INVESTING IN MANCHESTER'S SUBURBS

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1. Introduction

1.1 Background

The northern UK city of Manchester is established as the single biggest tech hub outside of London, boasting a cumulative digital turnover of around £2.9 billion and offering an impressive 62,653 digital jobs. Jobs in the technology industry and other modern industries attract 'young professionals' from all over the world. Those 'young professionals' like to socialise and meet new people in local bars, clubs and eateries, they have high expendable income, rent properties, and when they move to Manchester they must find somewhere to live.

As the number of jobs in modern industries has been increasing in Manchester, certain suburbs have seen substantial hikes in house prices, and people owning property in those areas have profited considerably as their houses have gained value over time. Historically people would more around much less and buy houses in the area they grew up, so I think many homeowners and landlords were fortunate that the area they lived improved. In this project I will explore the idea that having an influx of venues that appeal to young professionals such as cafes, bars, restaurants can increase value of property in a whole area. I would like to show that homebuyers and investors can use venue data to *predict* which suburbs are likely to see larger increases in property value in the near future and make *informed decisions* on where to invest more heavily.

1.2 Problem

I will use data to explore the relationship between the number and type of venues in areas of Manchester and the price of residential properties in those areas, then determine whether it's possible to accurately predict which suburbs of Manchester are likely to see the largest increases in property value in the near future.

1.3 Interest

The intended goal of this project is to predict which suburbs of Manchester will see the largest increase in house prices soon, so that homebuyers and property investors can predict where to buy property to make the most money. Young professionals planning a move to Manchester may also find the results of this report useful if when trying to determine which suburb of Manchester will have lots of popular venues nearby that suit their requirements, transport links and reasonably priced rent. I will also explore which types of venue bring most money to an area, so town planners and local councils should consider offering incentives to certain small businesses looking to move to deprived areas requiring investment. Those could benefit hugely from the addition of desirable venues to their high streets.

2. Data acquisition and cleaning

2.1 Data sources

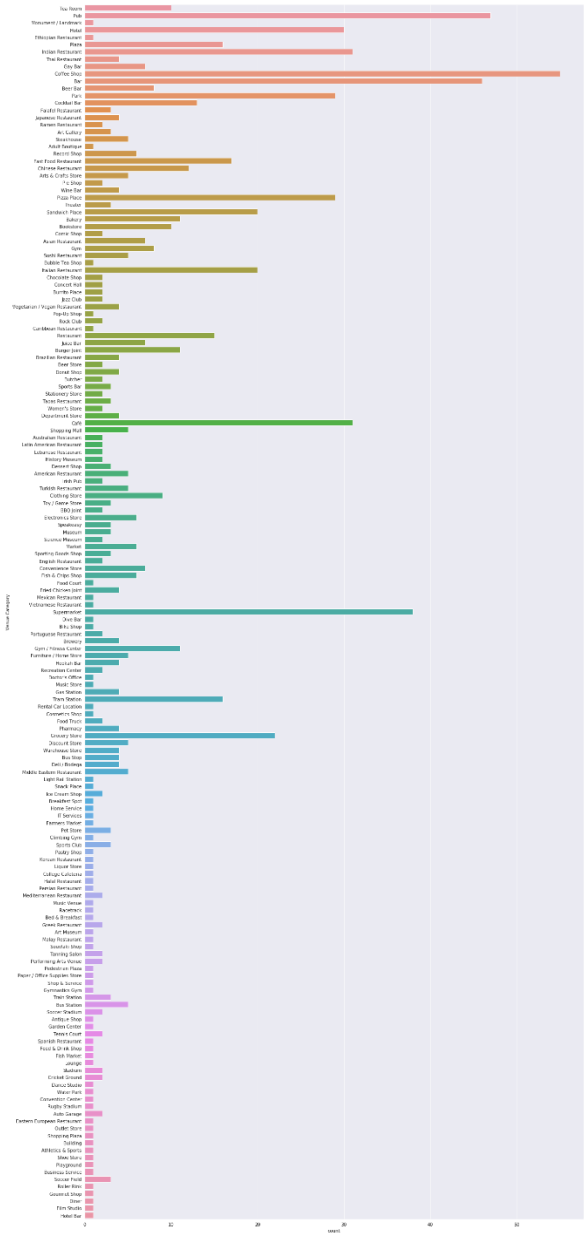
I used the Foursquare API I Foursquare API to retrieve a list of venues within 800m of the central point of each Manchester postcode: https://api.foursquare.com/v2/venues/explore. In order to call the API I required the latitude and longitude of the central point of the out codes of all Manchester postcodes (i.e. M1, M2, M3), so I downloaded that data from the following website: https://www.freemaptools.com/download-uk-postcode-lat-lng.htm. To compliment the data I had for each postcode, I scraped a list of the suburb names corresponding to each postcode from the following Wikipedia page: https://en.wikipedia.org/wiki/M_postcode_area. Live data including average house price, average percentage yield, average rent per square foot, increase/decrease in

average house price over the last 5 years is all available from https://propertydata.co.uk/cities/Manchester. I scraped those property stats for all Manchester out codes on the 29/07/2020 and used it for my analysis.

2.2 Data cleaning

All property data I used for analysis was split by postcode out code, which is the first part of a UK postcode. In Manchester, all postcodes start with the letter M, so an example of a postcode out code in Manchester is 'M20'. Postcodes are well defined and boundaries are clear geographically so I was happy to use this data, but even a Mancunian does not know each area of Manchester by postcode so I also wanted to retrieve a list of the suburb names that correspond to each postcode. I scraped these from Wikipedia, dropped data I didn't need such as the 'local authority area', then merged the suburb names for each postcode into a dataframe with the property stats from propertydata.co.uk, which was straight forward. The only thing to note is that there were some postcodes listed on Wikipedia which had no property data, but the reason for the lack of data available was that those postcodes missing were not for residential areas, so I chose to exclude those postcodes.

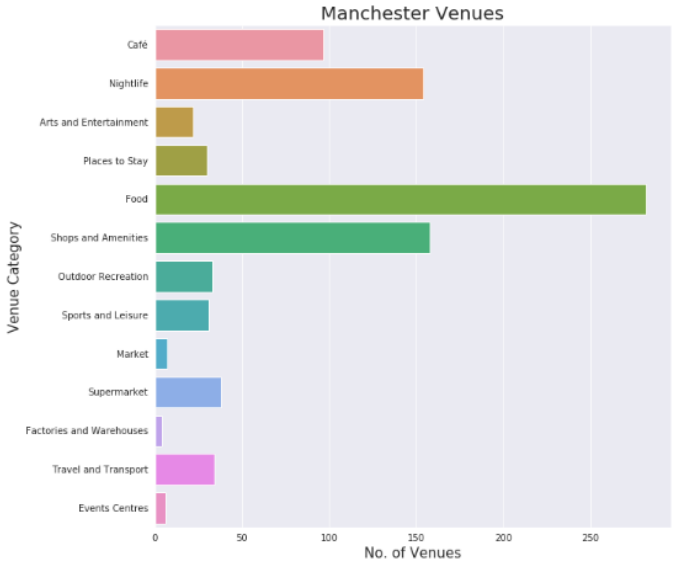
Finally, I retrieved the venue data for each postcode from the Foursquare API. I got the category for each venue from the results, but those categories were too specific, meaning the data was not insightful. You can see the full list of categories in the following visualisation:



I grouped similar categories together using keywords, e.g. 'Ethiopian Restaurant' was categorized as 'Restaurant' and was able to gather more meaningful insights from the data.

