Prospects of a starting a Radiology Consultation Agency in Tamilnadu state, India

1.Discussion & Background of the Business problem

1.1 Introduction/Background:

Tamilnadu is the second developed state in India with a total poulation of 78.3Million. Atomic Energy Regulatory Board(AERB),Mumbai, India is the Government Organization to regularize Diagnostic Radiology Equipment across the country. As per AERB's directive, all existing and new radiology equipmet(X ray machines, CT scanners, C-Arm Machines, Dental X ray units and fluroscopy unit) should get registered under e-Liscensing of Radiation Application (eLORA) system. The AERB issues Licences of operation to the equipment after scrutinizing the Quality Assurance(QA) test reports, submitted through eLORA system by the hospitals. There are 9730 radiology equiplment available in Tamilnadu as per their latest report published in eLORA website. But,in the sate, QA services agencies listed by AERB is ONLY 18. The License issued is valid for a period of 3 Years. After 3 years, a hospital must seek a QA agency to visit and perform the mandatory QA tests and the Report of the same should be submitted to AERB for the License Renewal. People are also advised to undergo diagnostic procedures with the AERB licensed Radiology machines. Thus, we have a bussiness opportunity to starting a new QA service agency in Tamilnadu which is a less competitive and more profitable interms of scarcity in resources availability.

1.2. Target Audiences:

- Bussiness people interested in investing in new projects
- Radiological Safety Officers, who is the signing authority for QA reports in its final form of eLORA,AERB
- Service engineers, Medical physicists who seek job opportunities in Diagnostic radiology.
- Budding Data Scientists, who want to implement some of the most used Exploratory Data Analysis techniques to obtain necessary data, analyze it, and, finally be able to tell a story out of it. This project will analyse the data and givesconclusions of where to start a Radiology QA service agency across the state and where to construct a office sapce in the most profitable
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2.DATA SECTION

2.1 Data Sources: Data of Medical Institutions with Licensesis listed in the AERB eLORA webpage https://elora.aerb.gov.in/ELORA/prePopulateGraphData.htm Available raw Data are: Institution Name, Address, City, Pincode(Zipcode), State, Type of equipment, Make, Model and Institution profile. In the same webpage, Approved Service agencies are listed. Available raw data are: Name of Institution, Permanent address, Landmark, city, state, pin, email, Office telephone and service engineers. Let's name the above two lists as List1 (Equipment Location) and List2(Agency Location) respectively.

2.2 Data Cleaning:

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A list 1 that contains the locations of all diagnostic equipment
was prepared.

 To review the locations of currently available Radiology
Coinsulting agencies, I have processed the approved agency
list(List2)

 Step 1: Replace "Name of Institute" as " Service Agency Name"
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Step 2: Join "Permanent address" column data with "Address" column data in List2
Step 3: "City" columns in the two lists are merged
Step 4: Join "pincode" column in the two lists
Step 5: Drop Columns like "state", "email","Institute Telephone", " Service engineer"
Step 6: In the list1 drop columns like "state", "make,"model" and "Institute Profile"
Step 7: Data scraped from the 2 lists are combined to make one table for making the analysis easy
Step 8: Replace "Institution Name" with "Hospital Name" in our new combined table
This table was named as LIST 2 and kept for review purpose. There are 9730 rows, and 7 coulmns in List1. 18 agencies will cover 5 of the cities in the cities, that might be having certain percentage of total registered equipments(9730). Remaining percentage of equipment in rest of the 27 cities fall in our business focus. List 1 was further refined by keeping only the region of interest(i.e; Sothern part of Tamilnadu incuding the cities Thoothukudi, Tirunelveli and Kanyakumari)18 0f the available agencies can be listed against each hospital in their respective location.
First 5 rows of List1 is depicted as below:

	S.No	Institution Name	Address	PinCode	City
0	1	Aarthi Scans	40,Palayamkottai Road	628001	Thoothukudi
1	2	Stanley Diagnostics	Victoria Extension road	628001	Thoothukudi
2	3	Best daignostic Center	7th Street middle, Bryant Nagar	628008	Thoothukudi
3	4	Apollo Diagnistics	49A,1st street,Bryant Nagar	628008	Thoothukudi
4	5	Super Scans	Kaliappa Pillai Street, Mattakadai	628001	Thoothukudi

3. Methods:

Feature Selection: After extracting the data and forming a new table, the new table will look like the one as below

There are 32 cities in the state. AERB approved QA agencies are located only in 5 major cities like Chennai, Coimbatore, Salem, krishnagiri and Madurai. Most of these cities are in the Northern part of Tamilnadu. Madurai is the only one city that has 2 service agencies in the southern region. List1 is with the following features as columns:S.No,InstitutionName,Address,City,PinCode,City, Location,Latitude and Longitude.Each row is a hospital with registered radiology equipment.

