



# Haiti Money Remittance Location Analysis

## 1 Introduction

### 1.1 Background

The **Republic of Haiti** is a country located on the island of Hispaniola in the Greater Antilles archipelago of the Caribbean Sea, to the east of Cuba and Jamaica and south of The Bahamas and the Turks and Caicos Islands. It occupies the western three-eighths of the island which it shares with the Dominican Republic. Haiti is 27,750 square kilometers (10,714 sq mi) in size, the third largest country in the Caribbean by area, and has an estimated population of 11.4 million, making it the most populous country in the Caribbean.

Historically poor and politically unstable, Haiti has the lowest Human Development Index in the Americas. Since the turn of the 21st century, the country has endured a *coup d'état*, which prompted a U.N. intervention, as well as a deadly earthquake that killed over 250,000.

Administratively, Haiti is divided into ten departments. The departments are listed below, with the departmental capital cities in parentheses.



1. Nord-Ouest (Port-de-Paix)
2. Nord (Cap-Haïtien)
3. Nord-Est (Fort-Liberté)
4. Artibonite (Gonaïves)
5. Centre (Hinche)
6. Ouest (Port-au-Prince)
7. Grand'Anse (Jérémie)
8. Nippes (Miragoâne)
9. Sud (Les Cayes)
10. Sud-Est (Jacmel)



The CIA World Factbook also states that "remittances are the primary source of foreign exchange, equaling one-fifth (20%) of GDP and representing more than five times the earnings from exports in 2012". The World Bank estimates that over 80% of college graduates from Haiti were living abroad in 2004.

## 1.2 Problem

As mentioned in the Background section Money Remittance is one of the main sources of income for Haiti. Based on this fact, it's important to identify areas of opportunity to open Money Remittance locations in strategic areas that can comply with the demand for this type of service.

## 2 Data

Based on the problem described several data source will be used for this project:

- Data of current locations obtained from one of the remittance company providers (private source) which will be used to understand which areas already have money remittance locations nearby.
- Foursquare API to obtain information on venues for the different Haiti departments for the analysis of possible locations opportunities.
- Wikipedia to obtain data of population per city and department which will help to analyze areas of opportunity.
- Google maps to obtain precise latitude and longitude coordinates.

## 3 Methodology

For a list of all cities and its population I used Wikipedia and we obtain below table (sample):



	Communes	Department	Arrondissement	Population
0	Abricots	Grand'Anse	Jérémie	34262
1	Acul-du-Nord	Nord	Acul-du-Nord	50844
2	Anse-à-Foleur	Nord-Ouest	Saint-Louis-du-Nord	27480
3	Anse-à-Galets	Ouest	Gonâve	56890
4	Anse-à-Veau	Nippes	Anse-à-Veau	31477
5	Anse-à-Pitres	Sud-Est	Belle-Anse	27415
6	Anse-d'Hainault	Grand'Anse	Anse d'Hainault	33103
7	Anse-Rouge	Artibonite	Gros-Morne	39463
8	Aquin	Sud	Aquin	94773
9	Arcahaie	Ouest	Arcahaie	118501
10	Arnaud	Nippes	Anse-à-Veau	18842
11	Arniquet	Sud	Port-Salut	26536

Which contains 140 entries. Still, as this project is focus on Department and to have a better understanding of the population, we removed “Communes” column, renamed “Arrondissement” column to be “City”, grouped the information by Department and sorted the data in descending order.

Department	City	Population
Ouest	20	3664620
Artibonite	15	1571020
Nord	19	922690
Sud	18	691590
Centre	12	678626
Nord-Ouest	10	662777
Sud-Est	10	575293
Grand'Anse	12	425878
Nord-Est	13	358277
Nippes	11	311497

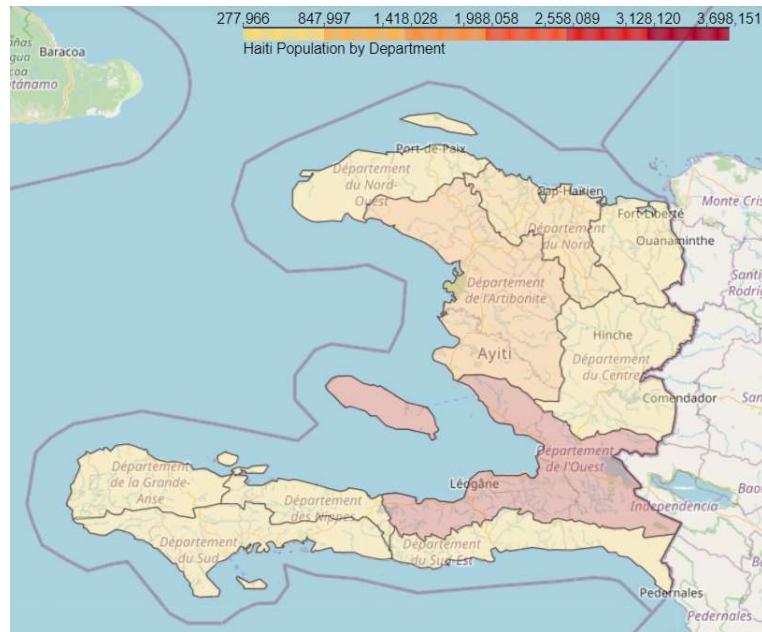
We can see the population is concentrated in Ouest Department.

Using Google maps to obtain coordinates for each Department and merged the data in one single dataframe:

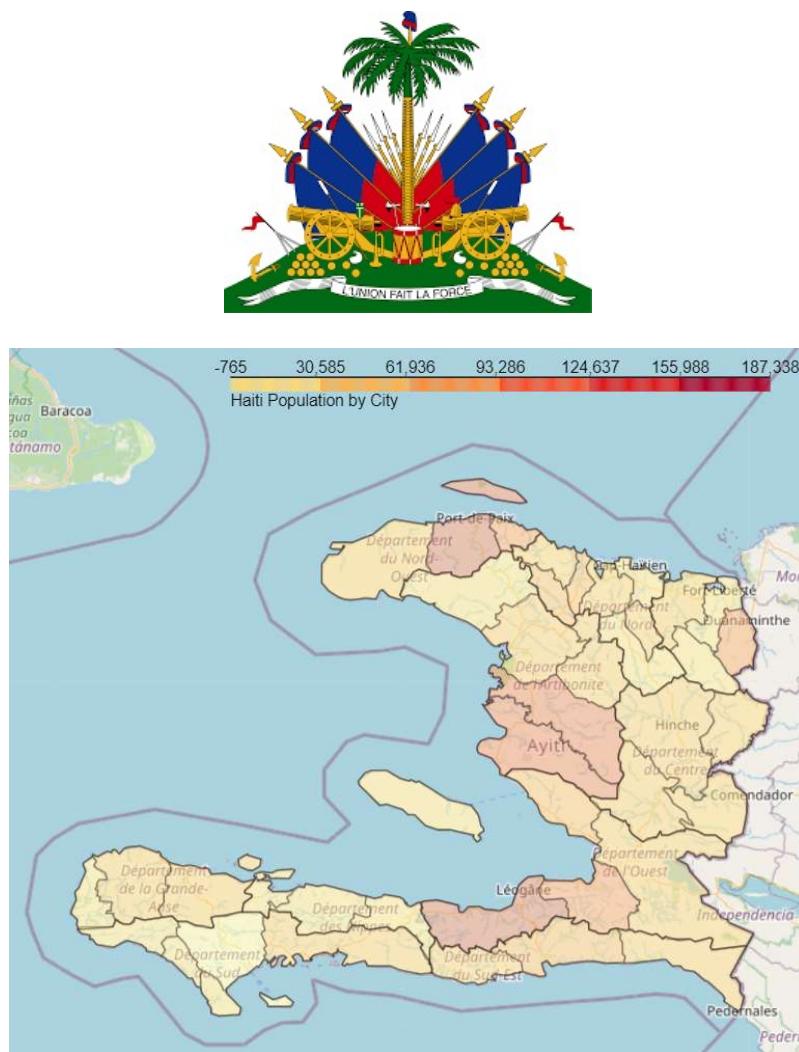


	Department	City	Population	Latitude	Longitude	Capital
0	Artibonite	15	1571020	19.362900	-72.425800	Gonaives
1	Centre	12	678626	18.958300	-72.046800	Hinche
2	Grand'Anse	12	425878	18.548900	-74.077000	Jeremie
3	Nippes	11	311497	18.399100	-73.418000	Miragoane
4	Nord	19	922690	19.568800	-72.189000	Cap-Haitien
5	Nord-Est	13	358277	19.489000	-71.857100	Fort Liberte
6	Nord-Ouest	10	662777	19.837400	-73.040500	Port de Paix
7	Ouest	20	3664620	18.593017	-72.308839	Port au Prince
8	Sud	18	691590	18.332000	-73.700700	Les Cayes
9	Sud-Est	10	575293	18.278400	-72.354800	Jacmel

I used Folium Choropleth to create a map to visualize Haiti population by Department:



Below image give us an understanding of concentrated population on city level.



### 3.1 Remittance Data Analysis

Data obtained from private resource where we can see location name, address, coordinates and general activity status. The data is for 1193 locations.

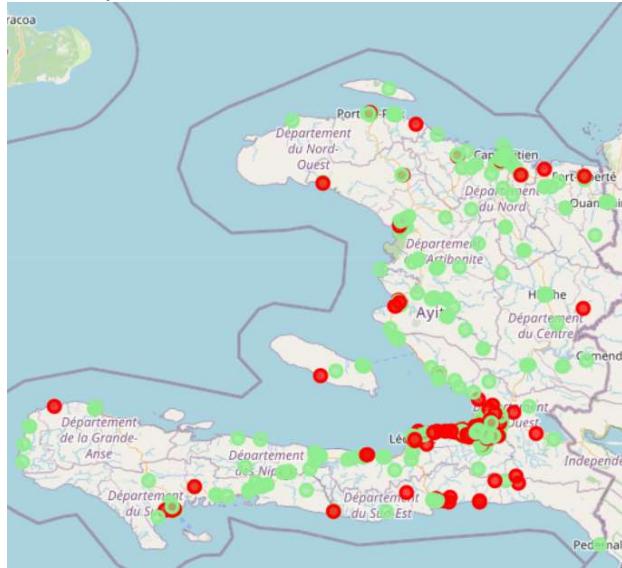
Country Code	Name	Address 1	Address 2	City	Department	Latitude	Longitude	Activity	
0	HT1-1	SOGEBANK PLACE GEFFRARD I	PLACE GEFFRARD I	13 RUE DES MIRACLES	PORT AU PRINCE	OUEST	0.000000	0.000000	Transacting
1	HT1-2	SOGEBANK RUE PAVEE	ANGLE RUES PAVEE ET MGR GUILLOUX		PORT AU PRINCE	OUEST	0.000000	0.000000	Transacting
2	HT1-3	SOGEBANK DELMAS AEROPORT	27, BOULEVARD TOUSSAINT LOUVER	IMMEUBLE SOGEFAC	DELMAS	OUEST	18.555463	-72.314754	Transacting
3	HT1-4	SOGEBANK AEROPORT I	BLVD TOUSSAINT LOUVERTURE		PORT AU PRINCE	OUEST	18.564796	-72.313508	Transacting
4	HT1-5	SOGEBANK AEROPORT II	AEROPORT II	ROUTE AEROPORT EN FACE DU PARC	PORT AU PRINCE	OUEST	0.000000	0.000000	Transacting
5	HT1-6	SOGEBANK LATHAN	LATHAN	ROUTE NATIONALE NUMERO 1 A COT	PORT AU PRINCE	OUEST	0.000000	0.000000	Transacting
6	HT1-7	SOGEBANK CROIX DES MISSIONS	CROIX DES MISSIONS	ROUTE NATIONALE NUMERO 1 AVANT	PORT AU PRINCE	OUEST	18.596591	-72.285090	Transacting
SOGEBANK PLATEAU									
df_HaitiLoc.shape									
(1193, 9)									

I grouped the data by Departments to have a better understanding of location distribution:



Department	Country Code	Name	Address 1	Address 2	City	Latitude	Longitude	Activity
ARTIBONITE	144	144	144	144	144	144	144	144
CENTRE	31	31	31	31	31	31	31	31
GRAND'ANSE	16	16	16	16	16	16	16	16
NIPPES	33	33	33	33	33	33	33	33
NORD	92	92	92	92	92	92	92	92
NORD-EST	20	20	20	20	20	20	20	20
NORD-OUEST	26	26	26	26	26	26	26	26
OUEST	726	726	726	726	726	726	726	726
SUD	54	54	54	54	54	54	54	54
SUD-EST	51	51	51	51	51	51	51	51

I used **folium** to visualize locations in Haiti in a map. I used color coding to easily identify locations with activity (green) and without activity (red).