I chose these broader venue categories...

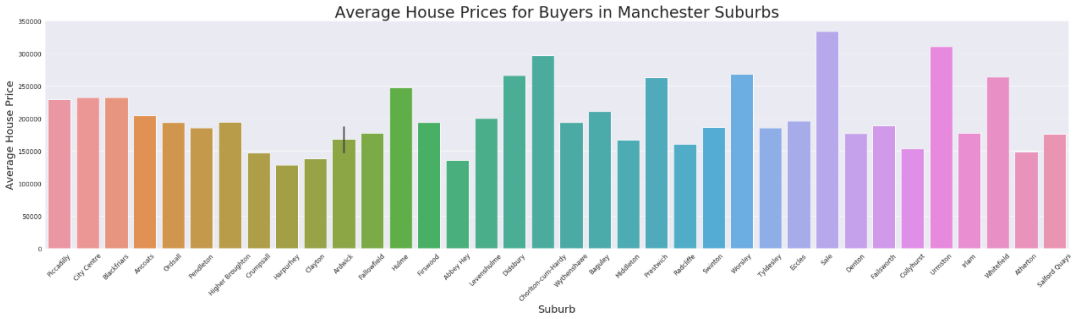
- Nightlife
- Food
- Cafe
- Outdoor Recreation
- Market
- Sports and Leisure
- Events Centres
- Factories and Warehouses
- Business Services
- Travel & Transport
- Arts and Entertainment
- Places to Stay
- Shops and Amenities
- Supermarkets



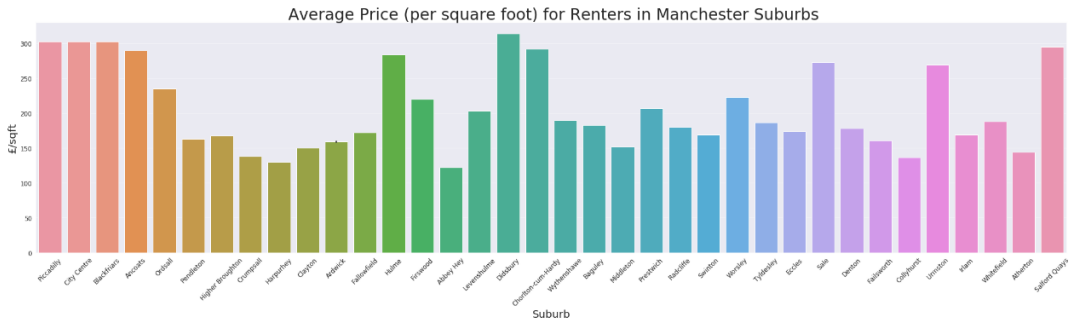
3. Exploratory Data Analysis

3.1 Property Prices

The first thing I wanted to do was identify the suburbs with the highest property value. I used the data taken from propertydata.co.uk for this; I visualised this by using a Seaborn 'countplot', with 'Suburb' as the independent variable and 'Average House Price' as the dependent variable. In the diagram below you can see that *house prices are highest* in the following areas:
Didsbury, **Chorlton-cum-Hardy**, **Prestwich**, **Worsley**, **Sale** and **Urmston**.



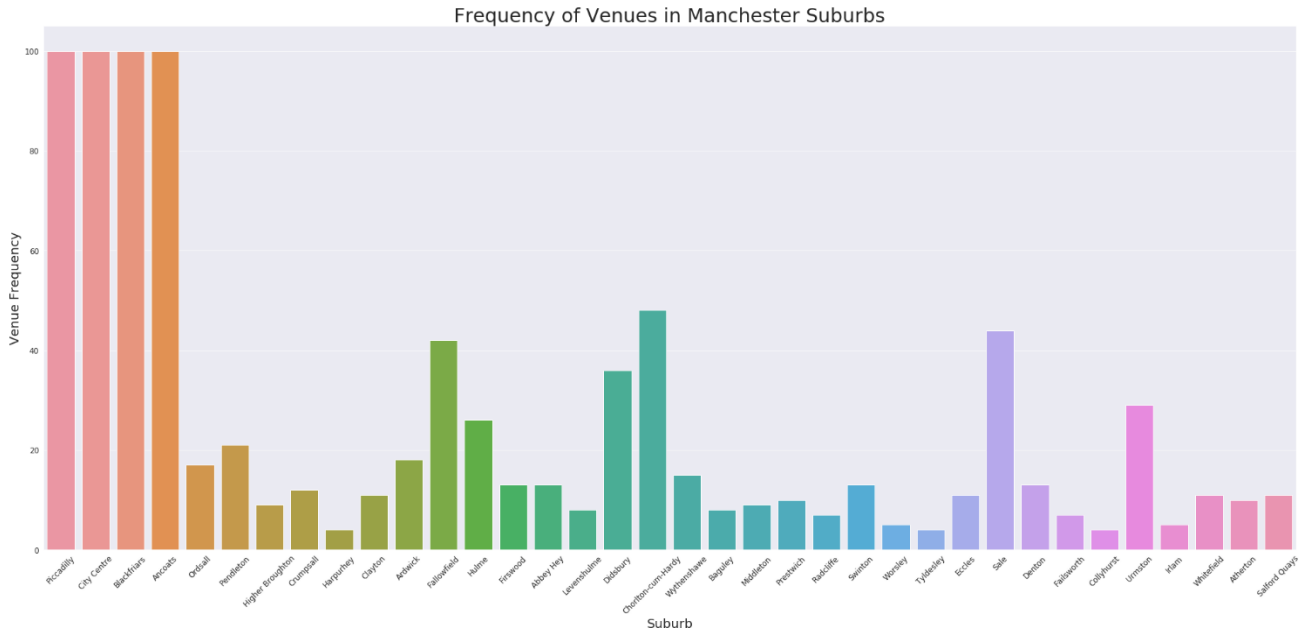
I then looked at the average price of rent per square foot in each suburb. Again I used the data from propertydata.co.uk, but this time 'Suburb' was the independent variable and 'Rent (£/sqft') was the dependent variable. We can see in the diagram below that the *rent is highest* in the following areas:
Piccadilly, **City Centre**, **Blackfriars**, **Ancoats**, **Hulme**, **Didsbury**, **Chorlton-cum-Hardy**, **Sale**, **Urmston** and **Salford Quays**.



So rent is high in Piccadilly, City Centre, Blackfriars, Ancoats, Hulme, Didsbury, Chorlton-cum-Hardy, Sale, Urmston and Salford Quays, but property prices are only high in Didsbury, Chorlton-cum-Hardy, Sale, Urmston and Salford Quays. This is because Piccadilly, City Centre, Blackfriars, Ancoats and Hulme are all areas with lots of one-two bedroom flats, which brings the average price of a single property down. The price per square foot is not accounted for with property price like it is for rent.