	S.No	Institution Name	Address	PinCode	City	location	point	latitude	longitude	altitude
0	16	Medall Diagnostics	10/5,Bypass road	627003	Tirunelveli	(Palayamkottai, Tirunelveli Kattabo, Tamil Nad...	(8.726356289189562, 77.7218275094003, 0.0)	8.726356	77.721828	0.0
1	17	Aarthi Scans and Labs	Lakshmi Complex, North High road	627002	Tirunelveli	(Palayamkottai, Tirunelveli Kattabo, Tamil Nad...	(8.72159774, 77.7378858, 0.0)	8.721598	77.737886	0.0
2	18	Anderson Daignostics and Labs	Anna Salai, Vannarpettai	627003	Tirunelveli	(Palayamkottai, Tirunelveli Kattabo, Tamil Nad...	(8.726356289189562, 77.7218275094003, 0.0)	8.726356	77.721828	0.0
3	19	RIO Scans and Labs	Ezhil Nagar, NGO Colony	627007	Tirunelveli	(Palayamkottai, Tirunelveli Kattabo, Tamil Nad...	(8.69764295341798, 77.73958474672634, 0.0)	8.697643	77.739585	0.0
4	20	Medall Healthcare pvt limited	Salai Street, Vannapettai	627003	Tirunelveli	(Palayamkottai, Tirunelveli Kattabo, Tamil Nad...	(8.726356289189562, 77.7218275094003, 0.0)	8.726356	77.721828	0.0
5	21	Medall Diagnostics	Chermadevi Road	627004	Tirunelveli	(Tirunelveli, Tirunelveli Kattabo, Tamil Nadu,...	(8.72443596, 77.68446775999999, 0.0)	8.724436	77.684468	0.0
6	22	Aarthi Scans and Labs	Trivandrum Road, Vannarpettai	627003	Tirunelveli	(Palayamkottai, Tirunelveli Kattabo, Tamil Nad...	(8.726356289189562, 77.7218275094003, 0.0)	8.726356	77.721828	0.0
7	23	Apollo Diagnostics	Muthamil ROAD, Vannarpettai	627003	Tirunelveli	(Palayamkottai, Tirunelveli Kattabo, Tamil Nad...	(8.726356289189562, 77.7218275094003, 0.0)	8.726356	77.721828	0.0
8	24	SRL Diagnostics	Palayamkottai	627002	Tirunelveli	(Palayamkottai, Tirunelveli Kattabo, Tamil Nad...	(8.72159774, 77.7378858, 0.0)	8.721598	77.737886	0.0

Geopy geocoder will help in getting us the latitude and longititude of cities of the nearby venues. we can select the most approprite cities where there is no availability of QA services near-by. From the observations, we can see Tirunelveli City is located in the middle of Thoothukudi and Kanyakumari cities in the southern region of Tamilnadu, India. With foursquare API, the most common venue is selected in the respective cities. Now, we can make calls to Foursquare to request for json files of top 100 nearby venues.

4.Results and Discussions:

11 results were obtained with our search. From the search output, “Bye-pass” is the most appropriate venue in Tirunelveli city. The json file must be preprocessed (listed by categories) and converted into pandas dataframe. One hot encoding process was done and the data are grouped in a name “T-grouped”. Top 7venues among the categories were listed based on their rankings.

	name	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue
0	Apple ttree	Hotel	Indian Restaurant	Dessert Shop	Clothing Store	Burger Joint	Bakery	Accessories Store
1	Arasan Bakery	Bakery	Indian Restaurant	Hotel	Dessert Shop	Clothing Store	Burger Joint	Accessories Store
2	Hotel Vaira maligai	Indian Restaurant	Hotel	Dessert Shop	Clothing Store	Burger Joint	Bakery	Accessories Store
3	King's Chic Arasan Hotel	Indian Restaurant	Hotel	Dessert Shop	Clothing Store	Burger Joint	Bakery	Accessories Store
4	Marrybrown	Burger Joint	Indian Restaurant	Hotel	Dessert Shop	Clothing Store	Bakery	Accessories Store

We can use the K-means Clustering algorithm with the init parameter Kcluster=5. An array output is obtained for the 11 results. Using 5 clusters, the model essentially aggregated equal amount of the data into 3 clusters. Out of 11 neighborhoods being considered, cluster2,1,0 has each 3venues. The remaining 2 neighborhoods were spread among clusters 4&3.

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Out[23]: array([1, 3, 2, 2, 0, 0, 0, 1, 2, 1], dtype=int32)

[24]: pd.Series(kmeans.labels_).value_counts()

Out[24]: 2    3
         1    3
         0    3
         4    1
         3    1
         dtype: int64
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Thus the sale price of office space for the agency can be investigated based on the results from the clustering algorithm. A list was made for analyzing the rent of office space in the venues sorted out by the algorithm.

S.No	Venue	Square Feet	Charges/Month(INR)
1.	Palayamkottai	400	11,000
2.	By-pass Road	300	13,000
3.	Junction	250	12,000
4.	Shanthi Nagar	700	16,000
5.	Maharaja Nagar	690	12,000
6.	KTC Nagar	850	25,500
7.	Rahamath Ngar	1000	15,000
8.	New Centuary Nagar	1000	20,000
9.	Tirunellveli Town	600	10,000

5. Conclusion:

This project will give an insight to "Investment cost" incurred in OFFICE SPACE in this new start-up business- Radiology Consulting Agency in Southern region of Tamilnadu, INDIA.