I used Foursquare API to explore nearby venues for whole Haiti. It's atypical to do such a big search, but wanted a general view to provide to the stakeholders. That is why I used the radius of 150Km for the obtained coordinates for Haiti.

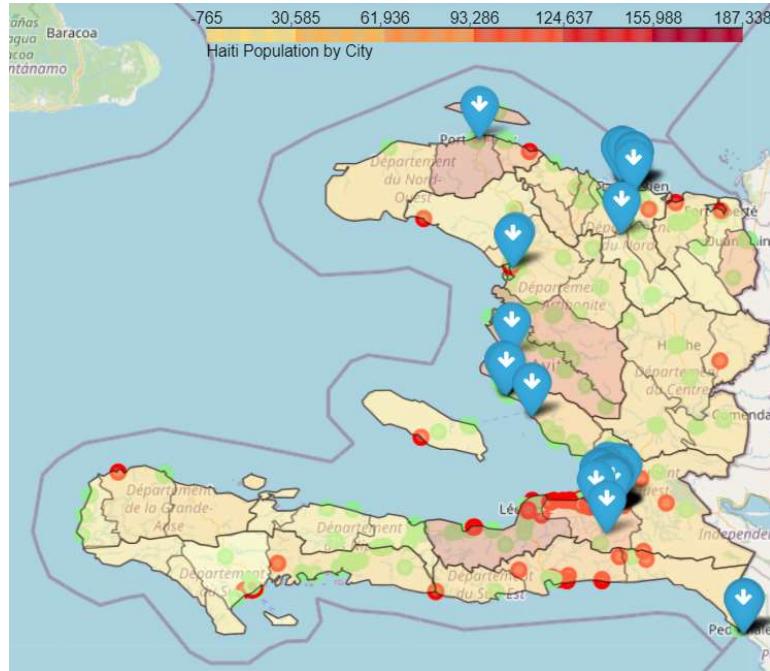
Below is a sample of list of venues obtained:

	name	categories	lat	lng
0	Wahoo Bay Beach	Resort	18.876689	-72.615515
1	Marie Beliard	Bakery	18.516036	-72.288455
2	Rebo Espresso	Coffee Shop	18.512118	-72.283136
3	ASU ROOFTOP Lounge	Lounge	18.521174	-72.300220
4	5 Coins (Centre Ville)	Restaurant	18.533747	-72.340001

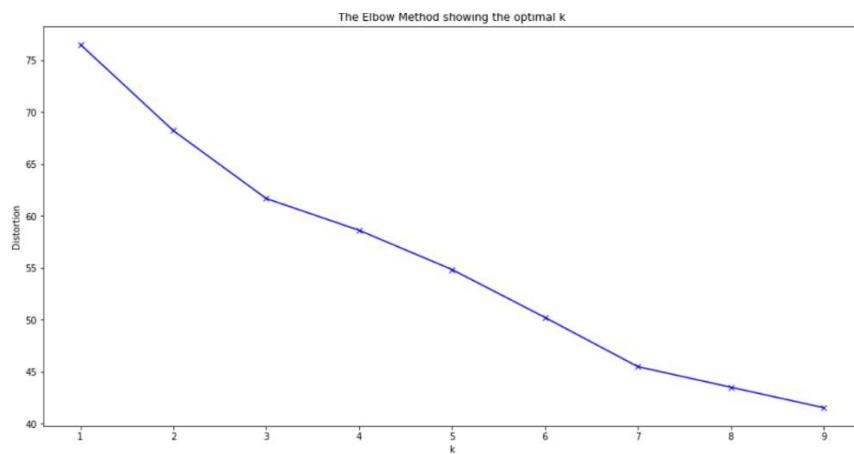
A total of 80 venues were returned with 42 unique categories.



I created map to show venues obtained in addition to locations and population by city, as it is easier to start visualizing gaps.



In order to create Venues clusters, I used the Elbow method to find the best K to utilize for K-means algorithm.



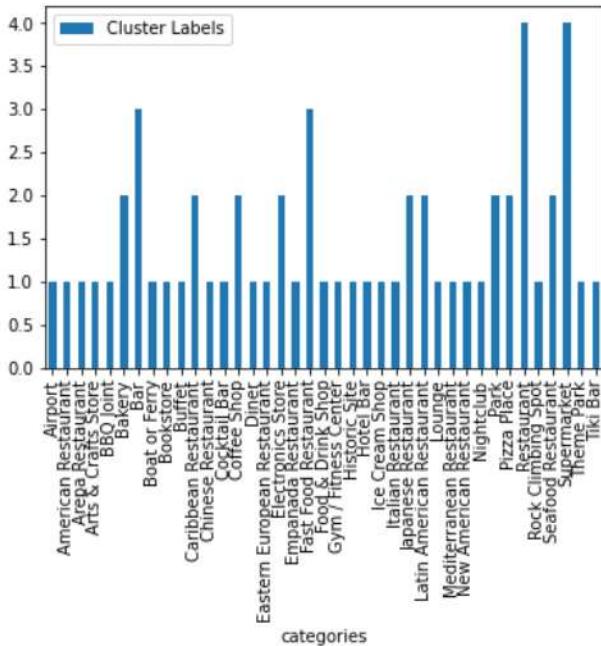
Unfortunately, the result is not 100% decisive, so I decided to use the value 4. And after running K-means algorithm, I merged the data to Venue table.



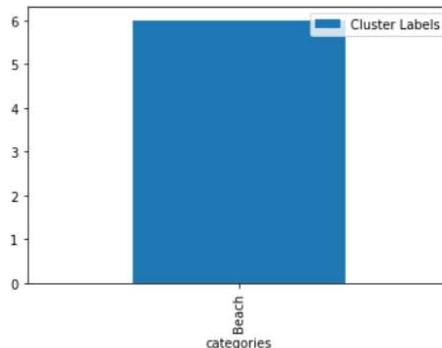
	Cluster Labels	name	categories	lat	lng
0	3	Wahoo Bay Beach	Resort	18.876689	-72.615515
1	0	Marie Beliard	Bakery	18.516036	-72.288455
2	0	Rebo Espresso	Coffee Shop	18.512118	-72.283136
3	0	ASU ROOFTOP Lounge	Lounge	18.521174	-72.300220
4	0	5 Coins (Centre Ville)	Restaurant	18.533747	-72.340001

I created a DataFrame and used a bar plot for each cluster to better understand which categories were included and rename the clusters accordingly.

### Cluster 0

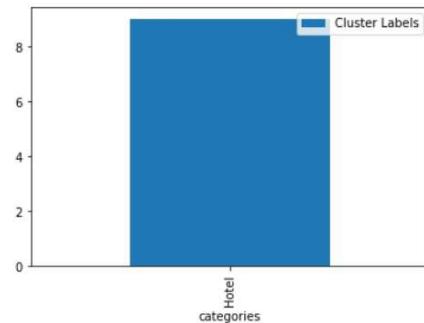


### Cluster 1

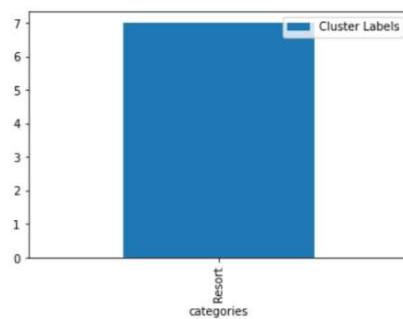




## Cluster 2



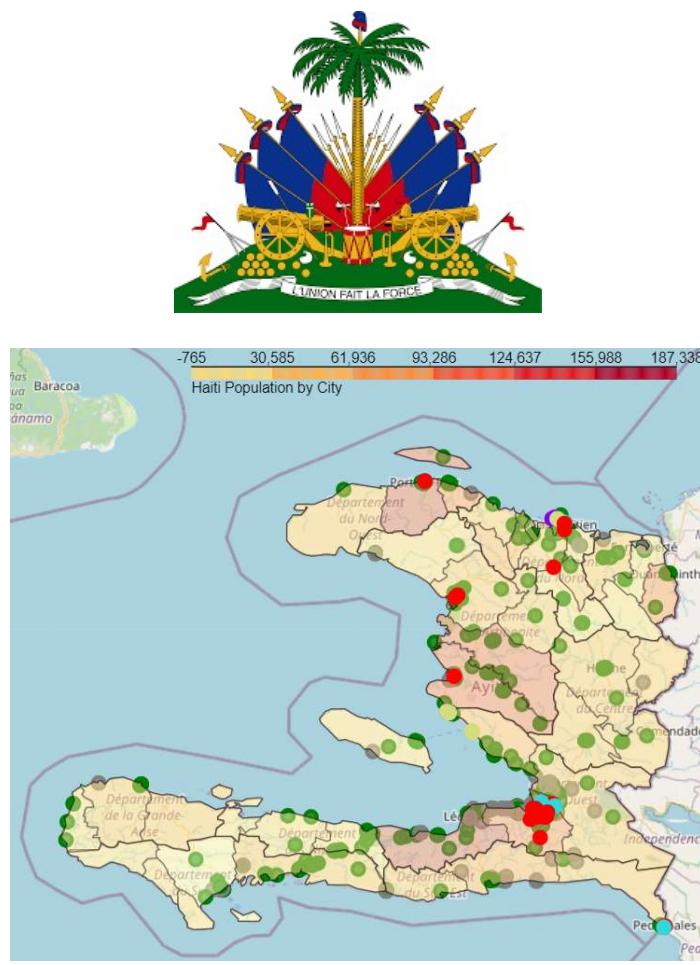
## Cluster 3



After reviewing each cluster, I updated the table with names for each cluster and obtained below table.

	Cluster Labels	name	categories	lat	lng
0	Resorts	Wahoo Bay Beach	Resort	18.876689	-72.615515
1	Restaurants, Supermarkets and other social venues	Marie Beliard	Bakery	18.516036	-72.288455
2	Restaurants, Supermarkets and other social venues	Rebo Espresso	Coffee Shop	18.512118	-72.283136
3	Restaurants, Supermarkets and other social venues	ASU ROOFTOP Lounge	Lounge	18.521174	-72.300220
4	Restaurants, Supermarkets and other social venues	5 Coins (Centre Ville)	Restaurant	18.533747	-72.340001

And updated map to show locations (with activity=green / without activity=grey) and venues in clusters.



We will review the venues at each department in the following section. The same steps were taken for each Department:

1. Create DataFrame for corresponding Department by locating the name of the Department in Haiti Location DataFrame.
2. Setting latitude and longitude for each Department (I decided to use coordinates obtained from Google maps).
3. Obtain venues using Foursquare API (radius varies by Department to obtain better results) and create a DataFrame based on the results.
4. Create map that includes venues, locations and population.
5. Use Elbow method to help identify the best K for clusters creation.
6. Use K-means algorithm to create clusters.
7. Add clusters to Department DataFrame.
8. Create a DataFrame and bar plot for each cluster to identify categories grouped in each cluster.
9. Rename each cluster.
10. Update cluster label in Department DataFrame.
11. Create map that includes venues, locations, population and clusters.

### 3.1.1 Ouest Department

We have 61% of the locations in Ouest which is expected as this Department is where the capital Port-au-Prince is located.