3.2 Venue Distribution

Using the Foursquare API, I had collected a list of all venues within 800m of the central part of each postcode and compiled the results into one dataframe. I grouped these venues by suburb, to find the total number of venues in each suburb, as well as the total number of each *type* of venue.



Piccadilly, **City Centre**, **Blackfriars** and **Ancoats** are all very central and unsurprisingly have the highest number of venues within an 800m radius. Notice they all appear in the areas with highest rent, but not highest average property prices.

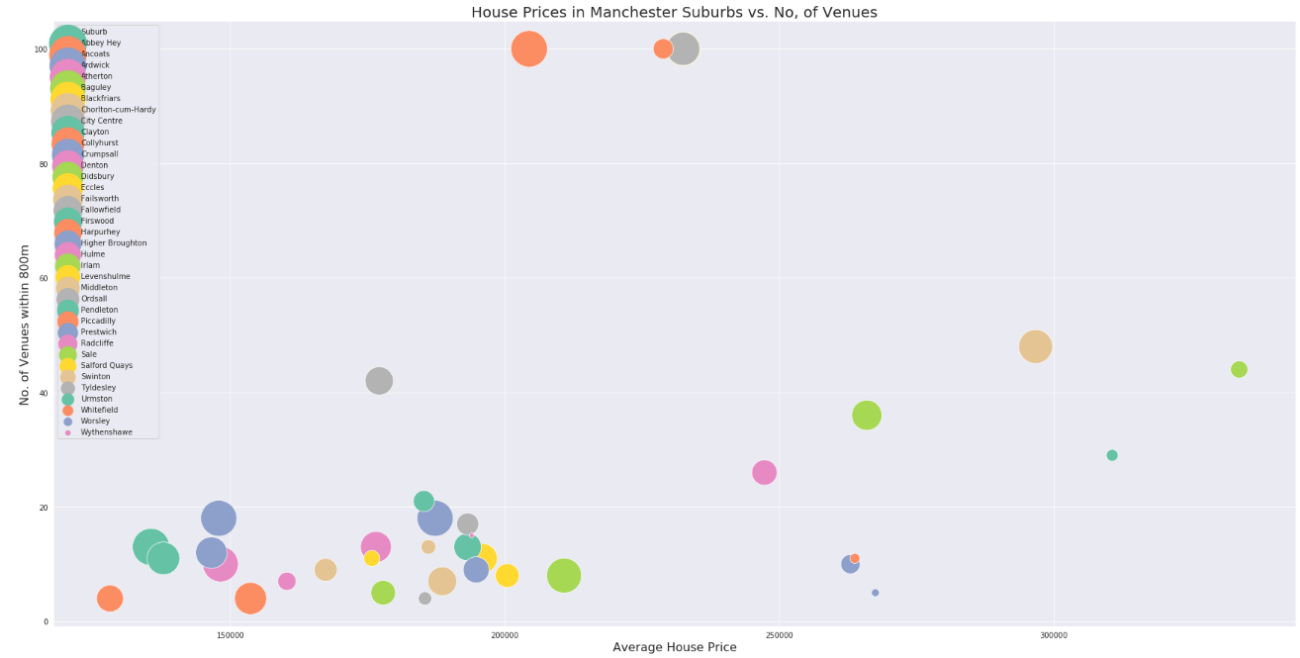
Other suburbs which are further from the centre of Manchester but still have a high number of venues include **Fallowfield**, **Didsbury**, **Chorlton-cum-Hardy**, **Sale** and **Urmston**. With the exception of Fallowfield, these areas *all* feature in the areas with the highest rent *and* the areas with the highest house prices.

Areas with lots of venues seem to have higher rent and higher property prices with the exceptions of:

- Student areas (e.g. Fallowfield) which have lots of venues but cheap housing and cheap rent.
- Very central areas which have lots of venues and high rent, but comparatively low average house prices as most residential properties are one-two bedroom flats as opposed to large houses.

3.3 Venue Frequency and Property Price

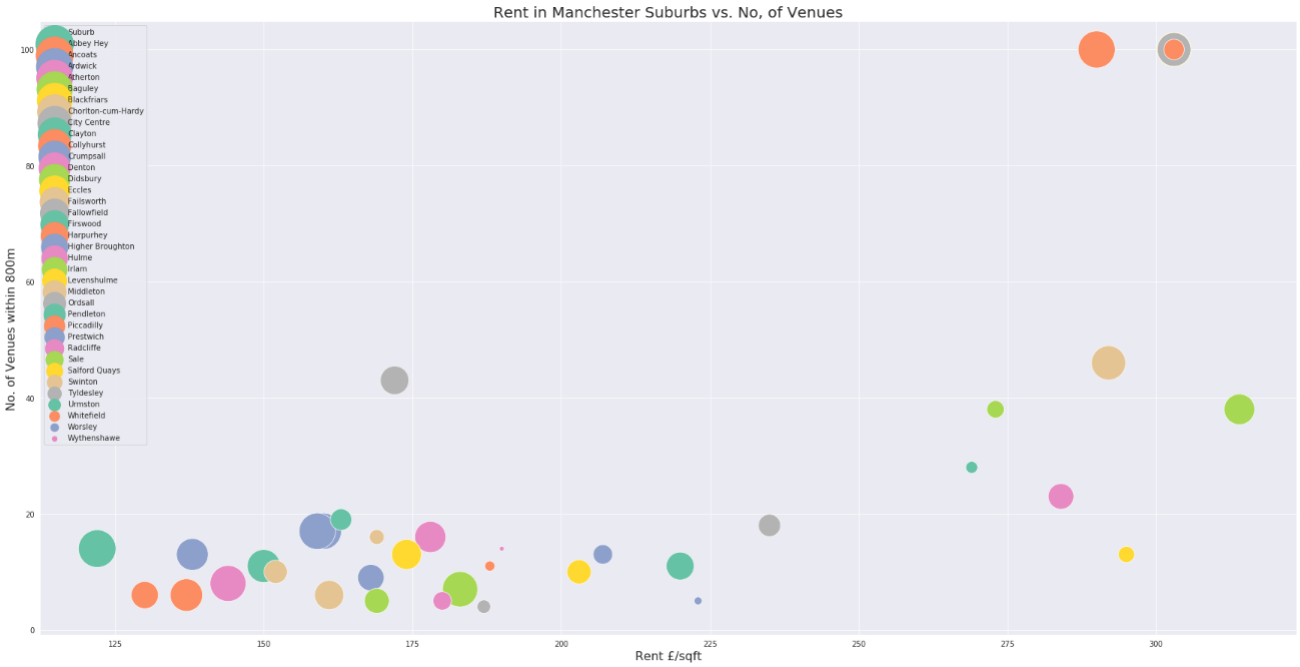
I explored the relationship between number of venues and property price. I took the total number of venues for each suburb and plotted them against the average house price. The different colour and size of each points identifies the suburb the point represents.



