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Assessing Retail Potential of Chicken Meat in Hyderabad Using Geographical Information System

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ABSTRACT

In this study, a geographic information system (GIS)-based decision support system (DSS) for assessing the retail potential of chicken meat in Hyderabad, Telangana, India is developed through various analyses namely, demographic analysis, competitor analysis and consumer preference analysis. This GIS-assisted DSS interactively explores the use of GIS in addressing critical strategic decisions, like where to locate a new retail outlet, or whether to close any existing retail outlets in overcrowded markets. The rapidly expanding consumer base in the city, and its changing food dietary patterns with growing incomes, make GIS a potential tool to analyse the markets and complex consumer behaviour, to facilitate the strategic decision-making by the retailers. With integration of the poultry industry and presence of a good number of organised players, chicken retail is seen as a major new business opportunity to drive revenues. Our study helps the retailers to gain competitive advantage through GIS to formulate their business plans and to analyse marketing strategies for chicken meat retailing.

Keywords: GIS, Spatial data, Attribute data, Demographic analysis, Competitor analysis, Consumer demand, Decision Support System

1. INTRODUCTION

GIS (geographic information system) is becoming a part of mainstream business and management operations around the world in areas as diverse as utilities, telecommunications, railroads, civil engineering, petroleum exploration, retailingand others in both private and public sectors. These arrays of institutional types are integrating GIS into their daily operations, and the applications associated with these systems are equally broad from infrastructure management, to vehicle routing, to site selection, to research and analysis. Almost without exceptions, various retail organisations need to plan for complex consumer markets and keep up with competitions. Over the past few decades, the methodologies used for research of sighting of retail outlets have become more sophisticated as a result of applicable modelling procedures being developed with GIS[1]. One such area in India, where GIS can play a pivotal role in setting business plans and strategies is chicken meat retailing.

Arc-GIS is developed and sold by Environmental Systems Research Institute (ESRI). It is a GIS for working with maps and geographic information. It is used for creating and using maps, compiling geographic data, analysing mapped information, sharing and discovering geographic information, using maps and geographic information in a range of applications and managing geographic information in a database. The system provides an infrastructure for making maps and geographic information through graphical user interface (GUI) mode, which makes it much easier to use. A decision support system (DSS) is a set of tools and procedures that work interactively to manage a particular system. It is capable of enhancing the quality of

the decision-making processes in the system. GIS system plays an important role in supporting managers in their decision-making activities.

Poultry in India has reached an agri-business industry status which was, otherwise, predominantly a backyard activity 30–40 years ago. Today, poultry industry is one of the fastest growing segments of the agricultural sectors in India, as the production of agricultural crops has been rising at a rate of only 1.5–2% per annum, while the production of eggs/broilers has been rising at a rate of 8–10% per annum. Currently, India is world's 5th largest egg producer and the 18th largest producer of broilers[2,3,4]. Most poultry meat in India is marketed to consumers in the form of live birds, with only a small share of output now marketed as chilled, frozen or further processed products. The costs of moving live birds, including transport, shrinkage and mortality costs, severely limit inter-regional movements[5]. As a result, Indian poultry markets are regional, rather than national in scope[6].

In the retail segment, growth is likely to be fostered by the emergence of a number of new approaches by poultry retailers, including the establishment of new franchises, adopting innovative systems like home delivery services and others. As such, a detailed study of the spatial correlation of non-veg stores relating to chicken meat sale using GISs in urban setting would be of great relevance to support strategic decision-making by organised retailers. This study proposes to apply GIS in mapping and assessing the retail potential of chicken meat outlets.

2. METHODOLOGY

2.1 Study Area

The area covered by the Greater Hyderabad Municipal Corporation (GHMC) in Telangana state, India is chosen as the study area. Telangana is one of the major chicken meat producing states in India and it accounts for 1/5th of the poultry meat as well as egg production in the country. About 30% of its broiler output and 15% of the egg output are exported to other states in India. Thus, it is a leading poultry meat producing state within India[7].