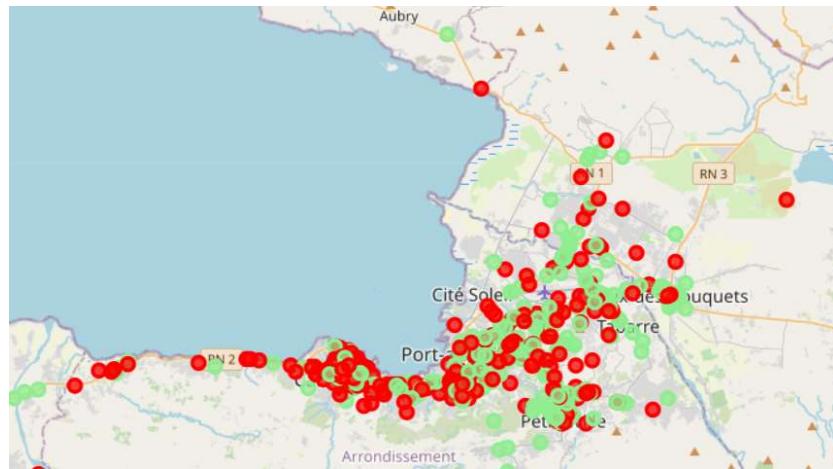
1. Create DataFrame for corresponding Department by locating the name of the Department in Haiti Location DataFrame.



(726, 9)

Country Code	Name	Address 1	Address 2	City	Department	Latitude	Longitude	Activity
0	HT1-1 SOGEBANK PLACE GEFFRARD I	PLACE GEFFRARD I	13 RUE DES MIRACLES	PORT AU PRINCE	OUEST	0.000000	0.000000	1
1	HT1-2 SOGEBANK RUE PAVEE	ANGLE RUES PAVEE ET MGR GUILLOUX		PORT AU PRINCE	OUEST	0.000000	0.000000	1
2	HT1-3 SOGEBANK DELMAS AEROPORT	27, BOULEVARD TOUSSAINT LOUVER	IMMEUBLE SOGEFAC	DELMAS	OUEST	18.555463	-72.314754	1
3	HT1-4 SOGEBANK AEROPORT I	BLVD TOUSSAINT LOUVERTURE		PORT AU PRINCE	OUEST	18.564786	-72.313508	1
4	HT1-5 SOGEBANK AEROPORT II	AEROPORT II	ROUTE AEROPORT EN FACE DU PARC	PORT AU PRINCE	OUEST	0.000000	0.000000	1

- Setting latitude and longitude for each Department (I decided to use coordinates obtained from Google maps).



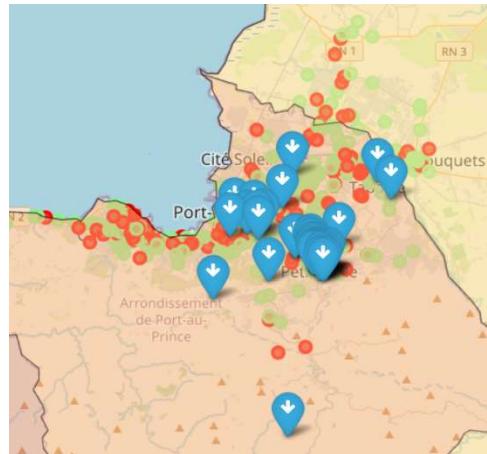
- Obtain venues using Foursquare API (radius varies by Department to obtain better results) and create a DataFrame based on the results.

	name	categories	lat	lng
0	Marie Beliard	Bakery	18.516036	-72.288455
1	ASU ROOFTOP Lounge	Lounge	18.521174	-72.300220
2	Rebo Espresso	Coffee Shop	18.512118	-72.283136
3	Patisserie Ste Claire	Bakery	18.535652	-72.320370
4	5 Coins (Centre Ville)	Restaurant	18.533747	-72.340001

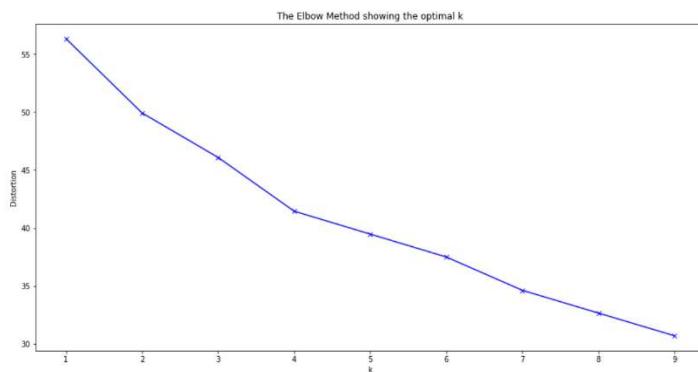
nearby\_venues\_Ouest.shape

(59, 4)

- Create map that includes venues, locations and population.



5. Use Elbow method to help identify the best K for clusters creation.

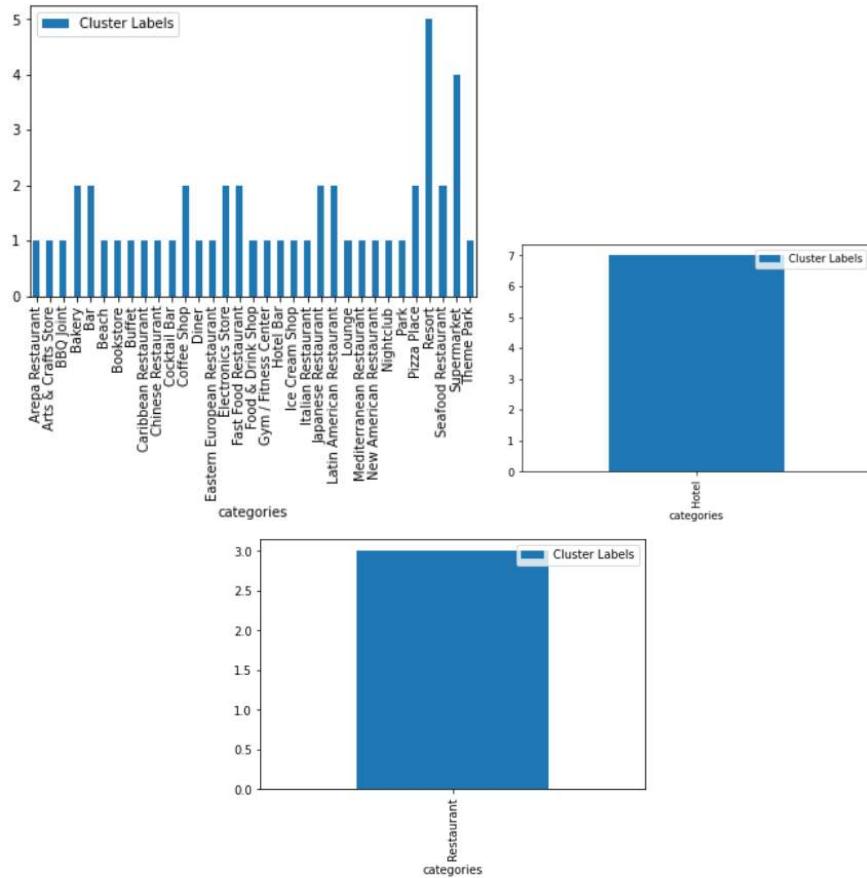


6. Use K-means algorithm to create clusters.

7. Add clusters to Department DataFrame.

	Cluster Labels	name	categories	lat	lng
0	0	Marie Beliard	Bakery	18.516036	-72.288455
1	0	ASU ROOFTOP Lounge	Lounge	18.521174	-72.300220
2	0	Rebo Espresso	Coffee Shop	18.512118	-72.283136
3	0	Patisserie Ste Claire	Bakery	18.535652	-72.320370
4	2	5 Coins (Centre Ville)	Restaurant	18.533747	-72.340001

8. Create a DataFrame and bar plot for each cluster to identify categories grouped in each cluster.

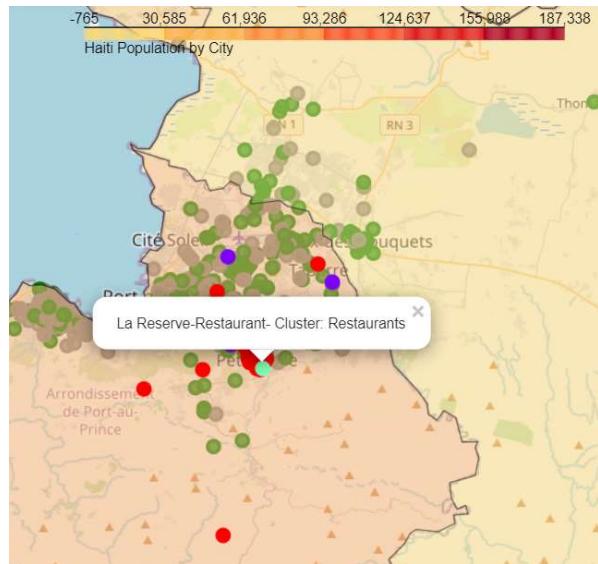


9. Rename each cluster.

10. Update cluster label in Department DataFrame.

	Cluster Labels		name	categories	lat	lng
0	Resort and Supermarkets		Marie Beliard	Bakery	18.516036	-72.288455
1	Resort and Supermarkets	ASU ROOFTOP Lounge		Lounge	18.521174	-72.300220
2	Resort and Supermarkets	Rebo Espresso	Coffee Shop	18.512118	-72.283136	
3	Resort and Supermarkets	Patisserie Ste Claire	Bakery	18.535652	-72.320370	
4	Restaurants	5 Coins (Centre Ville)	Restaurant	18.533747	-72.340001	

11. Create map that includes venues, locations, population and clusters.



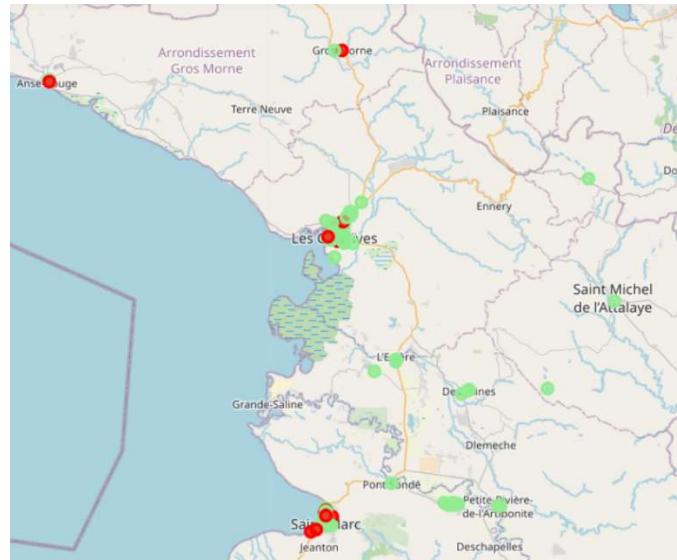
### 3.1.2 Artibonite Department

1. Create DataFrame for corresponding Department by locating the name of the Department in Haiti Location DataFrame.

(144, 9)

Country Code	Name	Address 1	Address 2	City	Department	Latitude	Longitude	Activity
0	SOGEBANK ST MARC	183, RUE LOUVERTURE		SAINT MARC	ARTIBONITE	19.108352	-72.701153	0
1	SOGEBANK GONAIVES I	RUE JEAN-JACQUES ET RUE T. LOU		GONAIVES	ARTIBONITE	19.447981	-72.694633	1
2	AGENCE REFERENCE 2000	GONAIVES		GONAIVES	ARTIBONITE	0.000000	0.000000	1
3	SOGEXPRESS ST MARC	183 RUE LOUVERTURE		SAINT MARC	ARTIBONITE	0.000000	0.000000	1
4	DGS COMMUNICATION GROS MORNE	ROUTE NATIONALE NUMERO 1		GROS MORNE	ARTIBONITE	0.000000	0.000000	1

