1	0.000000
12	West Lancashire	3	0.000227
11	Warrington	5	0.000453
2	Cheshire East	6	0.000566
10	Trafford	1764	0.199728
1	Bury	1822	0.206299
8	Stockport	2424	0.274499
5	Rochdale	2510	0.284242
9	Tameside	2548	0.288547
7	Salford	2771	0.313810
4	Oldham	2842	0.321853
13	Wigan	2924	0.331143
0	Bolton	3609	0.408746
3	Manchester	8828	1.000000

2 **Property, School and Restaurant Cluster Data**

	Borough	Median-PricePaid	Mean-ReadingScore	Mean-MathScore	Cluster Labels	ReadingSchoolScore	MathSchoolScore
0	Bolton	128000.0	102.720000	104.090000	2	0.069459	0.547965
1	Bury	160000.0	105.200000	105.175000	3	1.000000	1.000000
2	Manchester	165000.0	102.535836	102.774744	1	0.000357	0.000000
3	Oldham	125000.0	103.812500	104.437500	2	0.479385	0.692741
4	Rochdale	125000.0	102.534884	103.953488	0	0.000000	0.491091
5	Salford	150010.0	103.172414	103.793103	1	0.239213	0.424271
6	Stockport	230050.0	104.800000	104.785714	4	0.849913	0.837815
7	Wigan	125000.0	102.594595	103.202703	2	0.022405	0.178297

- During the analysis we worked with 7 Boroughs in Greater Manchester with 5 Clusters generated by K-Means.
- The Safest Boroughs identified from the results were **Bury, Trafford and Stockport** if outliers are ignored
- Locations with a stronger presence of Restaurants were **Manchester, Bolton, Oldham, Wigan and Stockport**.
- Most Boroughs would be affordable with the exception of Stockport.
- The Boroughs with the highest School scores were from **Bury, Stockport and Oldham**.

Limitations

- Using Foursquare API, information could be collected for various venues around Manchester however not all venue categories appear to have been available. In this exercise it appeared that Schools could not be easily filtered out from Foursquare unless the actual school name was known, this lead to having to go to other publicly available sources to obtain their information.
- One of the other challenges in this was that when using Wikipedia to extract the Borough information there appeared to be inconsistencies between different wiki pages as to what were the main Boroughs, as some lists were longer than others. So clearly the definition of a Borough will vary depending on the source you would use.
- Despite these limitation it was still possible to come to a satisfactory conclusion as the data extracted gave us a deeper insight into the characteristics of each neighbourhood.

Conclusion

There are 2 potential locations that the Willis Family should focus on, **Bury** and **Oldham**. However, each location does not offer all 4 requirements and therefore it will be down to which criteria they value more. Oldham has more Restaurants but has slightly more Crime incidents compared to Bury, which has fewer Restaurants but less crime.

Both locations in Greater Manchester are suitable to move to, and it is now down to personal preference for the Willis Family.

References

Image of Manchester Skyline: **vexels.com**