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1 INTRODUCTION: BUSINESS PROBLEM

1.1 Background

With the boom in the entertainment industry and the increase in collaboration between African countries, more East Africans have found themselves immigrating (temporarily or otherwise) to West Africa. Particularly looking at major cities like **Accra**, Ghana, and **Lagos**, Nigeria. Focussing on academic and artistic young (*ages 18-35*) immigrants from **Nairobi**, Kenya; looking for similarities in recreation or to start an accessible restaurant with a feeling of home.

1.2 Problem

This project aims to find **relatively similar neighborhoods**, that are **close to the city center**. Areas with a multi-cultural restaurant option might be highlighted. Note that although Lagos might be a major entertainment destination, things like the cost of living might also affect the decision. Nairobi is an arbitrary East African country chosen for this project.

1.3 Interest

Based on our target demographic and criteria specified, some neighborhoods will be selected. Their features will also be outlined for the stakeholders to choose the best location for their restaurant. This not only brings a homely feel to an otherwise foreign area, but it also adds variety to the menu/restaurant options of the locals.

2 DATA

The criteria set in the problem definition section identifies the following as decision influencers:

1. Similarity of neighborhoods
2. distance from city center
3. Cost of living

2.1 Data Source

A base cost of living in these three cities can be compared, and data scraped from **Numbeo** to get:

- [Nairobi vs Ghana](#)
- [Nairobi vs Lagos](#)

All costs will be extracted in Kenyan shilling. Due to the small amount of data available on **Foursquare API** for these locations, the number of location types for a small set will be used to determine similarity. City center coordinates will be obtained.

2.2 Data Collection and Data Cleaning

From the age group the assumption of a single person, renting an apartment away from the centre. To reduce the extracted data, our initial search deals with a demographic with no dependents (*Based on population data, and general society structure this might not be the case*). These are just a few indicators; foodstuff prices were not extracted as they vary with location within cities.

Index difference along with the following shall be extracted:

- Basic (Electricity, Heating, Cooling, Water, Garbage) for 85m2 Apartment
- Apartment (1 bedroom) Outside of Centre
- Fitness Club, Monthly Fee for 1 Adult
- Internet (60 Mbps or More, Unlimited Data, Cable/ADSL)
- Monthly Pass (Regular Price) (**There has been an increase in fuel price in Nigeria, so this might not be a true representation**)
- Meal for 2 People, Mid-range Restaurant, Three-course
- Meal, Inexpensive Restaurant

Having outlined all necessary parameters that will be observed, the data cleaning process was performed.

2.2.1 Nairobi vs Accra Cost of Living

In this section, the web scraping method to extract information will be set-up. Libraries are imported, and function defined to create a general structure of how the *numbeo* cost of living data is extracted. The data frame will then be created for the Nairobi Accra comparison. Functions were created for ease of analysis, the indices difference extracted was:

- The Overall indicator differences for both are as follows:
- Consumer Prices in Accra are 13.91% higher than in Nairobi (without rent)
- Consumer Prices Including Rent in Accra are 24.17% higher than in Nairobi
- Rent Prices in Accra are 56.68% higher than in Nairobi
- Restaurant Prices in Accra are 5.74% higher than in Nairobi
- Groceries Prices in Accra are 28.42% higher than in Nairobi
- Local Purchasing Power in Accra is 22.16% lower than in Nairobi

Now that the difference has been displayed, the specified indicator prices and percent difference comparison of Nairobi and Accra is given as:

Table 1: Price list of Specified Indicators [Nairobi vs Accra]

Indicator	Nairobi (KSh)	Accra (KSh)	NairobiAccra (%)
Meal	500.00	554.51	10.90

Meal for 2	3500.00	3824.19	9.26
Transportation	3489.13	3346.17	-4.10
Basic	4348.98	8237.95	89.42
Internet	6266.63	6028.99	-3.79

2.2.2 Nairobi vs Lagos Cost of Living

Following the resulting data frame with the Ghana comparison, a similar process will be followed to create a Nairobi/Lagos comparison data frame. The extracted data will then be showcased as a combined table. First, the web scraping result will display the highlighted index difference between Nairobi and Lagos:

- The Overall indicator differences for both are as follows:
- Consumer Prices in Lagos are 6.01% lower than in Nairobi (without rent)
- Consumer Prices Including Rent in Lagos are 53.28% higher than in Nairobi
- Rent Prices in Lagos are 241.09% higher than in Nairobi
- Restaurant Prices in Lagos are 14.14% lower than in Nairobi
- Groceries Prices in Lagos are 7.20% higher than in Nairobi
- Local Purchasing Power in Lagos is 59.00% lower than in Nairobi

Now that the differences have been displayed, the specified indicator prices and percent difference comparison of Nairobi and Lagos is given as:

Table 2: Price list of Specified Indicators [Nairobi vs Lagos]

Indicator	Nairobi (KSh)	Lagos (KSh)	NairobiLagos (%)
Meal	500.00	267.05	-46.59
Meal for 2	3500.00	4330.49	23.73
Transportation	3489.13	2886.99	-17.26
Basic	4348.98	3336.70	-23.28
Internet	6266.63	4575.36	-26.99

Merging the two price tables a resultant table the city living cots has been derived:

Table 3: Indicator, Price List, and Percent Difference of Living Cost in Nairobi, Lagos, and Accra

Indicator	Nairobi (KSh)	Lagos (KSh)	NairobiLagos (%)	Accra (KSh)	NairobiAccra (%)
Meal	500.00	267.05	-46.590000	554.51	10.900000
Meal for 2	3500.00	4330.49	23.730000	3824.19	9.260000

Transportation	3489.13	2886.99	-17.260000	3346.17	-4.100000
Basic	4348.98	3336.70	-23.280000	8237.95	89.420000
Internet	6266.63	4575.36	-26.990000	6028.99	-3.790000
Fitness	5310.34	5081.10	-4.320000	6596.74	24.220000
Rent	19281.25	75886.62	293.580000	11559.50	-40.050000
TOTAL	42696.33	96364.31	125.696939	40148.05	-5.968382

2.2.3 Getting venues from each city

Using Foursquare API, restaurant and venue information will be obtained for Nairobi, Accra, and Lagos. A sub-category list of restaurants will also be filtered.

Focussing on entertainment and recreation only, therefore places of worship, shopping centers, and other areas might not be explicitly searched for. The following categories are of interest:

- **Arts & Entertainment** ('4d4b7104d754a06370d81259')
- **Event** ('4d4b7105d754a06373d81259')
- **Food** ('4d4b7105d754a06374d81259')
- **Nightlife Spot** ('4d4b7105d754a06376d81259')
- **Outdoors & Recreation** ('4d4b7105d754a06377d81259')
- **Food** ('4d4b7105d754a06374d81259')

For ease of data collection and cleaning, two functions were created. This was to improve code efficiency as the foursquare method and maps will be executed for each city.

Obtaining the 500 Accra venues within a 7500 m radius from the city center (**this ensures that some parts of the outskirts are captured**) and plotting map:

Table 4: Accra Venue Snapshot.