2. Setting latitude and longitude for each Department (I decided to use coordinates obtained from Google maps).



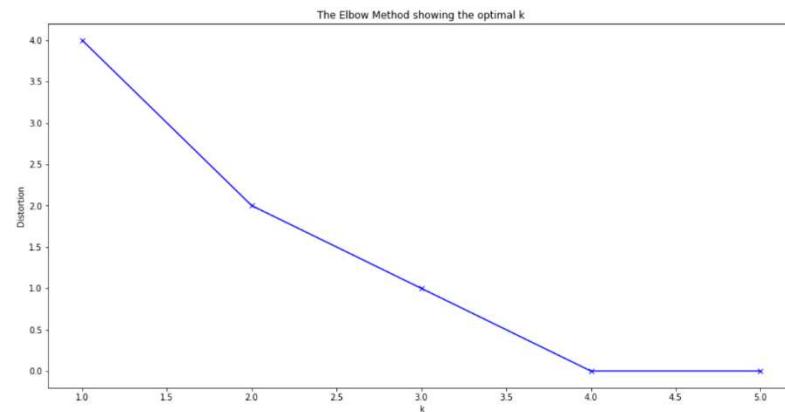
3. Obtain venues using Foursquare API (radius varies by Department to obtain better results) and create a DataFrame based on the results.

	name	categories	lat	lng
0	Citadelle La Ferrière	Historic Site	19.573498	-72.243862
1	Celeste Bar Resto	Restaurant	19.447856	-72.690723
2	Coin D'or	Fast Food Restaurant	19.455900	-72.678370
3	Kay Foun	New American Restaurant	19.106901	-72.697795
4	Ennery	Campground	19.488505	-72.485965

4. Create map that includes venues, locations and population.



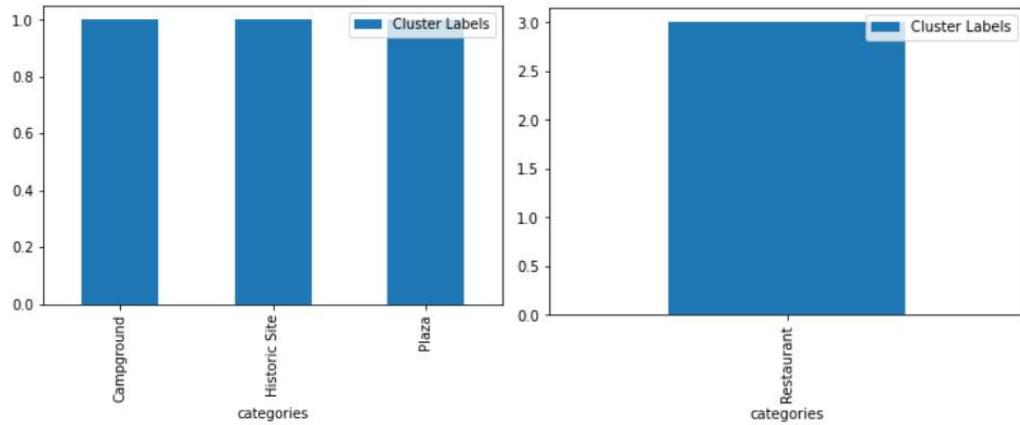
5. Use Elbow method to help identify the best K for clusters creation.



6. Use K-means algorithm to create clusters.
7. Add clusters to Department DataFrame.

Cluster Labels		name	categories	lat	lng
0	0	Citadelle La Ferrière	Historic Site	19.573498	-72.243862
1	1	Celeste Bar Resto	Restaurant	19.447856	-72.690723
2	1	Coin D'or	Restaurant	19.455900	-72.678370
3	1	Kay Foun	Restaurant	19.106901	-72.697795
4	0	Ennery	Campground	19.488505	-72.485965

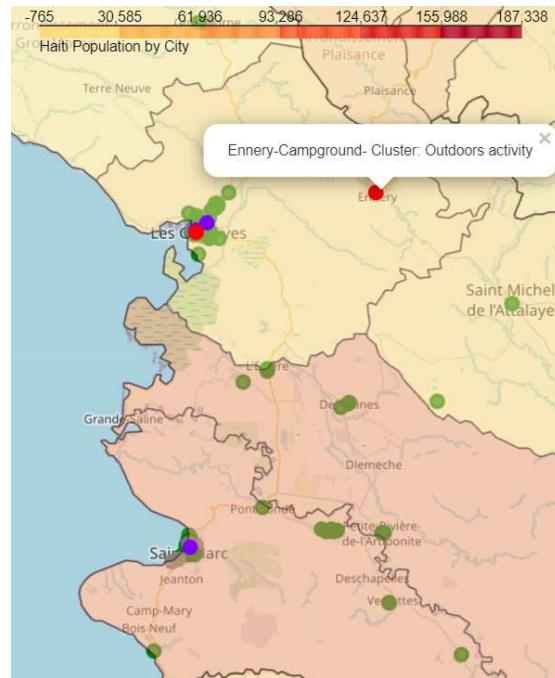
8. Create a DataFrame and bar plot for each cluster to identify categories grouped in each cluster.



9. Rename each cluster.
10. Update cluster label in Department DataFrame.

	Cluster Labels	name	categories	lat	lng
0	Outdoors activity	Citadelle La Ferrière	Historic Site	19.573498	-72.243862
1	Restaurants	Celeste Bar Resto	Restaurant	19.447856	-72.690723
2	Restaurants	Coin D'or	Restaurant	19.455900	-72.678370
3	Restaurants	Kay Foun	Restaurant	19.106901	-72.697795
4	Outdoors activity	Ennery	Campground	19.488505	-72.485965

11. Create map that includes venues, locations, population and clusters.



### 3.1.3 Centre Department

- Create DataFrame for corresponding Department by locating the name of the Department in Haiti Location DataFrame.

(31, 9)

	Country Code	Name	Address 1	Address 2	City	Department	Latitude	Longitude	Activity
0	HT1-105	DGS HINCHE	96 RUE STENIO VINCENT		HINCHE	CENTRE	0.0	0.0	1
1	HT1-116	HENRY NET CYBER CAFE	169 RUE CLAIRE HEUREUSE	RUE CLAIRE HEUREUSE MIREBALAIS	MIREBALAIS	CENTRE	0.0	0.0	1
2	HT1-163	DGS BELLADERES	BELLADERES		BELLADERE	CENTRE	0.0	0.0	1
3	HT1-189	SCHILO PHARMACIE	LASCAHOBAS		LASCAHOBAS	CENTRE	0.0	0.0	1
4	HT1-194	SOGE BANK MIREBALAIS	MIREBALAIS		MIREBALAIS	CENTRE	0.0	0.0	0

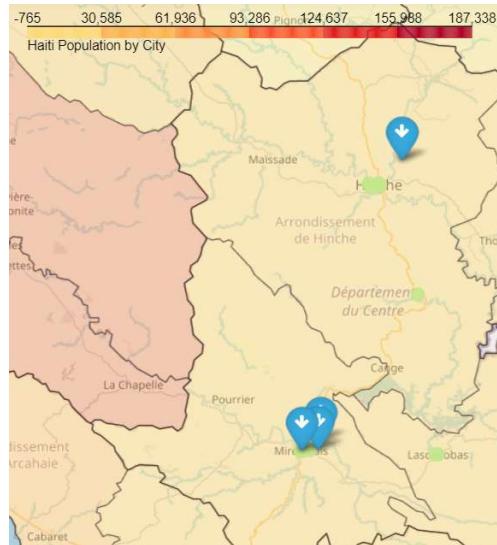
- Setting latitude and longitude for each Department (I decided to use coordinates obtained from Google maps).



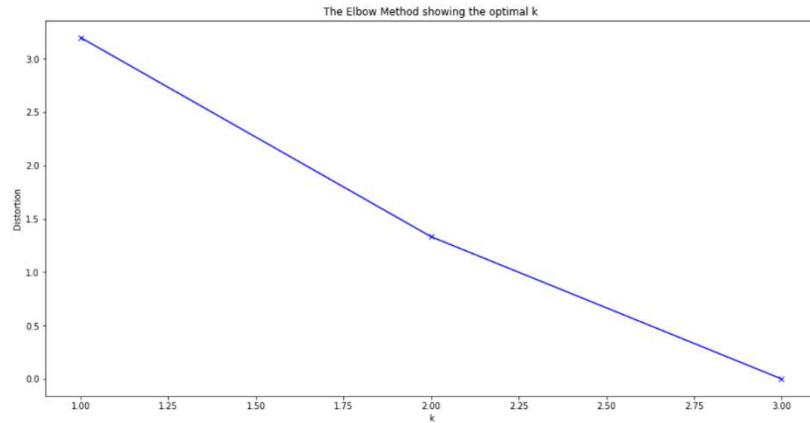
- Obtain venues using Foursquare API (radius varies by Department to obtain better results) and create a DataFrame based on the results.

	name	categories	lat	lng
0	Maguana Hotel	Hotel	19.173215	-71.981374
1	Wozo Plaza Hotel	Hotel	18.847140	-72.081423
2	Riviere Fer A Cheval	River	18.836615	-72.083535
3	Place Mirebalais	Park	18.834201	-72.104150
4	Parque Elias Piña	Park	18.876661	-71.702968

- Create map that includes venues, locations and population.



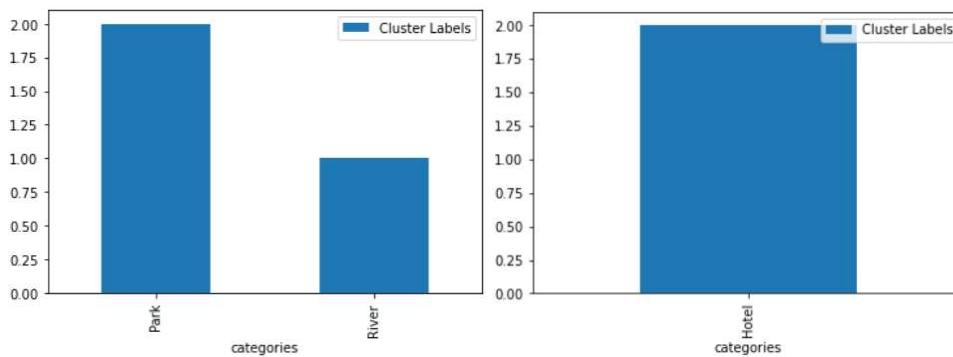
- Use Elbow method to help identify the best K for clusters creation.



6. Use K-means algorithm to create clusters.
7. Add clusters to Department DataFrame.

	Cluster Labels	name	categories	lat	lng
0	1	Maguana Hotel	Hotel	19.173215	-71.981374
1	1	Wozo Plaza Hotel	Hotel	18.847140	-72.081423
2	0	Riviere Fer A Cheval	River	18.836615	-72.083535
3	0	Place Mirebalais	Park	18.834201	-72.104150
4	0	Parque Elias Piña	Park	18.876661	-71.702968

8. Create a DataFrame and bar plot for each cluster to identify categories grouped in each cluster.
9. Rename each cluster.