I found that there was a positive correlation between average house price and no. of venues, but notice the three outliers at the top of the graph. **Ancoats**, **Piccadilly** and **City Centre** are all very central suburbs which obviously have a high number of venues, but where the vast majority of residential properties are one-two bedroom flats, so have a lower average house price than the larger properties in the outer suburbs.

3.4 Venue Frequency and Rent

I explored the relationship between number of venues and rent. I took the total number of venues for each suburb and plotted them against the average rent, measure in £/sqft. The different colour and size of each points identifies the suburb the point represents.



There is a noticeable positive correlation between average rent and number of nearby venues. The small grey outlier is **Fallowfield**, which we see has low rent and a high number of venues nearby. This makes sense as **Fallowfield** is an immensely popular student area in Manchester.

Also notice that central areas such as the **City Centre** and **Piccadilly** have high rent (£/sqft), but a very high number of venues compared to other areas. **Ancoats** is less central, also has a high number of venues and high (but slightly lower) rent.

4. Methodology - Statistical Analysis and Clustering

From our exploratory analysis it seemed that there is a relationship between the number of venues and the price of houses, and a relationship between the number of venues in an area and the average cost of rent. I explored this idea further, to see if the *type* of venues in an area can impact the price of property, as well as the frequency.

My hypothesis is that venues that appeal to young professionals such as nightlife, bar, eateries and cafes increase the value of property in an area.

4.1 Normalizing the Data

The number of each type of venue in each suburb was a number between 0 and 100, the range of values for house prices was between 135,000 and 334,000 and the range of values for average rent was between 122 and 314, so I normalized the data using MinMaxScaler() so that all values were between 0 and 1. The full normalized dataframe is on GitHub in a dataframe called df_mergedsum.

Suburb	Arts and Entertainment	Café	Events Centres	Factories and Warehouses	Food	Market	Nightlife	Outdoor Recreation	Places to Stay	Shops and Amenities	Sports and Leisure	Supermarket	Travel and Transport	Total	Avg yield	Avg price	£/sqft	5yr +/-
Abbey Hey	0.0	0.000000	1.0	0.0	0.09375	1.0	0.000000	0.333333	0.125	0.00	1.000000	0.333333	0.50	0.093750	0.608696	0.036331	0.000000	0.750
Ancoats	0.2	1.000000	0.0	1.0	0.87500	1.0	0.785714	0.666667	0.500	1.00	0.666667	0.333333	0.00	1.000000	0.565217	0.371193	0.875000	0.625
Ardwick	0.0	0.058824	0.0	0.0	0.21875	0.0	0.071429	0.000000	0.000	0.05	0.333333	0.333333	0.00	0.093750	0.608696	0.096337	0.197917	0.875
Ardwick	0.0	0.058824	0.0	0.0	0.21875	0.0	0.071429	0.000000	0.000	0.05	0.333333	0.333333	0.00	0.093750	0.673913	0.287931	0.192708	0.125
Atherton	0.0	0.000000	0.0	0.0	0.03125	0.0	0.035714	0.000000	0.000	0.10	1.000000	0.333333	0.00	0.041667	0.369565	0.097898	0.114583	0.125
Baguley	0.0	0.058824	0.0	0.0	0.06250	0.0	0.000000	0.000000	0.000	0.05	0.333333	0.333333	0.25	0.031250	0.304348	0.402117	0.317708	0.250
Blackfriars	1.0	0.882353	0.0	0.0	1.00000	1.0	0.714286	0.666667	1.000	0.80	0.333333	0.000000	0.00	1.000000	0.369565	0.507585	0.942708	0.375
Chorlton-cum-Hardy	0.0	0.294118	0.0	0.0	0.62500	0.0	0.428571	0.666667	0.000	0.30	0.000000	0.000000	0.25	0.437500	0.086957	0.819696	0.885417	0.250
City Centre	1.0	0.882353	0.0	0.0	1.00000	1.0	0.714286	0.666667	1.000	0.80	0.333333	0.000000	0.00	1.000000	0.369565	0.507585	0.942708	0.375
Clayton	0.0	0.000000	0.0	0.0	0.09375	1.0	0.000000	0.333333	0.000	0.20	0.000000	0.333333	0.25	0.072917	0.978261	0.047262	0.145833	0.500
Collyhurst	0.0	0.000000	0.0	0.0	0.00000	0.0	0.000000	0.000000	0.000	0.05	0.333333	0.666667	0.75	0.031250	0.500000	0.124485	0.078125	0.625
Crumpsall	0.2	0.058824	0.0	0.0	0.12500	0.0	0.000000	0.333333	0.000	0.00	0.000000	0.333333	0.00	0.041667	0.630435	0.089816	0.083333	1.000
Denton	0.0	0.117647	0.0	0.0	0.06250	0.0	0.000000	0.000000	0.000	0.40	0.333333	0.666667	0.00	0.114583	0.304348	0.235535	0.291667	0.250
Didsbury	0.0	0.176471	0.0	0.0	0.56250	0.0	0.250000	0.333333	0.000	0.05	1.000000	0.333333	0.75	0.343750	0.391304	0.670239	1.000000	0.250

4.2 Correlation Between Variables

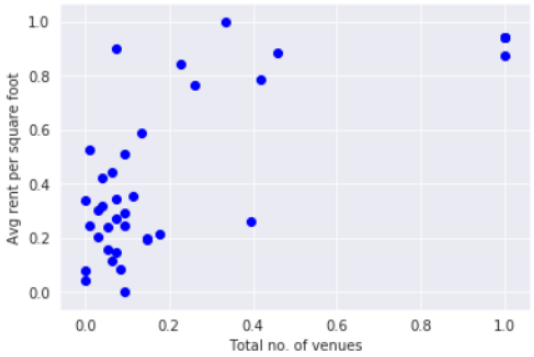
Once the data was normalized, I used corr() to assess the correlation between all variables.