| name	categories	address	lat	LNG	distance
Mövenpick Ambassador Hotel	Hotel	Independence Ave.	5.554508	-0.202435	635
Palace Chinese Restaurant	Chinese Restaurant	N/A	5.613215	-0.196568	6366
Nana's Enterprise	Snack Place	Opposite Odorkor Police Quarters	5.568720	-0.247848	5819
Independence Square	Plaza	Labadi Rd, Accra,	5.549360	-0.191886	926
Banton's Bakery	Bakery	N/A	5.579027	-0.140104	6793
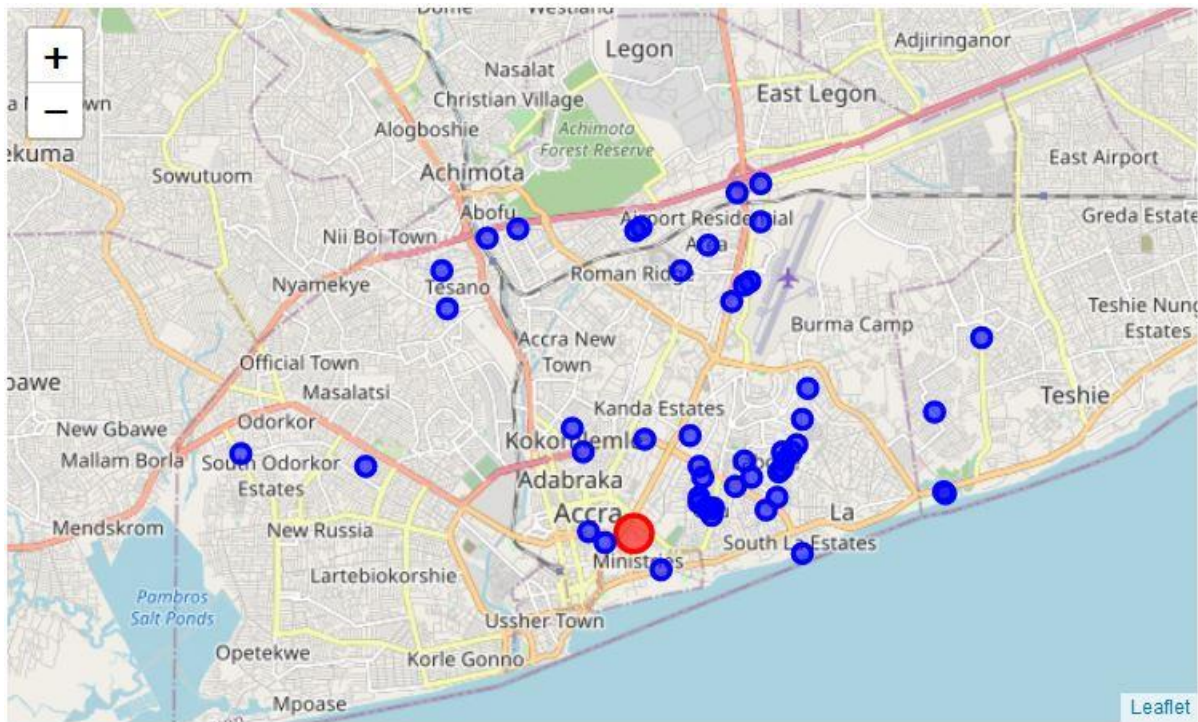
Figure 1: Accra Venues Displayed on Map.

Obtaining the 500 Lagos venues within a 17,000 m radius from the city centre (**this ensures that some parts of the outskirts are captured**) and plotting map:

Table 5: Lagos Venue Snapshot.

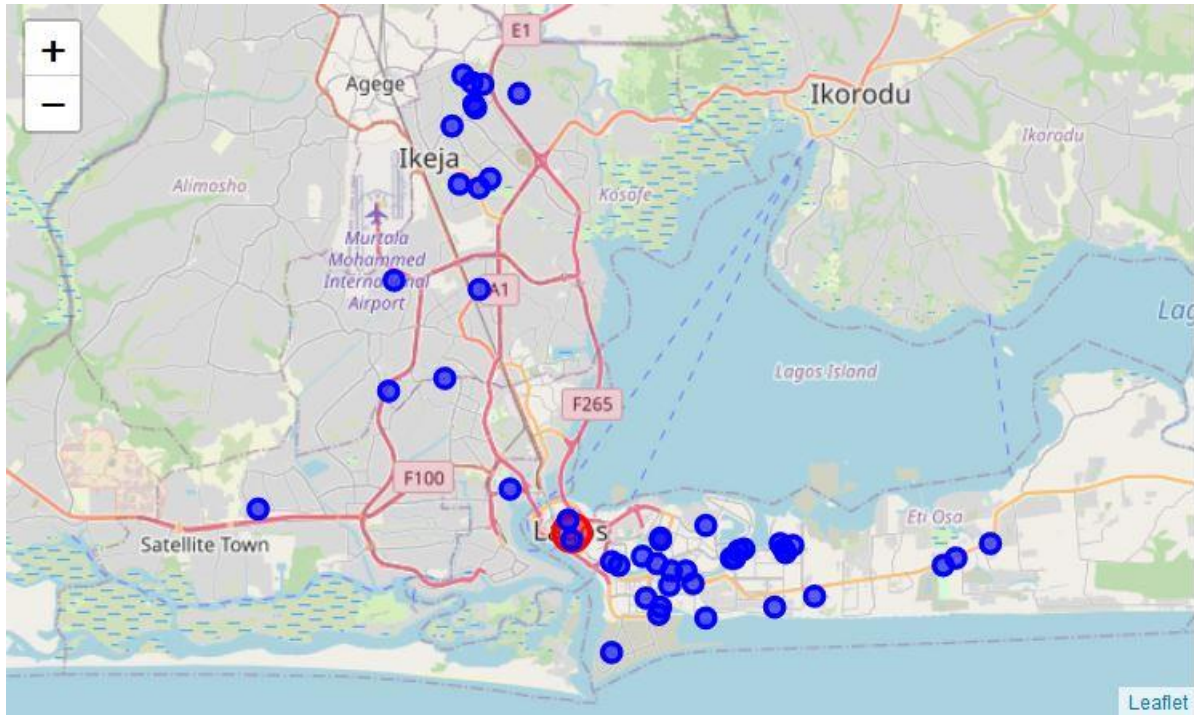| name	categories	address	lat	lng	distance
Campos Stadium	Soccer Field	Campos Street	6.451098	3.394655	330
Eko Bridge	Bridge	Lagos	6.470538	3.371415	3158
Lekki Conservation Centre	Park	N/A	6.441374	3.535440	15635
Danfo Bistro	Bistro	2 Alexander Road, Ikoyi	6.456228	3.445512	5628
Chicken Republic	Fried Chicken Joint	N/A	6.614715	3.357743	18343