In Telangana, Hyderabad is the city with maximum poultry and hatcheries. Hyderabad is situated between 17°21′ to 17°71′N latitude and 78°21′ to 78°76′E longitude in the north-western part of Telangana in southeastern India. It lies on the banks of the Musi river in the northern part of the Deccan plateau and rises to an average height of 536 masland spread over an area of 650km^2, making it one of the largest metropolitan areas in India (Figure 1). The outlets of some of the major organised retailers as well as supermarket chains

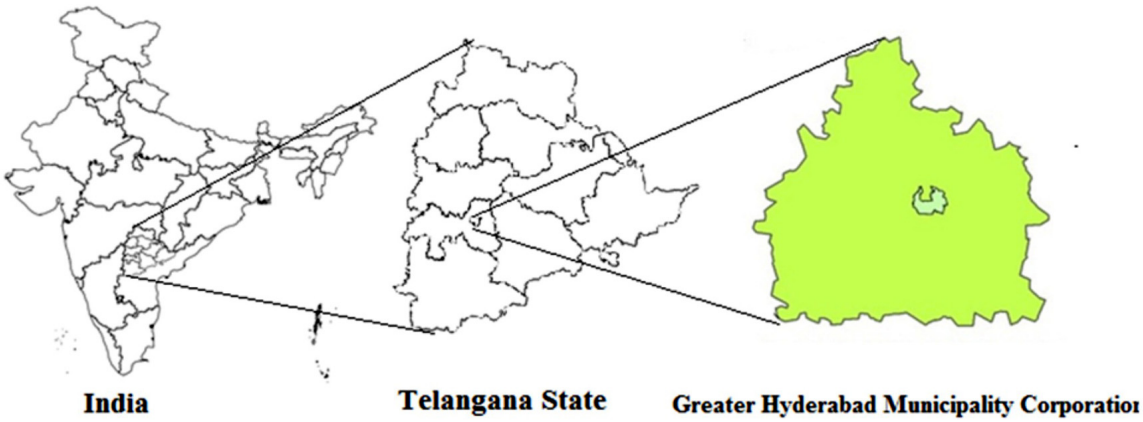

Figure 1: Location of the study area (Greater Hyderabad Municipal Corporation)

which provide chicken meat are selected for the survey. These include Suguna Chicken, Venkys Chicken, Vencobbs Chicken, among the meat retailers and Spar and Spencer stores among supermarket chains. The stores of each chain in the GHMC area and their location coordinates were identified from Google maps. Both spatial and attribute data of this study, were collected from different sources.

2.2 Spatial Data

Spatial data of the GHMC area and its geodemographics were provided by National Academy of Agricultural Research Management, Hyderabad. The data layers (shape files) used in this study are Hyderabad city limit region, extended area region, locality region, PIN code region, point of interest, highway, sub locality and wards. Data of retail store locations is collected from internet sources like Google maps and converted to shape files. The selected organised chicken meat retail outlets data layers are Suguna chicken coordinates, Vencobbs chicken coordinates, Venkys chicken coordinates and super market outlets Spencers coordinates and Spar coordinates.

2.3 Attribute Data

Secondary data includes data about the demographics of the Hyderabad city area namely, total households, total population, total male population, total female population, total working population, ward-wise income data of the population and others.

The entire study was made using Arc-GIS software. For the analysis, the attribute data is linked with the GIS to assess and map the consumer behaviour with respect to locations. Various analytical tools provided in Arc-GIS are used for buffer areas around the chicken meat retail stores. The graphs, tables and maps are generated using various tools provided along with the software. Buffers, joins, relate and other features of GIS are used for proximity analysis and consumer analysis. Statistical analysis tools in Arc-GIS were used to work out averages, sum and mean for various demographic characteristics in and around buffer zones of the sample chicken meat outlets like household number, total population, total working population and income levels and others. Consumption patterns, consumer preference for meat and meat products, convenience criteria like travel time, frequency of meat consumption and others., are analysed and imported to Arc-GIS to relate with the geographic coordinates.

2.4 Demographic Analysis

It involved both population analysis and income analysis. To compute population analysis, the information on the total households, population and working population in each ward in which the stores are located is obtained by joining the attribute tables of Hyderabad wards and sub localities with corresponding coordinates of each store in the wards considered.

2.5 Competitor Analysis

It was done for each retail chain by creating 5-km buffer around each store of the chain, identifying the demographic characteristics like number of households, population, working population, and number of sub localities in each buffer, identifying the competing stores in each buffer, identifying bulk consumers in the buffer around each retail chain store and assessing market crowding by competitors and identifying areas with relatively less competition. The feature attribute tables of the stores layer are joined with the Hyderabad sub location attribute table by performing join function based on the ward number as a field to base the join. Once the joins are performed, selection is done based on location and buffer of 5 km is performed for each retail chain separately.