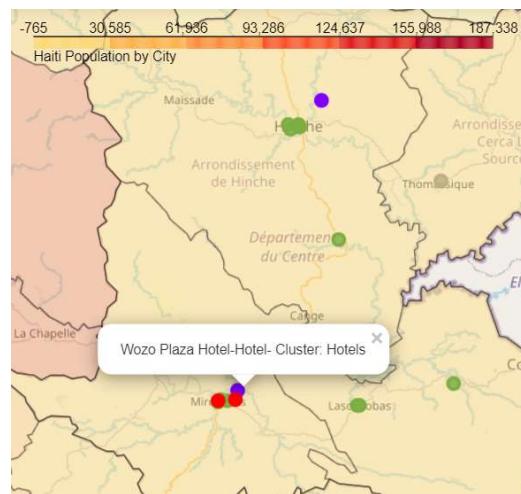


10. Update cluster label in Department DataFrame.



	Cluster Labels	name	categories	lat	lng
0	Hotels	Maguana Hotel	Hotel	19.173215	-71.981374
1	Hotels	Wozo Plaza Hotel	Hotel	18.847140	-72.081423
2	Outdoors activity	Riviere Fer A Cheval	River	18.836615	-72.083535
3	Outdoors activity	Place Mirebalais	Park	18.834201	-72.104150
4	Outdoors activity	Parque Elias Piña	Park	18.876661	-71.702968

11. Create map that includes venues, locations, population and clusters.



### 3.1.4 Grand'Anse Department

1. Create DataFrame for corresponding Department by locating the name of the Department in Haiti Location DataFrame.

(16, 9)

	Country Code	Name	Address 1	Address 2	City	Department	Latitude	Longitude	Activity
0	HT1-71	L OISEAU CYBER CAFE	ROUTE NATIONALE 2		DAME MARIE	GRAND'ANSE	18.560625	-74.419303	1
1	HT1-90	SOGEBANK JEREMIE	GRAND RUE		JEREMIE	GRAND'ANSE	0.000000	0.000000	0
2	HT1-92	SOGEXPRESS JEREMIE	JEREMIE		JEREMIE	GRAND'ANSE	0.000000	0.000000	1
3	HT1-203	DEPOT PA NOU	11,RUE GEFFRARD DAME MARIE		DAME MARIE	GRAND'ANSE	0.000000	0.000000	1
4	HT1-243	LORY CONFORT 2	25,RUE HORTENSIO MERLET	SUR LA PLACE DE LA CATHEDRALE	JEREMIE	GRAND'ANSE	18.645005	-74.113884	0

2. Setting latitude and longitude for each Department (I decided to use coordinates obtained from Google maps).



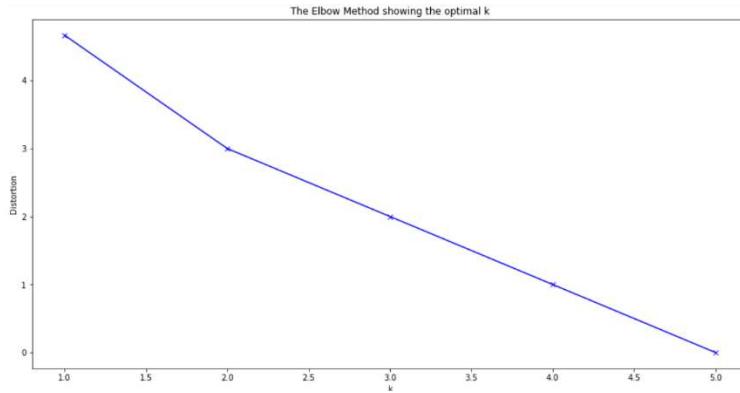
3. Obtain venues using Foursquare API (radius varies by Department to obtain better results) and create a DataFrame based on the results.

	name	categories	lat	lng
0	Carrefour Bac Jeremie	Bus Station	18.634427	-74.110206
1	Parc Santa Helena	Soccer Field	18.638556	-74.114824
2	Jeremie Airport	Airport	18.662799	-74.170899
3	Romelo's Sur Cap Suddinner	Restaurant	18.652510	-74.123970
4	Le Dame-Marien Resto	Restaurant	18.560894	-74.421110

4. Create map that includes venues, locations and population.



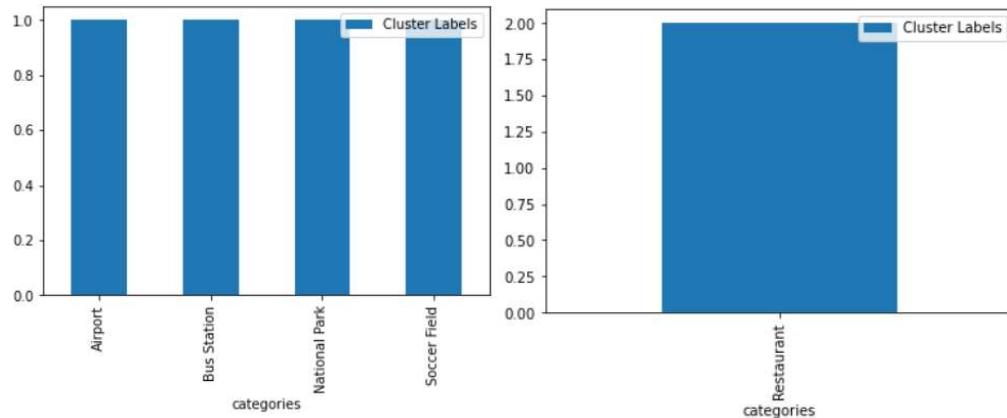
5. Use Elbow method to help identify the best K for clusters creation.



6. Use K-means algorithm to create clusters.
7. Add clusters to Department DataFrame.

	Cluster Labels	name	categories	lat	lng
0	0	Carrefour Bac Jeremie	Bus Station	18.634427	-74.110206
1	0	Parc Santa Helena	Soccer Field	18.638556	-74.114824
2	0	Jeremie Airport	Airport	18.662799	-74.170899
3	1	Romelo's Sur Cap Suddinner	Restaurant	18.652510	-74.123970
4	1	Le Dame-Marien Resto	Restaurant	18.560894	-74.421110

8. Create a DataFrame and bar plot for each cluster to identify categories grouped in each cluster.



9. Rename each cluster.
10. Update cluster label in Department DataFrame.



	Cluster Labels	name	categories	lat	lng
0	Outdoors activity and Transportation	Carrefour Bac Jeremie	Bus Station	18.634427	-74.110206
1	Outdoors activity and Transportation	Parc Santa Helena	Soccer Field	18.638556	-74.114824
2	Outdoors activity and Transportation	Jeremie Airport	Airport	18.662799	-74.170899
3	Restaurants	Romelo's Sur Cap Suddinner	Restaurant	18.652510	-74.123970
4	Restaurants	Le Dame-Marien Resto	Restaurant	18.560894	-74.421110

11. Create map that includes venues, locations, population and clusters.



### 3.1.5 Nippes Department

1. Create DataFrame for corresponding Department by locating the name of the Department in Haiti Location DataFrame.

(33, 9)

Country Code	Name	Address 1	Address 2	City	Department	Latitude	Longitude	Activity
0	HT1-21 SOGEBANK MIRAGOANE	MIRAGOANE	CARREFOUR DESRUISSEAUX	MIRAGOANE	NIPPES	0.000000	0.000000	0
1	HT1-60 SOGEXPRESS MIRAGOANE	ROUTE NATIONALE NUMERO 2	MIRAGOANE	MIRAGOANE	NIPPES	0.000000	0.000000	1
2	HT1-93 DEPOT ETERNEL GIN BON DOS	10 FOND DES NEGRES		FONDS DES NEGRES	NIPPES	0.100000	0.000000	1
3	HT1-119 KING COMMUNICATION 1	ANGLE RUE DE LA PLACE GRAND RU	MIRAGOANE	MIRAGOANE	NIPPES	0.000000	0.000000	1
4	HT1-173 MACATY MULTI SERVICES	MORISSEAU, LAZILE		LASILE	NIPPES	19.089189	-72.444879	1

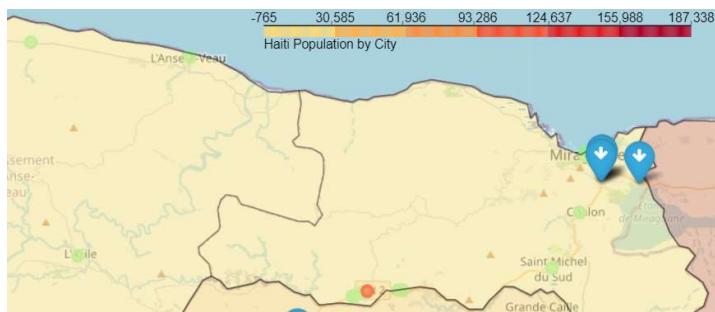
2. Setting latitude and longitude for each Department (I decided to use coordinates obtained from Google maps).



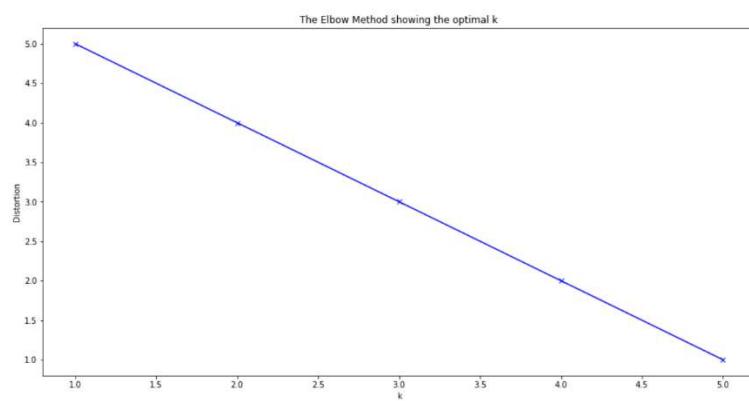
- Obtain venues using Foursquare API (radius varies by Department to obtain better results) and create a DataFrame based on the results.

	name	categories	lat	lng
0	Tiz Bar Resto	Restaurant	18.428709	-73.079952
1	Morne Coma	Mountain	18.325745	-73.275410
2	Carrefour Des Ruisseaux	Pedestrian Plaza	18.431420	-73.079948
3	Tiz Market	Flea Market	18.428755	-73.080115
4	Chez Den Restaurant	Caribbean Restaurant	18.431273	-73.079752

- Create map that includes venues, locations and population.



- Use Elbow method to help identify the best K for clusters creation.

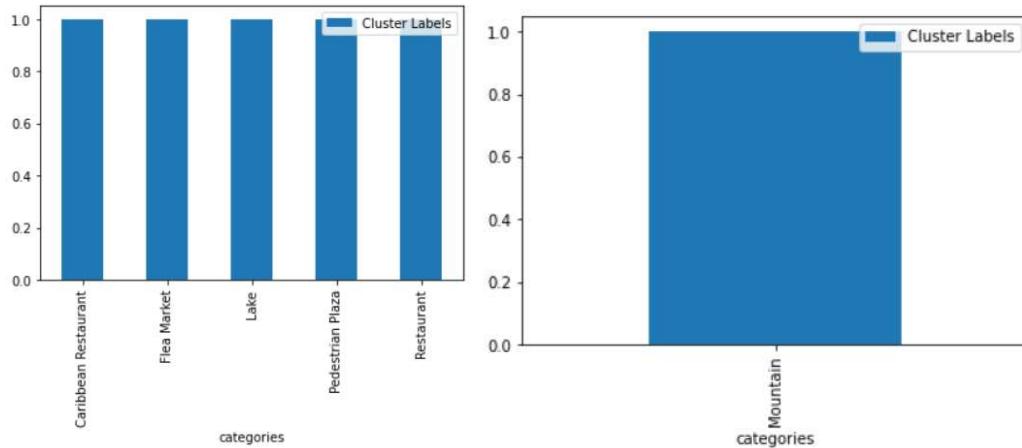




6. Use K-means algorithm to create clusters.
7. Add clusters to Department DataFrame.

	Cluster Labels	name	categories	lat	lng
0	0	Tiz Bar Resto	Restaurant	18.428709	-73.079952
1	1	Morne Coma	Mountain	18.325745	-73.275410
2	0	Carrefour Des Ruisseaux	Pedestrian Plaza	18.431420	-73.079948
3	0	Tiz Market	Flea Market	18.428755	-73.080115
4	0	Chez Den Restaurant	Caribbean Restaurant	18.431273	-73.079752
5	0	Etang De Miragoane	Lake	18.427593	-73.055928

8. Create a DataFrame and bar plot for each cluster to identify categories grouped in each cluster.



9. Rename each cluster.
10. Update cluster label in Department DataFrame.

	Cluster Labels	name	categories	lat	lng
0	Restaurants and Outdoors activity	Tiz Bar Resto	Restaurant	18.428709	-73.079952
1	Outdoors activity	Morne Coma	Mountain	18.325745	-73.275410
2	Restaurants and Outdoors activity	Carrefour Des Ruisseaux	Pedestrian Plaza	18.431420	-73.079948
3	Restaurants and Outdoors activity	Tiz Market	Flea Market	18.428755	-73.080115
4	Restaurants and Outdoors activity	Chez Den Restaurant	Caribbean Restaurant	18.431273	-73.079752