	Arts and Entertainment	Café	Events Centres	Factories and Warehouses	Food	Market	Nightlife	Outdoor Recreation	Places to Stay	Shops and Amenities	Sports and Leisure	Supermarket	Travel and Transport	Total	Avg yield	Avg price	£/sqft	5yr +/-
Arts and Entertainment	1.000000	0.759350	-0.163238	0.018694	0.796352	0.401230	0.773137	0.249792	0.916023	0.734479	0.159198	-0.330497	-0.261708	0.818179	0.091469	0.171587	0.529104	-0.054295
Café	0.759350	1.000000	-0.167337	0.279168	0.906858	0.614917	0.914952	0.424094	0.826414	0.893042	0.280316	-0.280541	-0.246932	0.959384	-0.024938	0.360287	0.691990	0.006486
Events Centres	-0.163238	-0.167337	1.000000	-0.162761	-0.224757	0.005376	-0.152419	-0.202141	-0.108116	-0.113096	0.011895	0.117945	-0.093289	-0.169871	-0.240574	0.051195	-0.116674	-0.056911
Factories and Warehouses	0.018694	0.279168	-0.162761	1.000000	0.191091	0.124009	0.193263	0.206805	0.063226	0.297003	0.168615	-0.088051	-0.116147	0.238709	0.148516	0.014891	0.226183	0.074263
Food	0.796352	0.906858	-0.224757	0.191091	1.000000	0.455996	0.941919	0.422292	0.808240	0.831665	0.338518	-0.321313	-0.078164	0.973655	0.085594	0.387588	0.703929	0.011486
Market	0.401230	0.614917	0.005376	0.124009	0.455996	1.000000	0.454753	0.441233	0.495700	0.458792	0.231946	-0.115839	-0.093289	0.528775	0.159560	0.056261	0.257734	0.124616
Nightlife	0.773137	0.914952	-0.152419	0.193263	0.941919	0.454753	1.000000	0.347007	0.845255	0.848057	0.285112	-0.364467	-0.179884	0.966500	-0.010129	0.372388	0.709215	-0.095738
Outdoor Recreation	0.249792	0.424094	-0.202141	0.206805	0.422292	0.441233	0.347007	1.000000	0.265967	0.304818	0.175521	0.007663	-0.171433	0.418929	0.031602	0.325014	0.310929	0.261025
Places to Stay	0.916023	0.826414	-0.108116	0.063226	0.808240	0.495700	0.845255	0.265967	1.000000	0.826830	0.164353	-0.346423	-0.281962	0.871811	0.051471	0.183701	0.611937	-0.012658
Shops and Amenities	0.734479	0.893042	-0.113096	0.297003	0.831665	0.458792	0.848057	0.304818	0.826830	1.000000	0.161249	-0.125974	-0.303877	0.913895	0.021206	0.250569	0.610121	0.089788
Sports and Leisure	0.159198	0.280316	0.011895	0.168615	0.338518	0.231946	0.285112	0.175521	0.164353	0.161249	1.000000	0.146004	-0.032835	0.326675	0.109695	0.147991	0.137634	-0.058976
Supermarket	-0.330497	-0.280541	0.117945	-0.088051	-0.321313	-0.115839	-0.364467	0.007663	-0.346423	-0.125974	0.146004	1.000000	-0.141199	-0.271618	-0.253374	0.020545	-0.309110	0.145301
Travel and Transport	-0.261708	-0.246932	-0.093289	-0.116147	-0.078164	-0.093289	-0.179884	-0.171433	-0.281962	-0.303877	-0.032835	-0.141199	1.000000	-0.179703	0.140887	0.061455	-0.032284	0.085517
Total	0.818179	0.959384	-0.169871	0.238709	0.973655	0.528775	0.966500	0.418929	0.871811	0.913895	0.326675	-0.271618	-0.179703	1.000000	0.036474	0.364939	0.707590	0.010224
Avg yield	0.091469	-0.024938	-0.240574	0.148516	0.085594	0.159560	-0.010129	0.031602	0.051471	0.021206	0.109695	-0.253374	0.140887	0.036474	1.000000	-0.670799	-0.302662	0.278885
Avg price	0.171587	0.360287	0.051195	0.014891	0.387588	0.056261	0.372388	0.325014	0.183701	0.250569	0.147991	0.020545	0.061455	0.364939	-0.670799	1.000000	0.712486	-0.186665
£/sqft	0.529104	0.691990	-0.116674	0.226183	0.703929	0.257734	0.709215	0.310929	0.611937	0.610121	0.137634	-0.309110	-0.032284	0.707590	-0.302662	0.712486	1.000000	-0.119761
5yr +/-	-0.054295	0.006486	-0.056911	0.074263	0.011486	0.124616	-0.095738	0.261025	-0.012658	0.089788	-0.058976	0.145301	0.085517	0.010224	0.278885	-0.186665	-0.119761	1.000000

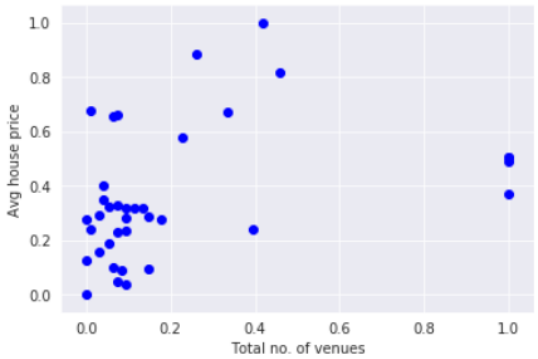
As you can see from the table, the correlation between the price of property (to rent or buy) and the following dependent variables is strong: no. of cafes, bars, nightlife, food, shops, no. of venues in total. I have used scatterplots to visualize this.

Total no. of Venues

The correlation between **total no. of venues** and **rent** (£/sqft) is 0.708. This is a strong positive correlation.

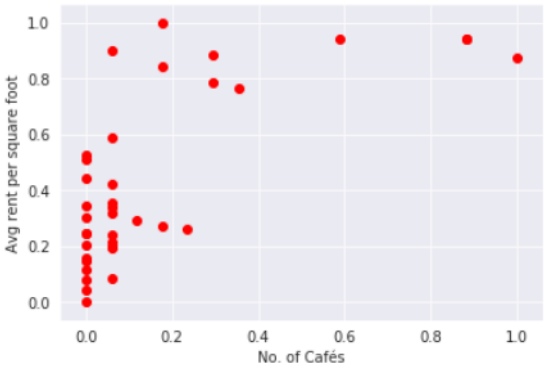


The correlation between **total no. of venues** and **house prices** is 0.365. This is a positive correlation.

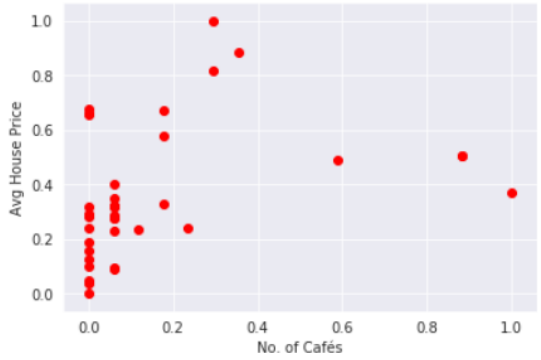


No. of Cafes

The correlation between **no. of cafes** and **rent** (£/sqft) is 0.692. This is a strong positive correlation.

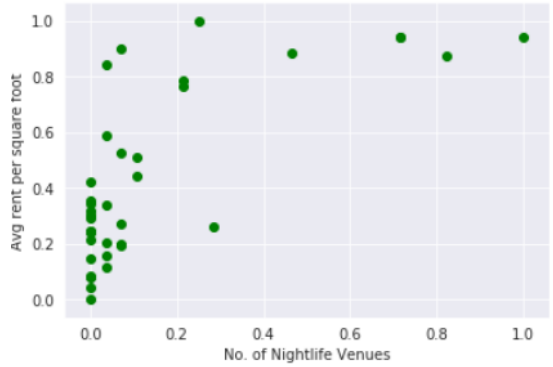


The correlation between **no. of cafes** and **house prices** is 0.360. This is a positive correlation.