2.6 Simulation Modelling

It was been done to analyse basic consumer preferences with respect to spatial locations based on a study on meat consumption pattern and its retailing in Karnataka[8]. In this study, a positive correlation was observed between frequency of chicken meat consumption and income levels and found that 60% urban families consumed meat four times a month. A second factor of importance to consumers is the travel time preferred by different income groups to make the purchase. On the basis of these two (demographic demand and travel time), a consumer demand was generated.

3. RESULT AND DISCUSSION

The selected chicken meat outlets with their spatial locations are shown in the legend bar where red circles denote Suguna stores, purple triangles denote Vencobbs outlets, black squares depict Venkys, green asterisk indicates Spar store and Pink circles with black centres represent Spencer stores (Figure 2).

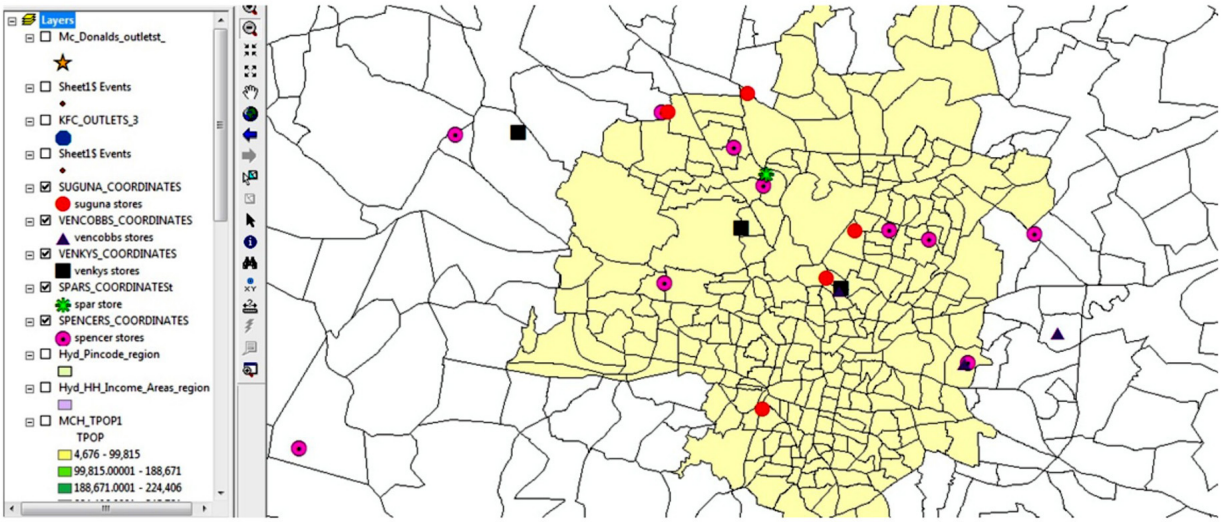

Figure 2: The selected chicken meet outlets in GHMC area

4. DEMOGRAPHIC ANALYSIS

A total of eight stores of Suguna are selected in GHMC which are located in Sreenivasa Nagar, Kukatpally, Girinagar, Yousufguda, Begumpet, Himayat Nagar, Dilsukhnagar and Nawab Saheb Kunta. The highest numbers of households are around Suguna-4 which is located in Yousufguda with 32,593 households followed by Suguna-6 in Himayatnagar with 19,950 households. Suguna-3 and -8 have the lowest households around them, each with 8,236 households. The Suguna-4 has the highest population, whereas Suguna-3 and -8 have the lowest. Suguna-4 has the highest working population which is quite obvious because it has highest households as well as highest population. The pictorial representation of above information is shown in Figure 3. A total of 10 stores of Spencers are selected in GHMC area, located in Vidyanagar, Dilsukhnagar, near Raj Bhawan, Ameerpet, SR Nagar, Kakatiya Nagar, Habsiguda, Gachibowli, Himayatnagar and Shivnath Mithaiwala. The Spencer-5 covers highest households of 20,767 in SR Nagar. The Spencer-4, which is located in Ameerpet has highest populationwhereas, Spencer-5 (SR Nagar) and Spencer-9 (Himayat Nagar) have highest working population. The Spencer-7 and -10 have least working population of 3,519 (Figure 4).