Figure 2: Lagos Venues Displayed on Map.

Obtaining the 500 Nairobi venues within a 14,900 m radius from the city centre (**this ensures that some parts of the outskirts are captured**) and plotting map:

Table 6: Nairobi Venue Snapshot.

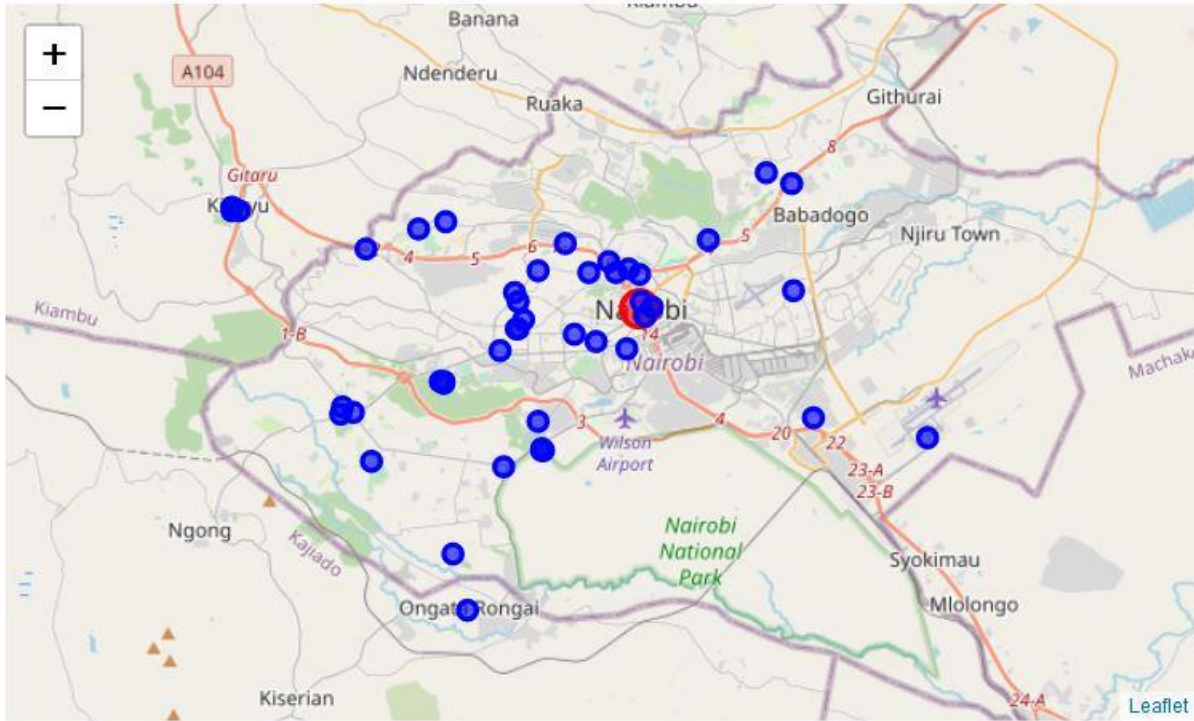| name	categories	lat	lng	distance	address
Ibury lounge	Lounge	-1.268784	36.778105	4587	N/A
Nairobi Safari Club Health Club	Gym	-1.280801	36.817412	293	N/A
GPO	Post Office	-1.286062	36.818532	368	Kenyatta Avenue
Winning Post	Lounge	-1.311537	36.742291	8853	N/A
Tibs ribs	BBQ Joint	-1.276540	36.874717	6504	N/A