11. Create map that includes venues, locations, population and clusters.



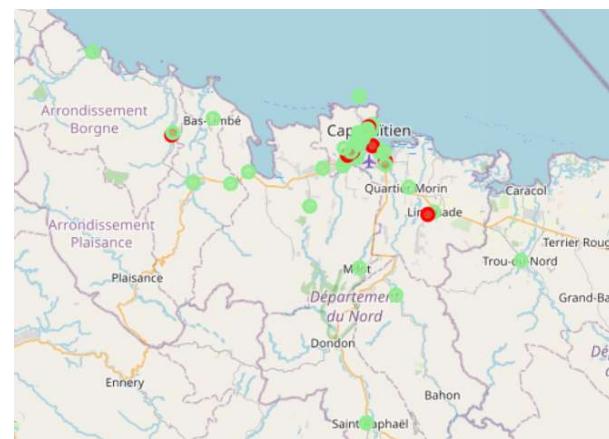
### 3.1.6 Nord Department

1. Create DataFrame for corresponding Department by locating the name of the Department in Haiti Location DataFrame.

(92, 9)

	Country Code	Name	Address 1	Address 2	City	Department	Latitude	Longitude	Activity
0	HT1-15	SOGEBANK CAP 1	RUE 11 A		CAP HAITIEN	NORD	-19.757953	-72.200228	1
1	HT1-28	SOGEXPRESS CAP 1	RUE 11A		CAP HAITIEN	NORD	0.000000	0.000000	1
2	HT1-32	SOGEBANK ST MICHEL	CAP HAITIEN		CAP HAITIEN	NORD	0.000000	0.000000	1
3	HT1-44	CABINE SOGEXPRESS VERTIERES	VERTIERES		CAP HAITIEN	NORD	0.000000	0.000000	1
4	HT1-45	MB PHARMA #58,RUE ESPAGNOLE			CAP HAITIEN	NORD	19.759732	-72.203632	1

2. Setting latitude and longitude for each Department (I decided to use coordinates obtained from Google maps).



3. Obtain venues using Foursquare API (radius varies by Department to obtain better results) and create a DataFrame based on the results.

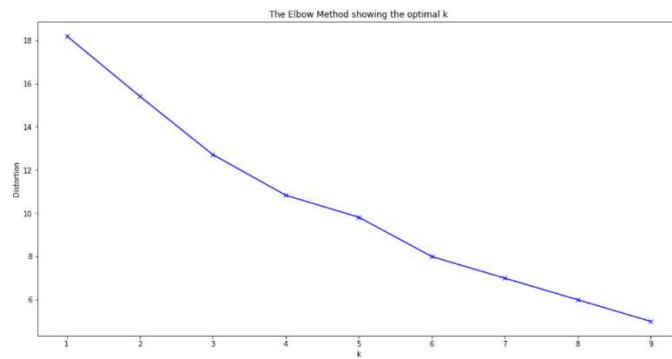


	name	categories	lat	lng
0	Citadelle La Ferrière	Historic Site	19.573498	-72.243862
1	La Kay Restaurant	Caribbean Restaurant	19.767594	-72.194401
2	Adrenaline Beach	Beach	19.786472	-72.242096
3	Dragon's Breath Flight Line	Rock Climbing Spot	19.787099	-72.246543
4	Allure Of The Seas	Boat or Ferry	19.784029	-72.249821

4. Create map that includes venues, locations and population.



5. Use Elbow method to help identify the best K for clusters creation.

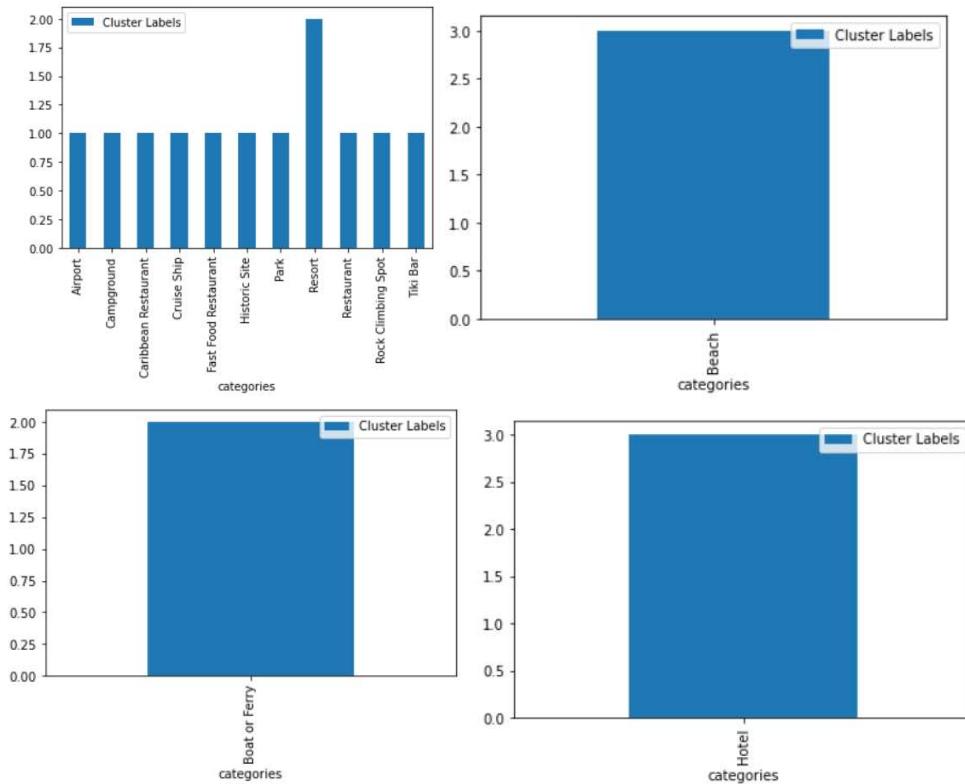


6. Use K-means algorithm to create clusters.
7. Add clusters to Department DataFrame.



Cluster Labels		name	categories	lat	lng
0	0	Citadelle La Ferrière	Historic Site	19.573498	-72.243862
1	0	La Kay Restaurant	Caribbean Restaurant	19.767594	-72.194401
2	1	Adrenaline Beach	Beach	19.786472	-72.242096
3	0	Dragon's Breath Flight Line	Rock Climbing Spot	19.787099	-72.246543
4	2	Allure Of The Seas	Boat or Ferry	19.784029	-72.249821

8. Create a DataFrame and bar plot for each cluster to identify categories grouped in each cluster.

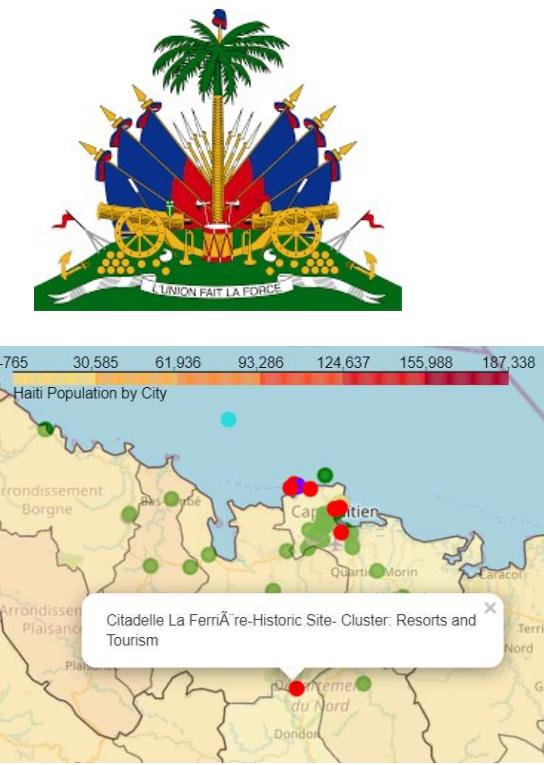


9. Rename each cluster.

10. Update cluster label in Department DataFrame.

Cluster Labels		name	categories	lat	lng
0	Resorts and Tourism	Citadelle La Ferrière	Historic Site	19.573498	-72.243862
1	Resorts and Tourism	La Kay Restaurant	Caribbean Restaurant	19.767594	-72.194401
2	Beach	Adrenaline Beach	Beach	19.786472	-72.242096
3	Resorts and Tourism	Dragon's Breath Flight Line	Rock Climbing Spot	19.787099	-72.246543
4	Water Activity	Allure Of The Seas	Boat or Ferry	19.784029	-72.249821

11. Create map that includes venues, locations, population and clusters.



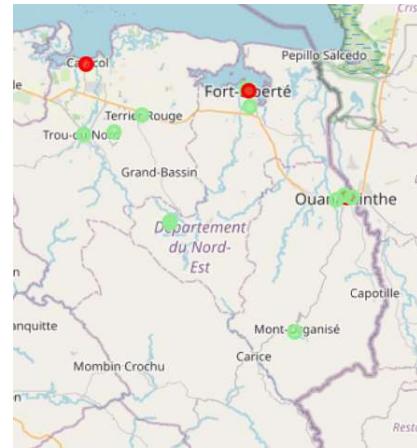
### 3.1.7 Nord-Est Department

1. Create DataFrame for corresponding Department by locating the name of the Department in Haiti Location DataFrame.

(20, 9)

Country Code	Name	Address 1	Address 2	City	Department	Latitude	Longitude	Activity
0 HT1-95	SOGEBANK OUANAMINTHE	ANGLE RUES ESPAGNOLE & NOTRE D		OUANAMINTHE	NORD-EST	19.550231	-71.723933	0
1 HT1-291	CAISSE POPULAIRE LE DAUPHIN CP	11, RUE CLUGNY FORT-LIBERTE		FORT LIBERTE	NORD-EST	19.646171	-71.834341	1
2 HT1-309	KPTAT PERCHES	EN FACE DE LA PLACE PUBLIQUE		PERCHES	NORD-EST	19.522474	-71.924214	1
3 HT1-310	KPSEK MONT ORGANISE	MONT-ORGANISE		MONT ORGANISE	NORD-EST	19.405893	-71.783189	1
4 HT1-318	HU ENTREPRISE	RUE ST CHARLES	87, RUE ST CHARLES	TROU DU NORD	NORD-EST	19.617331	-72.022179	1

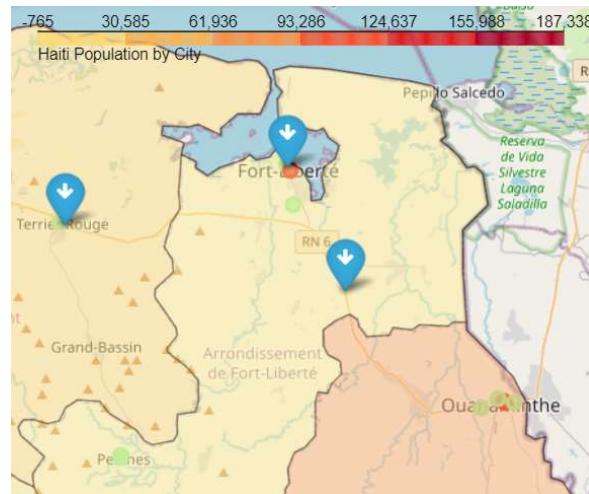
2. Setting latitude and longitude for each Department (I decided to use coordinates obtained from Google maps).