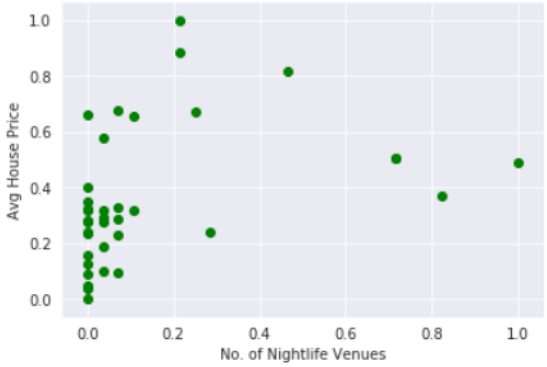


No. of Nightlife Venues

The correlation between **no. of nightlife venues** and **rent** (£/sqft) is 0.709. This is a strong positive correlation.

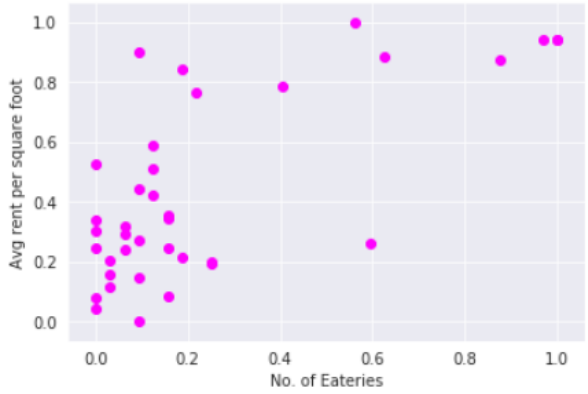


The correlation between **no. of nightlife venues** and **house prices** is 0.372. This is a positive correlation.

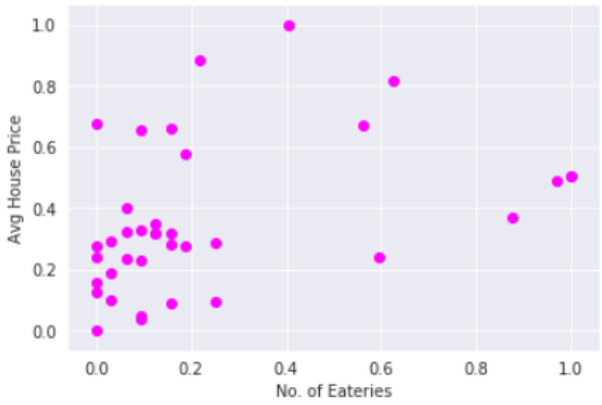


No. of Eateries

The correlation between **no. of eateries** and **rent (£/sqft)** is 0.704. This is a strong positive correlation.

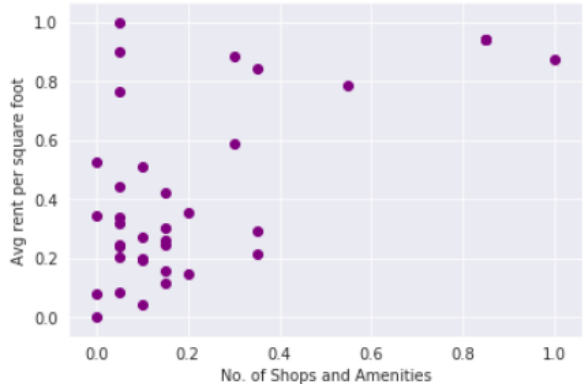


The correlation between **no. of eateries** and **house prices** is 0.388. This is a positive correlation.

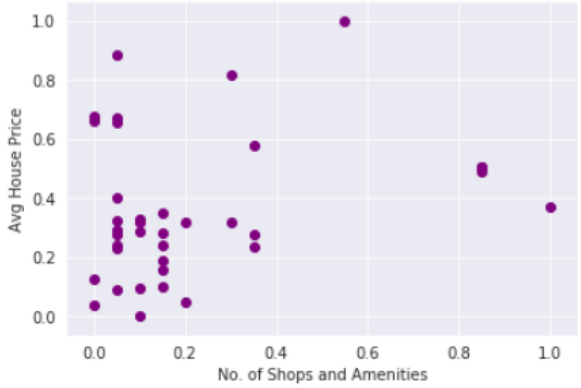


No. of Shops and Amenities

The correlation between **no. of shops/amenities** and **rent** (£/sqft) is 0.650. This is a positive correlation.

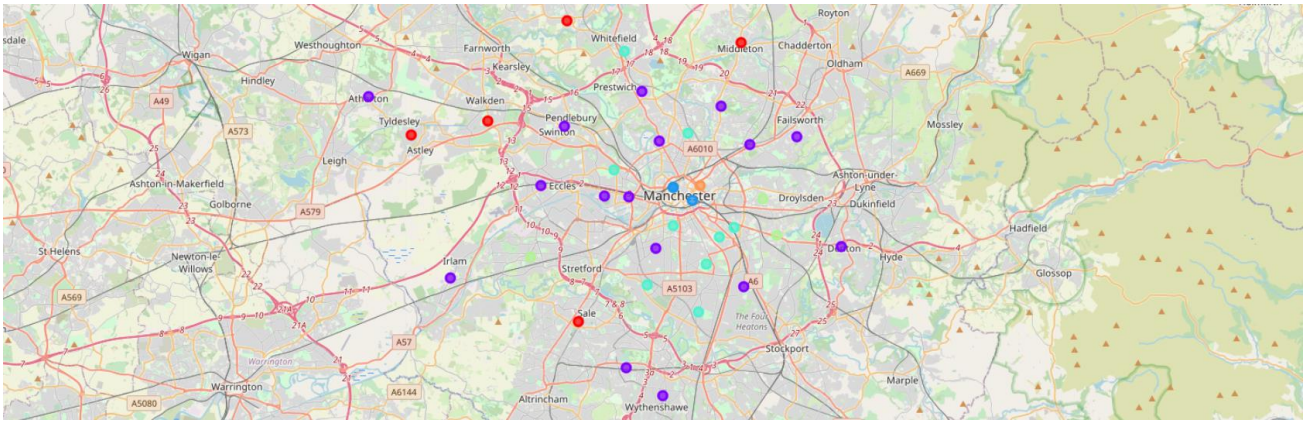


The correlation between total **no. of venues** and **house prices** is 0.251. This is a positive correlation.