Figure 3: Nairobi Venues Displayed on Map.

Now that all the necessary data has been extracted and cleaned, the next step is to give a proper overview of how the data science methodology will be applied to this business project.

3 METHODOLOGY

Although insights on possible restaurant locations in a West African city can be gained from this project, it will focus on exploring the similarities in the recreational lives of the single independent Youths of these cities. Factoring in the overall cost of living as compared to a similarly popular East African city.

To achieve this, living cost information was extracted from **numbeo*** based on specified indicators. Some exploratory analysis was done, with charts for better visualization. The next step was the application of the foursquare API, where **five hundred (500) venues from each city** were gotten. These venues are based on recreation and entertainment; therefore, the appropriate categories were applied for filtering.

The maps and locations were rendered, analysis on this data would be performed by determining the number of venues that exist in each category. These restaurants will also be filtered, although there is a lack of address and neighborhood data for some of the extracted venues the few that exist will be compared.

*data has been collected from people Nairobi (129), Accra (57), Lagos (140) which is a small representation of overall living costs.

4   ANALYSIS

In this section, basic exploratory data analysis will be used to gain additional information from the cleaned data.

4.1   Living Cost Comparison

The table below shows a statistical analysis of the living cost data extracted from numbeo; the total calculated during initial cleaning was not included in this analysis.

Table 7: Statistical breakdown of Living Cost

	Nairobi (KSh)	Lagos (KSh)	NairobiLagos (%)	Accra (KSh)	NairobiAccra (%)
count	7.000000	7.000000	7.000000	7.000000	7.000000
mean	6099.475714	13766.330000	28.410000	5735.435714	12.265714
std	6088.231699	27438.538704	118.925782	3587.333361	39.516125
min	500.000000	267.050000	-46.590000	554.510000	-40.050000
25%	3494.565000	3111.845000	-25.135000	3585.180000	-3.945000
50%	4348.980000	4330.490000	-17.260000	6028.990000	9.260000
75%	5788.485000	4828.230000	9.705000	7417.345000	17.560000
max	19281.250000	75886.620000	293.580000	11559.500000	89.420000

A brief sidenote to highlight the exchange rate between *Kenyan Shilling* and *Ghanaian Cedi* is significantly lower than the exchange rate with *Nigerian Naira*. The table is generally nice as an initial overview, but more analysis is needed to gain more insight, and so graphs were created.

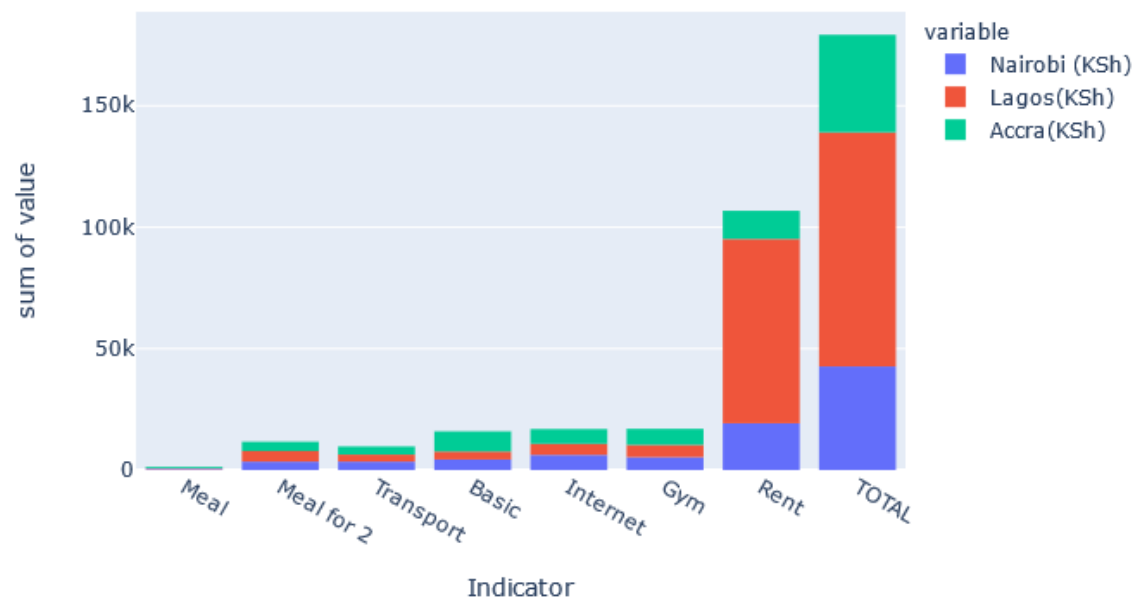## Histogram of Nairobi, Lagos and Accra Living Costs