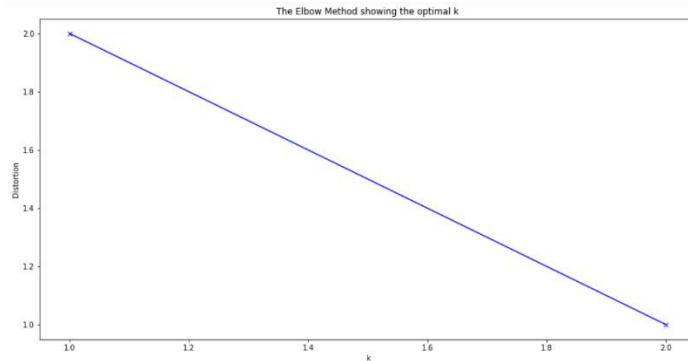
3. Obtain venues using Foursquare API (radius varies by Department to obtain better results) and create a DataFrame based on the results.

	name	categories	lat	lng
0	Fort Liberté, Haiti	Scenic Lookout	19.664927	-71.837245
1	Morne Casse	Mountain	19.604307	-71.807365
2	faeton Beach	Beach	19.636711	-71.953575

4. Create map that includes venues, locations and population.



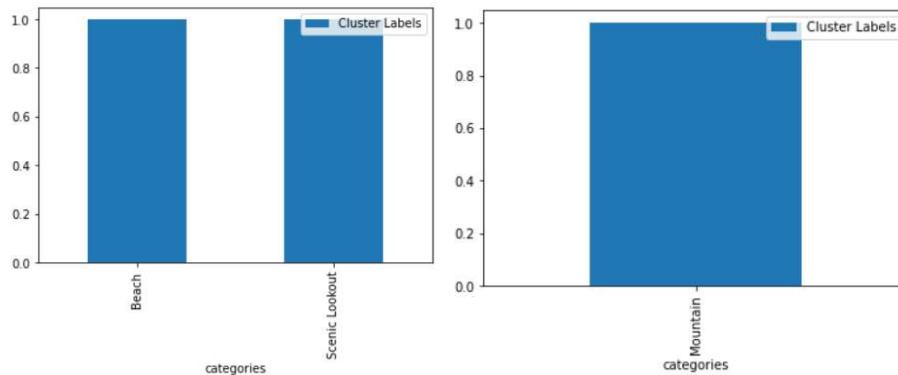
5. Use Elbow method to help identify the best K for clusters creation.



6. Use K-means algorithm to create clusters.
7. Add clusters to Department DataFrame.

	Cluster Labels	name	categories	lat	lng
0	0	Fort Liberté, Haiti	Scenic Lookout	19.664927	-71.837245
1	1	Morne Casse	Mountain	19.604307	-71.807365
2	0	faeton Beach	Beach	19.636711	-71.953575

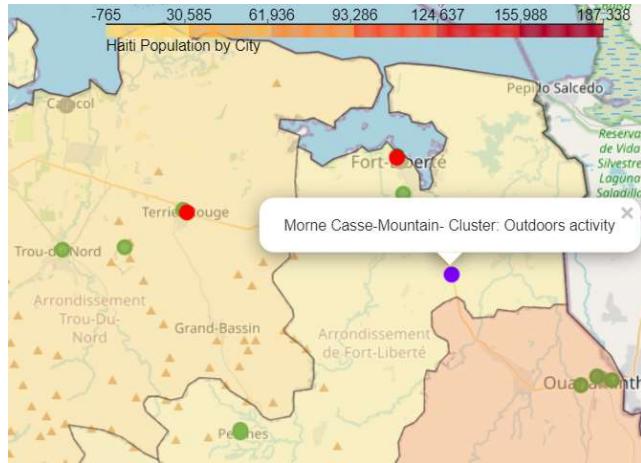
8. Create a DataFrame and bar plot for each cluster to identify categories grouped in each cluster.



9. Rename each cluster.
10. Update cluster label in Department DataFrame.

	Cluster Labels	name	categories	lat	lng
0	Beach and Tourism	Fort Liberté, Haiti	Scenic Lookout	19.664927	-71.837245
1	Outdoors activity	Morne Casse	Mountain	19.604307	-71.807365
2	Beach and Tourism	faeton Beach	Beach	19.636711	-71.953575

11. Create map that includes venues, locations, population and clusters.



### 3.1.8 Nord-Ouest Department

1. Create DataFrame for corresponding Department by locating the name of the Department in Haiti Location DataFrame.

(26, 9)

	Country Code	Name	Address 1	Address 2	City	Department	Latitude	Longitude	Activity
0	HT1-31	SOGEXPRESS PORT DE PAIX 1	RUE STENIO VINCENT		PORT DE PAIX	NORD-OUEST	0.000000	0.000000	1
1	HT1-87	INFOTEL MULTISERVICES	MARE ROUGE MOLE ST NICOLAS	15 RUE LA PAIX	PORT DE PAIX	NORD-OUEST	1.000000	0.000000	1
2	HT1-88	SOGEXPRESS PORT DE PAIX 2	2, RUE DESSALINES	A COTE DU BUREAU POSTAL	PORT DE PAIX	NORD-OUEST	19.939239	-72.830195	1
3	HT1-136	DGS PORT AU PAIX	PORT-DE-PAIX 72, rue Sténio Vincent		PORT DE PAIX	NORD-OUEST	0.000000	0.000000	1
4	HT1-162	DGS SAINT LOUIS DU NORD	SAINT LOUIS DU NORD		SAINT LOUIS DU NORD	NORD-OUEST	0.000000	0.000000	1

2. Setting latitude and longitude for each Department (I decided to use coordinates obtained from Google maps).



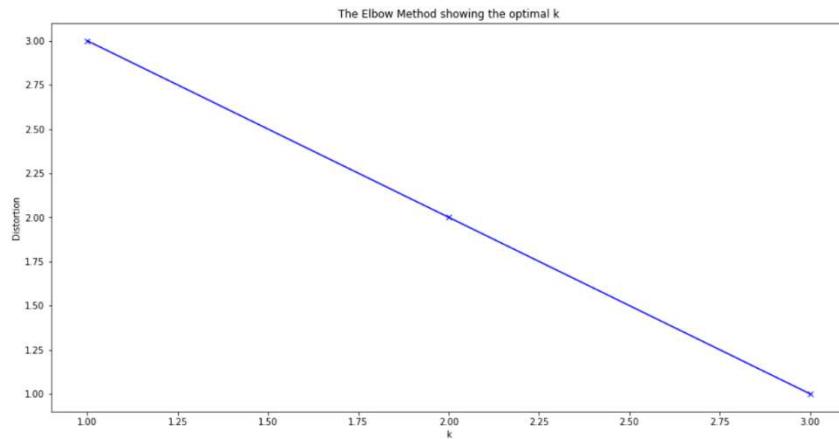
3. Obtain venues using Foursquare API (radius varies by Department to obtain better results) and create a DataFrame based on the results.

	name	categories	lat	lng
0	Abaka Bay	Resort	18.094167	-73.702026
1	Gelée Beach	Beach	18.181293	-73.767581
2	Hot Spot	Fast Food Restaurant	18.204678	-73.756530
3	Pointe Sable Beach	Beach	18.099404	-73.939159
4	Pen Dore	Burger Joint	18.192869	-73.748329

4. Create map that includes venues, locations and population.



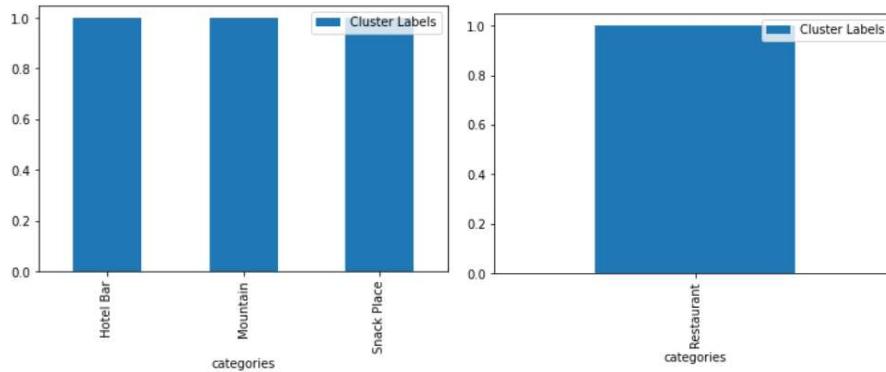
5. Use Elbow method to help identify the best K for clusters creation.



6. Use K-means algorithm to create clusters.
7. Add clusters to Department DataFrame.

	Cluster Labels	name	categories	lat	lng
0	0	RENDEZ-VOUS Club Hotel	Hotel Bar	19.945531	-72.826646
1	0	Seven Eleven [Centre Ville]	Snack Place	19.938031	-72.829735
2	1	Solarium Bistro	Restaurant	19.990118	-72.959310
3	0	Lanou	Mountain	19.765045	-72.910970

8. Create a DataFrame and bar plot for each cluster to identify categories grouped in each cluster.



9. Rename each cluster.
10. Update cluster label in Department DataFrame.

	Cluster Labels	name	categories	lat	lng
0	Bar and Snacks	RENDEZ-VOUS Club Hotel	Hotel Bar	19.945531	-72.826646
1	Bar and Snacks	Seven Eleven [Centre Ville]	Snack Place	19.938031	-72.829735
2	Restaurants	Solarium Bistro	Restaurant	19.990118	-72.959310
3	Bar and Snacks	Lanou	Mountain	19.765045	-72.910970



## 11. Create map that includes venues, locations, population and clusters.



### 3.1.9 Sud Department

- Create DataFrame for corresponding Department by locating the name of the Department in Haiti Location DataFrame.

(54, 9)

	Country Code	Name	Address 1	Address 2	City	Department	Latitude	Longitude	Activity
0	HT1-19	SOGEBANK CAYES	105, RUE STENIO VINCENT	PRES DE LA MAIRIE	LES CAYES	SUD	18.194956	-73.748136	1
1	HT1-43	SOGEXPRESS CAYES 1	105, RUE STENIO VINCENT		LES CAYES	SUD	18.194956	-73.748136	1
2	HT1-63	CARAIBES INTER MULTI SERVICES	RUE DR HYPPOLITE # 39	ROUTE NATIONALE 2	GRAND ANSE	SUD	18.640344	-74.117531	1
3	HT1-64	THE FELIX BUSINESS1 VIEUX BOUR	88 RUE LAZELE		AQUIN	SUD	18.282674	-73.392129	1
4	HT1-81	AGENCE DEUX MAPOUS	65 AVENUE CARTAGENA	ROUTE DEUX MAPOUS	LES CAYES	SUD	18.194523	-73.742642	1

- Setting latitude and longitude for each Department (I decided to use coordinates obtained from Google maps).