4.3 Clustering

Confident that there is a strong relationship between the number and types of venues in areas and the price of both renting and buying property, I can now split the suburbs of Manchester into clusters based on the make-up of their venues. I removed all property data from the normalized table and used the venue data to categorize the Manchester suburbs into 6 clusters, using KMeans. The resulting clusters are plotted on this map of Manchester:



5. Results

5.1 Clusters

Medium Blue – Areas included in the darker blue cluster are central suburbs with *lots of venues* including food, nightlife, places to stay, shop and amenities nearby:

Suburb	Cluster Labels	Suburb	Arts and Entertainment	Café	Events Centres	Factories and Warehouses	Food	Market	Nightlife	Outdoor Recreation	Places to Stay	Shops and Amenities	Sports and Leisure	Supermarket	Travel and Transport	Total	Postcode	Avg yield	Avg price	£/sqft	5yr +/-
Blackfriars	2	Blackfriars	1.0	0.882353	0.0	0.0	1.00000	1.0	0.714286	0.666667	1.0	0.85	0.333333	0.0	0.0	1.0	M3	0.047	232477.0	303.0	0.12
City Centre	2	City Centre	1.0	0.882353	0.0	0.0	1.00000	1.0	0.714286	0.666667	1.0	0.85	0.333333	0.0	0.0	1.0	M3	0.047	232477.0	303.0	0.12
Piccadilly	2	Piccadilly	0.8	0.588235	0.0	0.0	0.96875	0.0	1.000000	0.333333	1.0	0.85	0.666667	0.0	0.0	1.0	M1	0.051	228854.0	303.0	0.12

Orange – Areas included in the orange cluster are very close to the centre of Manchester, have a very high number of venues, but not as many hotels etc as the very centre of town. There are also some larger, industrial buildings such as factories and warehouses.

Suburb	Cluster Labels	Suburb	Arts and Entertainment	Café	Events Centres	Factories and Warehouses	Food	Market	Nightlife	Outdoor Recreation	Places to Stay	Shops and Amenities	Sports and Leisure	Supermarket	Travel and Transport	Total	Postcode	Avg yield	Avg price	£/sqft	5yr +/-
Ancoats	5	Ancoats	0.2	1.0	0.0	1.0	0.875	1.0	0.821429	0.666667	0.428571	1.0	0.666667	0.333333	0.0	1.0	M4	0.056	204426.0	290.0	0.14

Light Blue/Cyan – Areas included in the lighter blue cluster are not central but do have a high number of venues mostly made up of food joints, cafes, nightlife and outdoor recreation facilities. I would say this category contains the most desirable areas for young professionals!

Suburb	Cluster Labels	Suburb	Arts and Entertainment	Café	Events Centres	Factories and Warehouses	Food	Market	Nightlife	Outdoor Recreation	Places to Stay	Shops and Amenities	Sports and Leisure	Supermarket	Travel and Transport	Total	Postcode	Avg yield	Avg price	£/sqft	5yr +/-
Ardwick	3	Ardwick	0.0	0.058824	0.0	0.5	0.25000	0.0	0.071429	0.333333	0.000000	0.10	0.333333	0.333333	0.25	0.145833	M12	0.058	147898.0	160.0	0.16
Ardwick	3	Ardwick	0.0	0.058824	0.0	0.5	0.25000	0.0	0.071429	0.333333	0.000000	0.10	0.333333	0.333333	0.25	0.145833	M13	0.061	187302.0	159.0	0.10
Chorlton-cum-Hardy	3	Chorlton-cum-Hardy	0.0	0.294118	0.0	0.0	0.62500	0.0	0.464286	0.666667	0.000000	0.30	0.000000	0.000000	0.50	0.458333	M21	0.034	296667.0	292.0	0.11
Crumpsall	3	Crumpsall	0.2	0.058824	0.0	0.0	0.15625	0.0	0.000000	0.666667	0.000000	0.05	0.000000	0.333333	0.25	0.083333	M8	0.059	146557.0	138.0	0.17
Didsbury	3	Didsbury	0.0	0.176471	0.0	0.0	0.56250	0.0	0.250000	0.333333	0.000000	0.05	1.000000	0.333333	0.50	0.333333	M20	0.048	265929.0	314.0	0.11
Fallowfield	3	Fallowfield	0.4	0.235294	0.0	0.0	0.59375	0.0	0.285714	0.333333	0.000000	0.15	1.000000	0.000000	0.50	0.395833	M14	0.076	177123.0	172.0	0.13
Hulme	3	Hulme	0.2	0.176471	0.0	1.0	0.18750	0.0	0.035714	0.666667	0.142857	0.35	0.666667	0.333333	0.00	0.229167	M15	0.046	247285.0	284.0	0.14
Pendleton	3	Pendleton	0.0	0.058824	0.0	0.0	0.18750	0.0	0.000000	1.000000	0.000000	0.35	0.333333	1.000000	0.00	0.177083	M6	0.053	185257.0	163.0	0.16
Whitefield	3	Whitefield	0.0	0.000000	0.0	0.0	0.15625	0.0	0.000000	0.666667	0.000000	0.00	0.333333	0.666667	0.25	0.072917	M45	0.038	263750.0	188.0	0.12

Lime Green - This consists of areas of Manchester which are not central, do not have many popular venues, but do have *some* eateries, supermarkets and transport links.

Suburb	Cluster Labels	Suburb	Arts and Entertainment	Café	Events Centres	Factories and Warehouses	Food	Market	Nightlife	Outdoor Recreation	Places to Stay	Shops and Amenities	Sports and Leisure	Supermarket	Travel and Transport	Total	Postcode	Avg yield	Avg price	£/sqft	5yr +/-
Abbey Hey	4	Abbey Hey	0.0	0.000000	1.0	0.0	0.09375	1.0	0.000000	0.333333	0.142857	0.00	1.000000	0.333333	0.50	0.093750	M18	0.058	135557.0	122.0	0.15
Clayton	4	Clayton	0.0	0.000000	0.0	0.0	0.09375	1.0	0.000000	0.333333	0.000000	0.20	0.000000	0.333333	0.25	0.072917	M11	0.075	137805.0	150.0	0.13
Urmston	4	Urmston	0.0	0.352941	0.0	0.0	0.21875	1.0	0.214286	1.000000	0.000000	0.05	0.666667	0.666667	0.25	0.260417	M41	0.030	310619.0	269.0	0.13

Purple – The areas in this cluster are even further out of town and are very residential, less desirable, with a low number of venues nearby. Some have good transport links or decent access to supermarkets.