Three Venky's stores are selected in GHMC area located in different areasnamely, Madhapur, Hi-tech City and Hyderguda. The Venkys-3 has the highest households of 99,515 and Venkys-2 has the lowest households

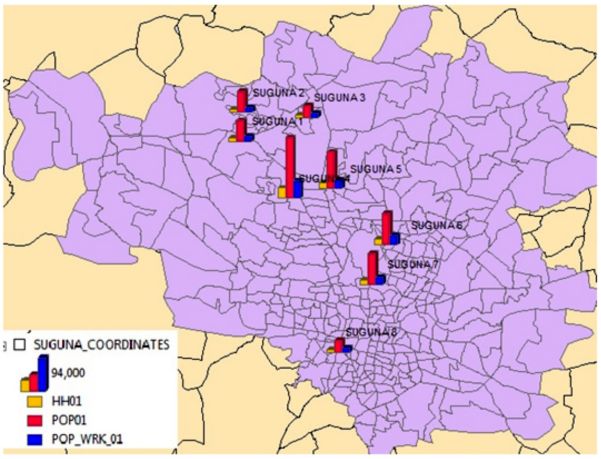

Figure 3: Suguna stores with locations showing the total households, total population and total working population in the wards

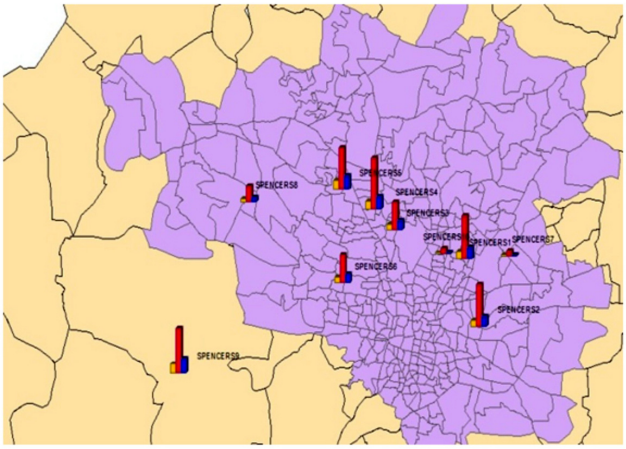

Figure 4: Spencer stores with locations showing the total households, total population and total working population in the wards

of 10,007. The Venkys-3 has the highest working population of 31,913 and Venkys-2 has the least working population of 3,212. Thus, among the outlets, Venkys-3 has the highest population and Venkys-2 has least (Figure 5). Four Vencobb stores are selected from GHMC that are located in Kalyannagar, Kothapet, Kukatpally and Tirmiragiri cross road. Among the outlets, Vencobb-1 has the highest households of 19,950, and Vencobb-2 has the least households of 1,752. Further, Vencobb-1 has the highest population and Vencobb-2 has the least. Among the outlets, Vencobb-1 has the highest working population followed by Vencobb-3 and Vencobb-2 (Figure 6).

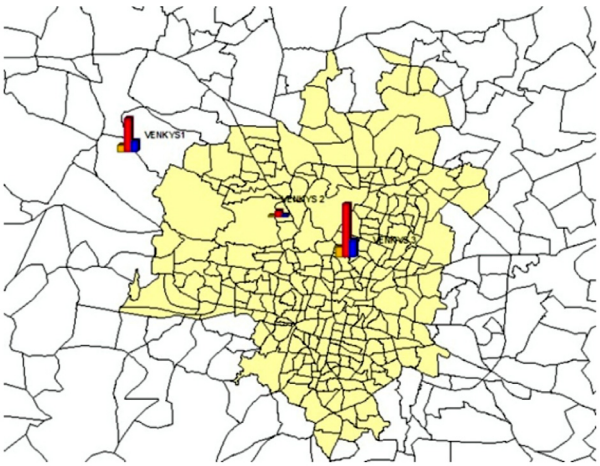

Figure 5: Venky's stores with locations showing the total households, total population and total working population in the wards