Figure 4: Histogram of Indicator Price per City

Removing the total and rent rows to get a better view of the individual changes:

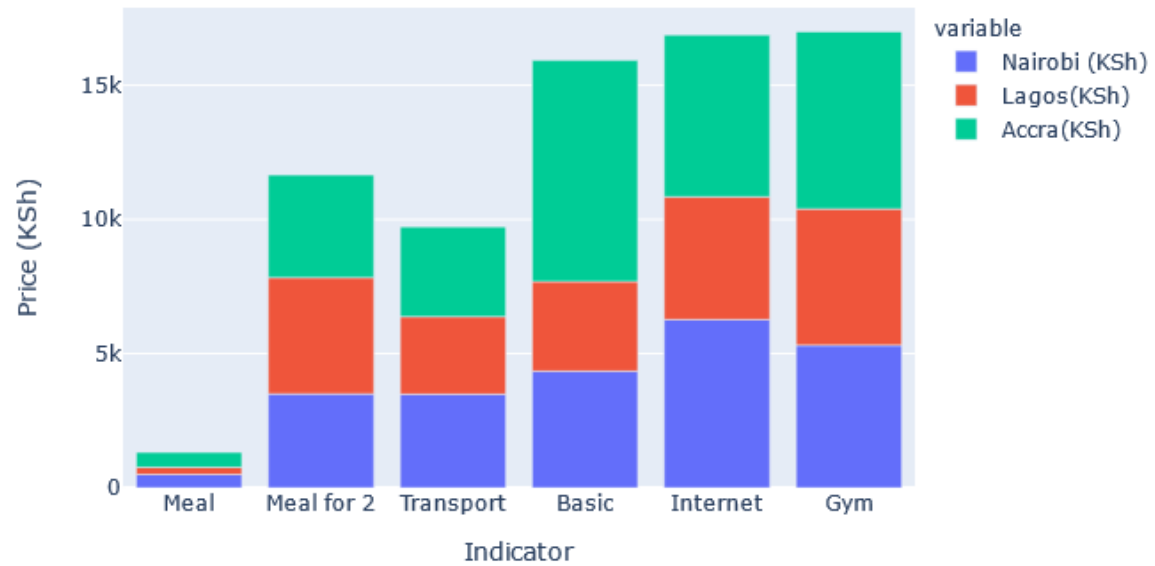## Bar of Nairobi, Lagos and Accra Living Costs

Figure 5 Rent indicator and Total bars removed:

From this, the rent in Lagos largely contributes to the high cost of living. The next plot showing the indicator percent difference further highlights this.
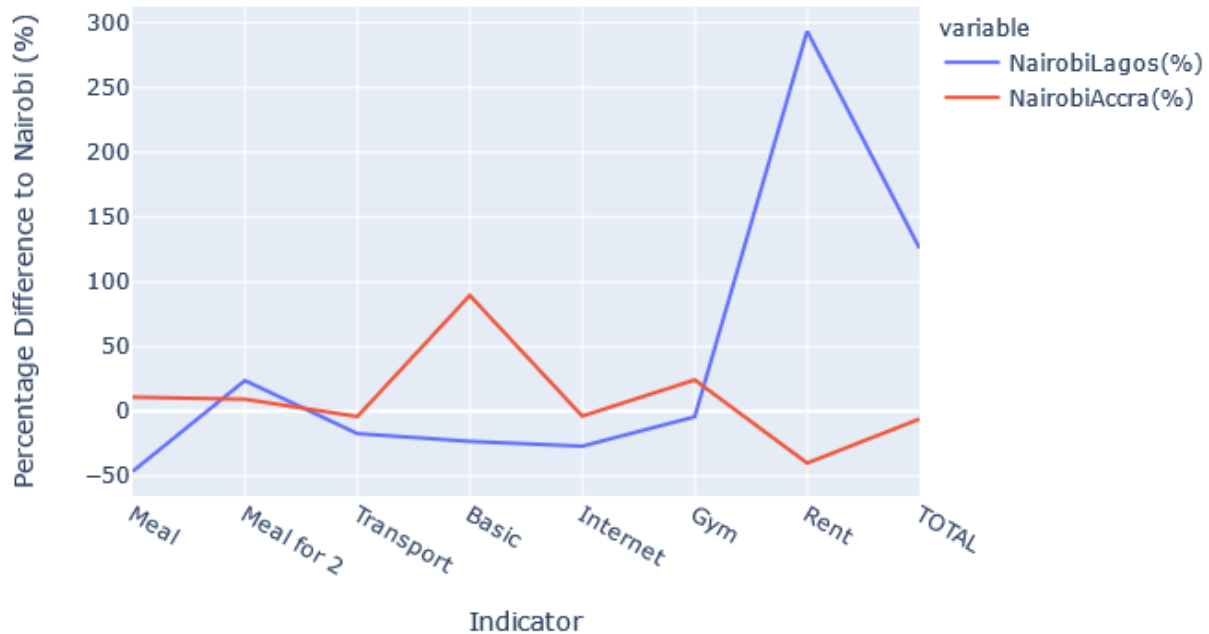
Figure 6: Line plot comparing Percentage Difference per indicator

Following the cost of living analysis, the next section will focus on recreational opportunities.

4.2   Foursquare Data

In this section, a surface-level analysis will be applied to the filtered venue data. Getting a feel of the categories, each category shall be counted and displayed before the removal of venues with missing data. A table showing the number of unique categories found in these 500 venues, and the top 5 venues with frequency can be seen below:

Table 8: Top 5 Unique Categories per City

City	Number of unique categories	Top 5 Categories	Frequency
Nairobi	31	Lounge	4
		Gym	4
		Post Office	4
		BBQ Joint	3
		Bar	2
Accra	31	Hotel	4
		Chinese Restaurant	4
		Snack Place	3

City		Plaza	3
		Bakery	3
Lagos	29	Soccer Field	6
		Bridge	4
		Park	3
		Bistro	3
		Fried Chicken Joint	2

At this point of the data science methodology, the initial broad categories from Foursquare API would be further specified by going one level down in the categories tree and identifying ideal entertainment and fun venues. Luckily, a function was created for this step and so a rerun would not be too much of a hassle. With *Arts and Entertainment* and *Nightlife* being the focus and the restaurant data being separated, the process is repeated.
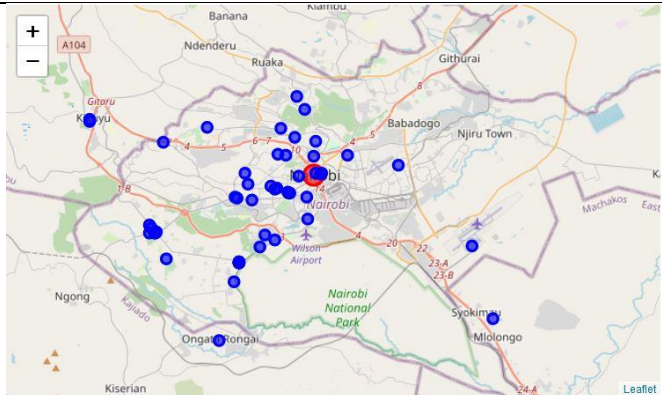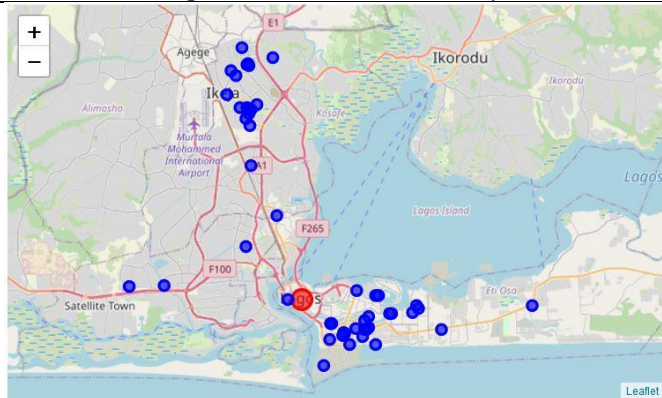
Table 9: Updated frequency Table of Venues