Suburb	Cluster Labels	Suburb	Arts and Entertainment	Café	Events Centres	Factories and Warehouses	Food	Market	Nightlife	Outdoor Recreation	Places to Stay	Shops and Amenities	Sports and Leisure	Supermarket	Travel and Transport	Total	Postcode	Avg yield	Avg price	£/sqft	5yr +/-
Atherton	1	Atherton	0.0	0.000000	0.0	0.0	0.03125	0.0	0.035714	0.000000	0.000000	0.15	1.000000	0.666667	0.00	0.062500	M46	0.047	148219.0	144.0	0.10
Baguley	1	Baguley	0.0	0.058824	0.0	0.0	0.06250	0.0	0.000000	0.000000	0.000000	0.05	0.333333	0.333333	0.50	0.041667	M23	0.044	210786.0	183.0	0.11
Collyhurst	1	Collyhurst	0.0	0.000000	0.0	0.0	0.00000	0.0	0.000000	0.000000	0.000000	0.00	0.333333	0.666667	0.25	0.000000	M40	0.053	153687.0	137.0	0.14
Denton	1	Denton	0.0	0.117647	0.0	0.0	0.06250	0.0	0.000000	0.000000	0.000000	0.35	0.000000	0.666667	0.00	0.093750	M34	0.044	176526.0	178.0	0.11
Eccles	1	Eccles	0.0	0.176471	0.0	0.0	0.09375	0.0	0.071429	0.000000	0.000000	0.10	0.333333	0.000000	0.00	0.072917	M30	0.041	195930.0	174.0	0.11
Failsworth	1	Failsworth	0.2	0.000000	0.0	0.0	0.03125	0.0	0.035714	0.000000	0.000000	0.05	0.333333	0.666667	0.00	0.031250	M35	0.038	188603.0	161.0	0.11
Firswood	1	Firswood	0.2	0.000000	0.0	0.5	0.12500	0.0	0.107143	0.000000	0.000000	0.10	0.000000	0.000000	0.50	0.093750	M16	0.045	193221.0	220.0	0.09
Harpurhey	1	Harpurhey	0.0	0.000000	0.0	0.0	0.00000	0.0	0.000000	0.333333	0.000000	0.10	0.000000	0.000000	0.25	0.000000	M9	0.062	128085.0	130.0	0.12
Higher Broughton	1	Higher Broughton	0.0	0.058824	0.0	0.0	0.06250	0.0	0.000000	0.333333	0.000000	0.05	0.666667	0.333333	0.25	0.052083	M7	0.053	194781.0	168.0	0.10
Irlam	1	Irlam	0.0	0.000000	0.0	0.0	0.00000	0.0	0.000000	0.333333	0.000000	0.05	0.333333	0.666667	0.00	0.010417	M44	0.039	177845.0	169.0	0.12
Levenshulme	1	Levenshulme	0.0	0.058824	0.0	0.0	0.12500	0.0	0.000000	0.000000	0.000000	0.15	0.000000	0.000000	0.00	0.041667	M19	0.048	200442.0	203.0	0.17
Ordsall	1	Ordsall	0.0	0.058824	0.0	0.0	0.12500	0.0	0.035714	0.333333	0.142857	0.30	0.000000	0.333333	0.50	0.135417	M5	0.052	193231.0	235.0	0.16
Prestwich	1	Prestwich	0.0	0.000000	0.0	0.0	0.09375	0.0	0.107143	0.000000	0.000000	0.05	0.000000	0.333333	0.50	0.062500	M25	0.037	262948.0	207.0	0.12
Salford Quays	1	Salford Quays	0.2	0.058824	0.0	0.0	0.09375	0.0	0.071429	0.000000	0.285714	0.05	0.000000	0.000000	0.25	0.072917	M50	0.060	175777.0	295.0	0.12
Swinton	1	Swinton	0.2	0.000000	0.0	0.0	0.15625	0.0	0.000000	0.333333	0.000000	0.15	0.000000	1.000000	0.00	0.093750	M27	0.046	186084.0	169.0	0.13
Wythenshawe	1	Wythenshawe	0.0	0.058824	0.0	0.0	0.15625	0.0	0.000000	0.000000	0.000000	0.20	0.000000	0.333333	1.00	0.114583	M22	0.046	193957.0	190.0	0.15

Red - The red clusters represent cluster 0, which is made up of suburbs which are far out of the centre of Manchester without many venues or transport links nearby. 'Sale' is the glaring exception. Sale has lots of popular venues, but has been included in this cluster as it has an events centre.

Suburb	Cluster Labels	Suburb	Arts and Entertainment	Café	Events Centres	Factories and Warehouses	Food	Market	Nightlife	Outdoor Recreation	Places to Stay	Shops and Amenities	Sports and Leisure	Supermarket	Travel and Transport	Total	Postcode	Avg yield	Avg price	£/sqft	5yr +/-
Middleton	0	Middleton	0.0	0.000000	1.0	0.0	0.03125	0.0	0.035714	0.000000	0.000000	0.15	0.333333	0.666667	0.00	0.052083	M24	0.044	167368.0	152.0	0.13
Radcliffe	0	Radcliffe	0.0	0.000000	1.0	0.0	0.00000	0.0	0.000000	0.000000	0.000000	0.15	0.000000	0.666667	0.25	0.031250	M26	0.047	160319.0	180.0	0.11
Sale	0	Sale	0.2	0.294118	1.0	0.0	0.40625	0.0	0.214286	0.000000	0.142857	0.55	0.666667	1.000000	0.25	0.416667	M33	0.031	333749.0	273.0	0.13
Tyldesley	0	Tyldesley	0.0	0.058824	1.0	0.0	0.00000	0.0	0.035714	0.000000	0.000000	0.05	0.000000	0.000000	0.00	0.000000	M29	0.039	185453.0	187.0	0.11
Worsley	0	Worsley	0.0	0.000000	1.0	0.0	0.00000	0.0	0.071429	0.666667	0.000000	0.00	0.000000	0.000000	0.00	0.010417	M28	0.037	267490.0	223.0	0.11

6. Discussion

6.1 Notes and observations

During this project I clustered Manchester's suburbs based on the number and types of venues within 800m of the central point. I gained the following useful insights:

1. Suburbs with most venues, thus the most desirable suburbs for young professionals are:

   - Central Suburbs: City Centre, Blackfriars, Piccadilly, Ancoats, Hulme
   - Outer Suburbs: Didsbury, Chorlton-cum-Hardy, Sale, Urmston and Salford Quays

2. Rent is higher in those suburbs with more venues

3. House prices are also higher in those areas with lots of venues

4. It would make sense for investors to invest in areas where the no. of venues particularly cafes, bars and nightlife is increasing

5. Based on the results of clustering, if I were an investor I would buy property in Hulme as it is central, has access to lots of venues, rent has already increased but property prices are still low compared to suburbs such as Didsbury and Chorlton-cum-Hardy and likely to rise

6. If I were a young professional looking to move to Manchester to rent, I would choose either Chorlton-cum-Hardy or Ancoats. Rent is more reasonable in these suburbs, although the number of popular venues nearby is high.

7. If I were a town planner looking to improve a Manchester suburb, I would certainly consider offering incentives to small business owners looking to open cafes, restaurants, bars nearby, as I have shown that these venues increase the value of property, as well as bring jobs to an area.

7. Conclusion

7.1 Conclusion

In this project, I analysed the relationship between the average price of property (to rent and buy) in Manchester's suburbs and the type and quantity of venues in the area. I identified that the number of venues, particularly the number of bars, eateries, restaurants and cafes in an area impacts the price of local residential properties. The correlation between no. of venues and rent was noticeably stronger than the relationship between no. of venues and house price, as rent is measured in £/sqft which takes the size of property into account, whereas I only had data for the *average sale price* of houses, nothing to say how many bedrooms or the *size* of residential properties sold.

During this study I used clustering to identify the most desirable areas of Manchester for young professionals, and presented my findings alongside the average rent. My findings could be useful to a number of people, including investors looking where to buy properties to let, and young professionals deciding where to rent. I have shown that there is an incentive for councils and town planners to encourage small businesses to open on their high streets to attract people with expendable income.

7.2 Future Directions

I would like to collect historical venue data so that I can see how the makeup of venues has changed in each suburb over time and measure how that has impacted house prices in each suburb, so that I can build a model to predict more accurately which areas of Manchester are most likely to see an increase in property value. I would also like to use data which includes the size or type (detached, semi-detached, apartment) of property sold.