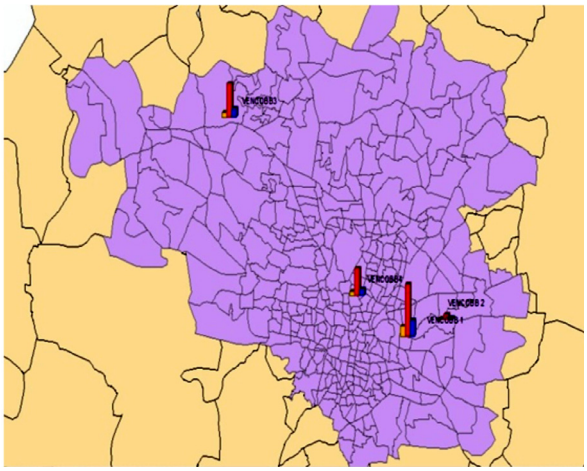

Figure 6: Vencobb stores with locations showing the total households, total population and total working population in the wards

Only one store of Spar is selected and it covers very large number of households of >18,000 and has a working population of 22,807. In Figure 7, staked bar chart shows the relationships between both total households, total population and total working population as well as allows absolute comparisons between the different retail chains. It can be seen that the outlets which have highest households, population and

working population are Suguna-4, Spencer-5, Spencer-4, Spar-1, Vencobb-4, Spencer-2, Spencer-1, Venkys-3, Suguna-5 and Venkys-1. The income analysis has been done with respect to locations and selected chicken meat retail chain outlets. The areas are divided into four groups of income categories <Rs. 1.5 lakhs; Rs. 1.5–5 lakhs; Rs. 5–10 lakhs and >Rs. 10 lakhs.

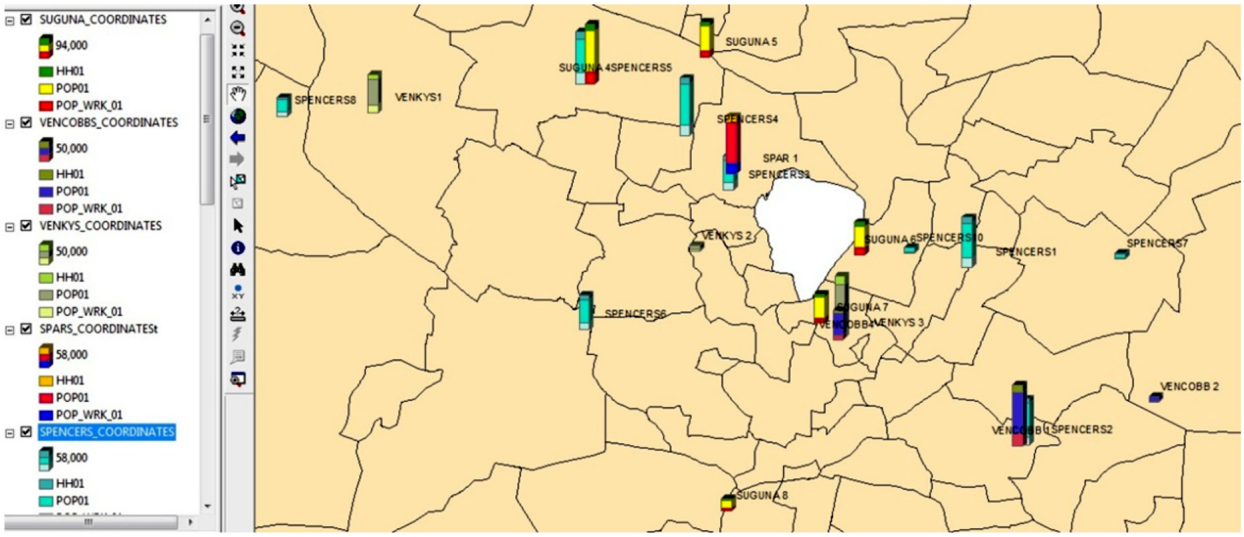

Figure 7: Staked bar diagram showing total households, total population and total working population in wards of all the selected chicken meat retail outlets

Using the function selection by attributes, the top 10 localities with the highest households are selected. The localities are highlighted by light blue colour (Figure 8). It can be seen that no organised chicken meat retail stores are located there. Therefore, to address the needs of these areas, chicken meat outlets can be opened in those areas. The areas identified are Bolaram Bazaar West, Moulali North, Dilsukhnagar, Banjara Hills part1, Sainikpuri, Alwal, Banjara Hills part2, APHB Colony, Ramanthpur and Vanasthalipuram West.