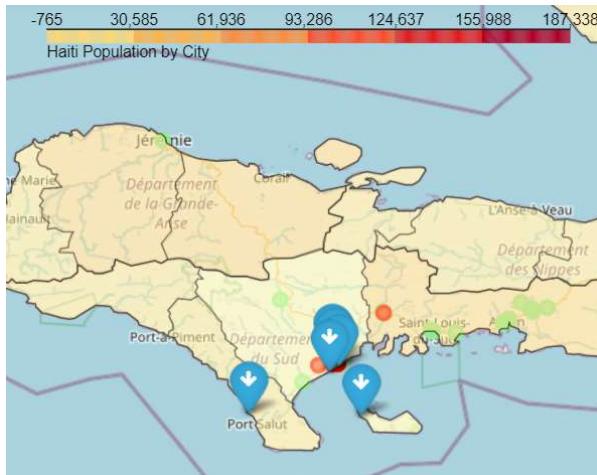




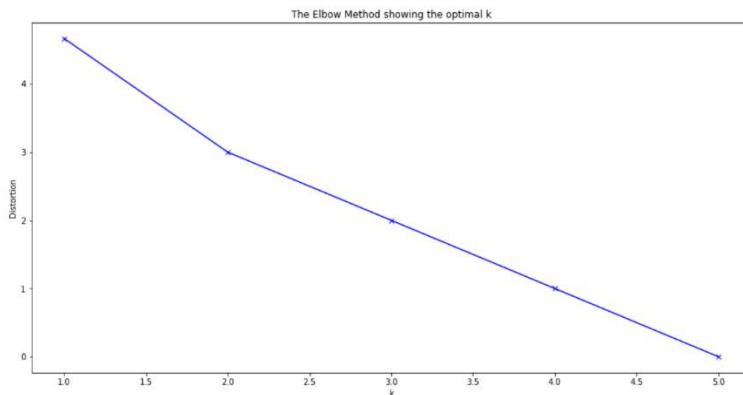
3. Obtain venues using Foursquare API (radius varies by Department to obtain better results) and create a DataFrame based on the results.

	name	categories	lat	lng
0	Abaka Bay	Resort	18.094167	-73.702026
1	Gelée Beach	Beach	18.181293	-73.767581
2	Hot Spot	Fast Food Restaurant	18.204678	-73.756530
3	Pointe Sable Beach	Beach	18.099404	-73.939159
4	Pen Dore	Burger Joint	18.192869	-73.748329

4. Create map that includes venues, locations and population.



5. Use Elbow method to help identify the best K for clusters creation.

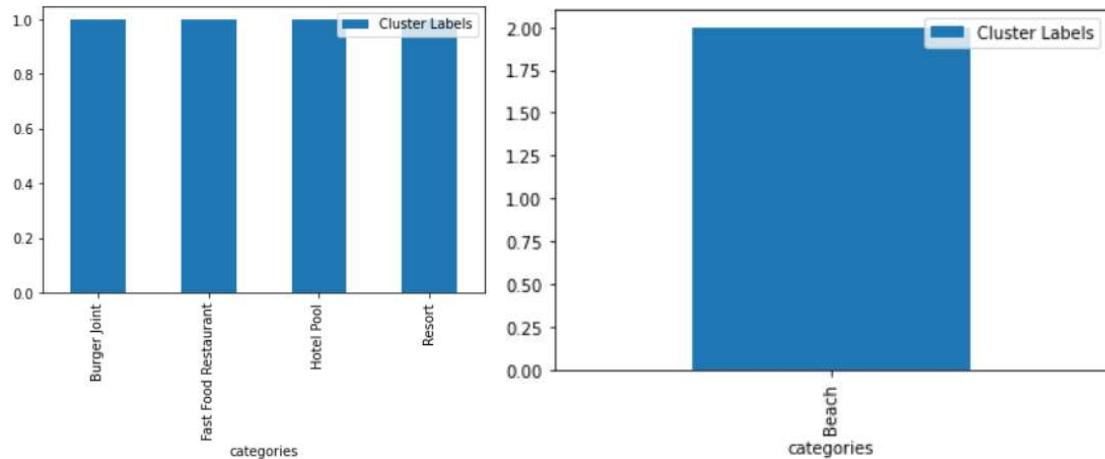


6. Use K-means algorithm to create clusters.
7. Add clusters to Department DataFrame.



	Cluster Labels	name	categories	lat	lng
0	0	Abaka Bay	Resort	18.094167	-73.702026
1	1	Gelée Beach	Beach	18.181293	-73.767581
2	0	Hot Spot	Fast Food Restaurant	18.204678	-73.756530
3	1	Pointe Sable Beach	Beach	18.099404	-73.939159
4	0	Pen Dore	Burger Joint	18.192869	-73.748329

8. Create a DataFrame and bar plot for each cluster to identify categories grouped in each cluster.



9. Rename each cluster.

10. Update cluster label in Department DataFrame.

	Cluster Labels	name	categories	lat	lng
0	Food Venues	Abaka Bay	Resort	18.094167	-73.702026
1	Beach	Gelée Beach	Beach	18.181293	-73.767581
2	Food Venues	Hot Spot	Fast Food Restaurant	18.204678	-73.756530
3	Beach	Pointe Sable Beach	Beach	18.099404	-73.939159
4	Food Venues	Pen Dore	Burger Joint	18.192869	-73.748329

11. Create map that includes venues, locations, population and clusters.



### 3.1.10 Sud-Est Department

1. Create DataFrame for corresponding Department by locating the name of the Department in Haiti Location DataFrame.

(51, 9)

	Country Code	Name	Address 1	Address 2	City	Department	Latitude	Longitude	Activity
0	HT1-14	SOGE BANK JACMEL	JACMEL	RUE LIBERTE	JACMEL	SUD-EST	0.000000	0.000000	1
1	HT1-38	SOGE EXPRESS JACMEL	RUE NOZIRELE LHERISSON		JACMEL	SUD-EST	0.000000	0.000000	1
2	HT1-104	PETER S SHOP	54 RUE STENIO VINCENT		JACMEL	SUD-EST	18.234327	-72.532361	0
3	HT1-151	JEANTY BUREAU DE CHANGE	CAP ROUGE		JACMEL	SUD-EST	0.000000	0.000000	1
4	HT1-152	PETER S SHOP MARIGOT	VALLEE DE JACMEL		JACMEL	SUD-EST	18.268656	-72.665951	0

2. Setting latitude and longitude for each Department (I decided to use coordinates obtained from Google maps).

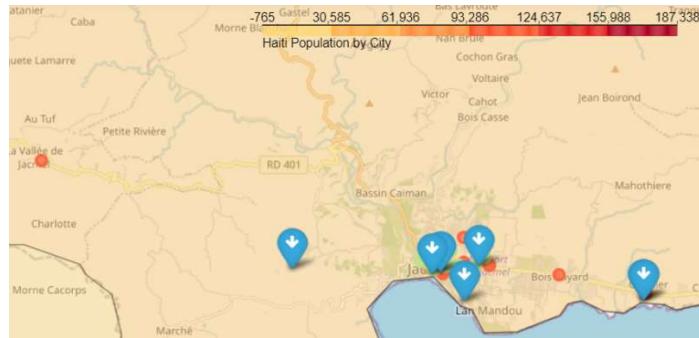


3. Obtain venues using Foursquare API (radius varies by Department to obtain better results) and create a DataFrame based on the results.

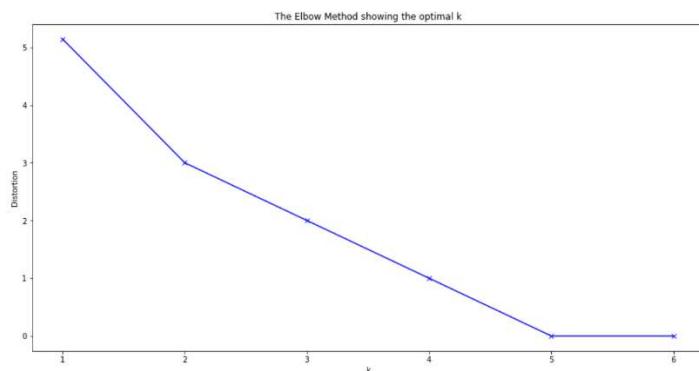
	name	categories	lat	lng
0	Hotel Cyvadier Restaurant, Jacmel	Caribbean Restaurant	18.224976	-72.467048
1	Cap Lamandou Hotel	Hotel	18.224636	-72.526185
2	Hotel Florita	Hotel	18.233394	-72.536721
3	Jacmel, Haiti	Airport Terminal	18.235721	-72.521422
4	Belvédère	Music Venue	18.234024	-72.534226



4. Create map that includes venues, locations and population.



5. Use Elbow method to help identify the best K for clusters creation.

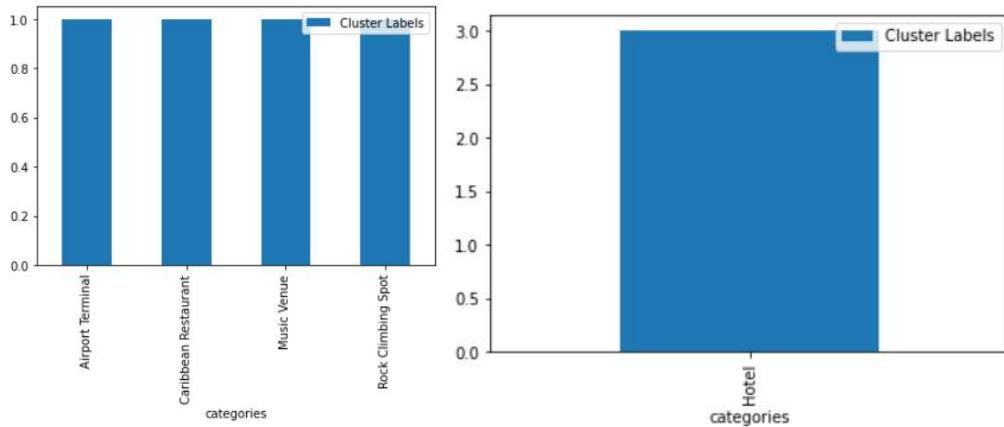


6. Use K-means algorithm to create clusters.

7. Add clusters to Department DataFrame.

	Cluster Labels	name	categories	lat	lng
0	0	Hotel Cyvadier Restaurant, Jacmel	Caribbean Restaurant	18.224976	-72.467048
1	1	Cap Lamandou Hotel	Hotel	18.224636	-72.526185
2	1	Hotel Florita	Hotel	18.233394	-72.536721
3	0	Jacmel, Haiti	Airport Terminal	18.235721	-72.521422
4	0	Belvédère	Music Venue	18.234024	-72.534226

8. Create a DataFrame and bar plot for each cluster to identify categories grouped in each cluster.

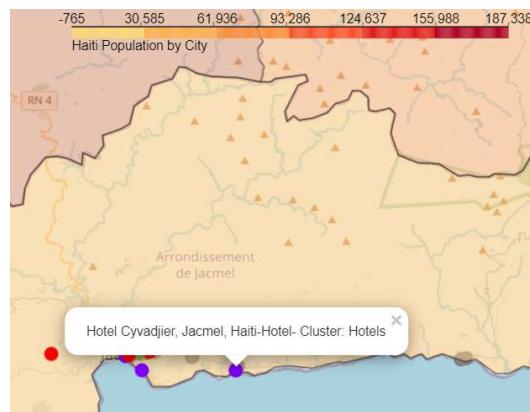


9. Rename each cluster.

10. Update cluster label in Department DataFrame.

	Cluster Labels	name	categories	lat	lng
0	Restaurants and Outdoors activity	Hotel Cyvadier Restaurant, Jacmel	Caribbean Restaurant	18.224976	-72.467048
1	Hotels	Cap Lamandou Hotel	Hotel	18.224636	-72.526185
2	Hotels	Hotel Florita	Hotel	18.233394	-72.536721
3	Restaurants and Outdoors activity	Jacmel, Haiti	Airport Terminal	18.235721	-72.521422
4	Restaurants and Outdoors activity	Belvédère	Music Venue	18.234024	-72.534226

11. Create map that includes venues, locations, population and clusters.



## 4 Results

The final map for Haiti and for each Department provides visibility of possible gaps where Money Remittance locations could be a good opportunity for a Money Remittance enterprise and gain for Haitian community.



As additional points, the analysis provided other inputs for the enterprise to review, analyze and optimize their current locations distribution.

## 5 Discussion

The original goal was to review Haiti as a whole, I went a little deeper by reviewing the data on Department level. Still, based on the results it's clear that a deeper review is necessary either on city level or even better on commune level to obtain more accurate data.

There were also several data missing:

- Locations with No Value in Activity, for this project I made the assumption these locations were indeed transacting.
- 271 locations either didn't have geo coordinates or the ones provided are incorrect (not Haiti). This caused the map results to be incomplete.

In addition, while reviewing the locations by Department it was clear that several coordinates were incorrect, as locations that should appear in one Department showed in a different Department in the map.

## 6 Conclusion

There are several opportunities for the stakeholders on different areas:

- Data clean-up to ensure coordinates and addresses are accurate.
- Current locations very close to other locations which affects activity/productivity. They should review with local team to analyze the cases and better resource usage.
- Work with local team to review potential zones in which a location could be enabled to attract more customers or even a new category of customers.

## 7 References

1. [Haiti - Wikipedia](#)
2. [List of cities in Haiti - Wikipedia](#)
3. [Haiti - Google Maps](#)
4. [Developer | Foursquare](#)