City	Number of unique categories	Top 5 Categories	Frequency
Nairobi	21	Lounge	11
		Post Office	11
		Bar	6
		Whisky Bar	4
		Nightclub	2
Accra	23	Lounge	10
		Casino	6
		Historic Site	4
		Beer Garden	3
		General Entertainment	2
Lagos	18	Convention Centre	15
		Art Gallery	6
		Nightclub	4
		Lounge	4
		Tennis Court	3

Well, Nairobi seems to have a lot of post offices, which can come in handy if moving to the West entails sending gifts. From a brief inspection, the categories for some of these venues are a bit curious. Comparing the results, however, Ghana seems to have a similar recreational category distribution as Nairobi, with the most unique categories. The final thing to do will be an analysis of the restaurants in each city, can you guess the top restaurant category?

Table 10: Restaurant Category Frequencies and Map

City	# of unique categories	Top 5 Categories	Frequency	Restaurant distribution across the city

Nairobi	27	Coffee Shop	8	
		BBQ Joint	6	
		Café	4	
		Fish & Chips Shop	4	
		Steakhouse	3	

Figure 7: Nairobi Restaurant Map

Accra	26	Hotel	7	
		Chinese Restaurant	5	
		Snack Place	4	
		Ethiopian Restaurant	4	
		Breakfast Spot	4	

Figure 8: Accra Restaurant Map

Lagos	26	Fast Food Restaurant	8	
		Brazilian Restaurant	7	
		Flower Shop	4	
		BBQ Joint	4	
		Bistro	2	

Figure 9: Lagos Restaurant Map

5 RESULTS AND DISCUSSION

Looking at the percent increase in the cost of living, although Accra has an **89.42%** increase in utilities for *Basic (Electricity, Heating, Cooling, Water, Garbage) for 85m2 Apartment*, the **293.58%** increase in Rent for *Lagos* makes it difficult to compare. This might be due to the high population density of the city, factoring in its notorious traffic and larger opportunities in its entertainment industry the stakeholder would have a difficult decision at hand.

And this is where the possibility of opening a restaurant, and overall personal fun and recreation comes into play. An in-depth analysis using clustering will be done in future studies. This section however did highlight a loopback required during the analysis, highlighting the need for agile solutions.

Looking at the Restaurant data was a bit interesting, let me guess your original most popular category was **African restaurant,** right? Lagos was the only place that had that in its top 5. Bear in mind these are all African cities, but for opening a restaurant the stakeholder has a choice. Accra presents it as not so popular, for a stakeholder looking for minimal competition that might be a good start. Lagos on the other hand seems to have a demand **(having African restaurants in an African city is not much of a qualifier as those counted might be all Nigerian/West African)**

6 CONCLUSION

The purpose of this capstone project was to compare major African cities in the quest for finding a place like home, with the possibility of adding to the city's multicultural restaurant scene. From the preliminary analysis, the cost of living in Accra compared to Nairobi is a little lower; however, living in Lagos is almost twice as expensive although it might have more growth opportunities entertainment-wise.

As previously stated, the test set used in this analysis was not much as the data available and the number of participants were not enough for a deeper analysis. Future considerations of this project would be to build on this initial analysis using a greater data source range. Google's API would be a good place to get location data as well and the cost can be overlooked for a more in-depth analysis.

7 REFERENCES

1. [Numbeo](#)
2. [Foursquare API Categories](#)
3. [Latitude Longitude Org](#)