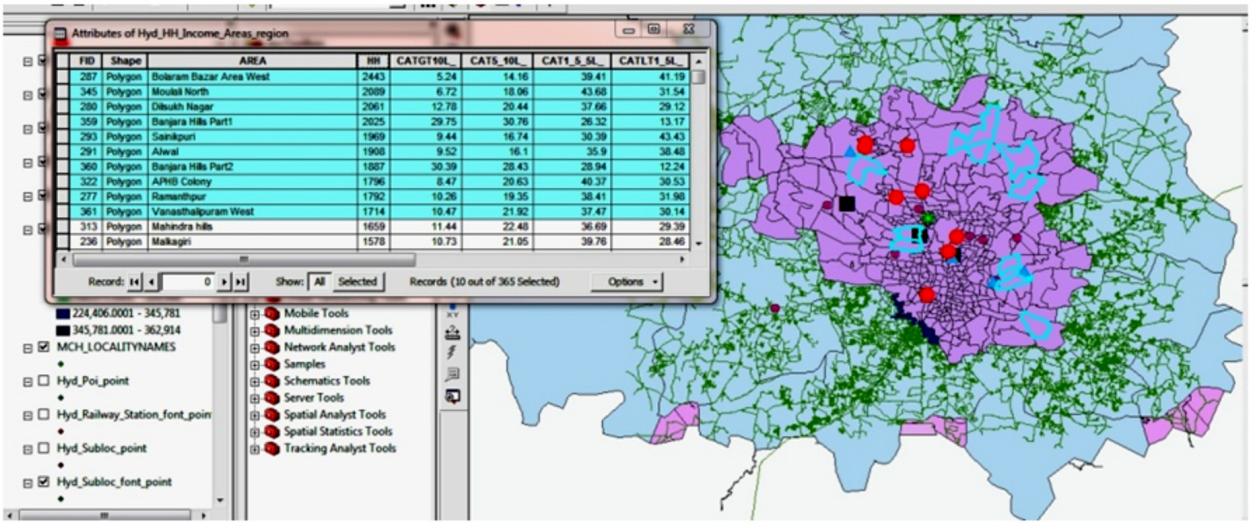

Figure 8: Top ten locations by number of households

The localities that are falling in the income category of Rs. 5–10 lakhs are Banjara Hills-1, Banjara Hills-2, Dilsukhnagar, Mahindra Hills, APHB colony, Ramanthpur, Vanashthalipuram West, Moulali North, Bolaram Bazaar Area West and Malkajgiri. The areas like Mahindra Hills, Moulali North, APHB colony and Malakgiri have much potential due to absence of organised retailers in these areas.

The areas with income >Rs. 10 lakhs are Banjara Hills Part 1, Banjara Hills Part 2, Jubilee Hills part 2, Jubilee Hills Part 1, Jubilee Hills Part 3, Dilsukhnagar, Khairtabad, Khairtabad West, Mahindra Hills and Sainikpuri. Relative distribution of household numbers in income levels of <Rs. 1.5 lakhs, 1.5–5 lakhs, 5–l0 lakhs and >10 lakhs with respect to all stores in each ward was calculated.

The outlets namely, Suguna-4,-5,-6 and -8 have the highest proportion of households in the income category of Rs. 1.5–5 lakhs. The second highest proportion of households lies in income level of <Rs. 1.5 lakhs with respect to all stores except Suguna-7 where it is highest. Among all the Suguna outlet, Suguna-6 has the highest proportion of households in income levels of Rs. 5–10 lakhs and >Rs. 10 lakhs categories. In case of Spencer, the outlets namely, Spencer-1,-3 and -4 has high proportion of households in income levels of <Rs. 1.5 lakhs, whereas the outlets namely, Spencer-2,-6,-8,-5,-10 and -7 have high proportions of households in income level of Rs. 1.5–5 lakhs. Among the Spencer stores, Store-4 and -3 have high proportion of households in higher income levels of Rs. 5 to >10 lakhs. In all the three Venkys stores, the proportion of households in income levels of Rs. 1.5–5 lakhs, is more followed by <Rs. 1.5 lakhs. The outlet, Venkys-1 has the highest proportion of households in high income groups of Rs. 5 to >10 lakhs among all the three stores. Vencobb-4 has high proportion of households in income levels of <Rs. 1.5 lakhs. The other stores namely, Vencobb-1,-2 and -3 have high household proportion in income group of Rs. 1.5–5 lakhs. In case of Spar, the highest proportions of households are in the income group of Rs. 1.5– 5 lakhs followed by Rs. 5 lakhs to >10 lakhs and <Rs. 1.5 lakhs categories (Figure 9).

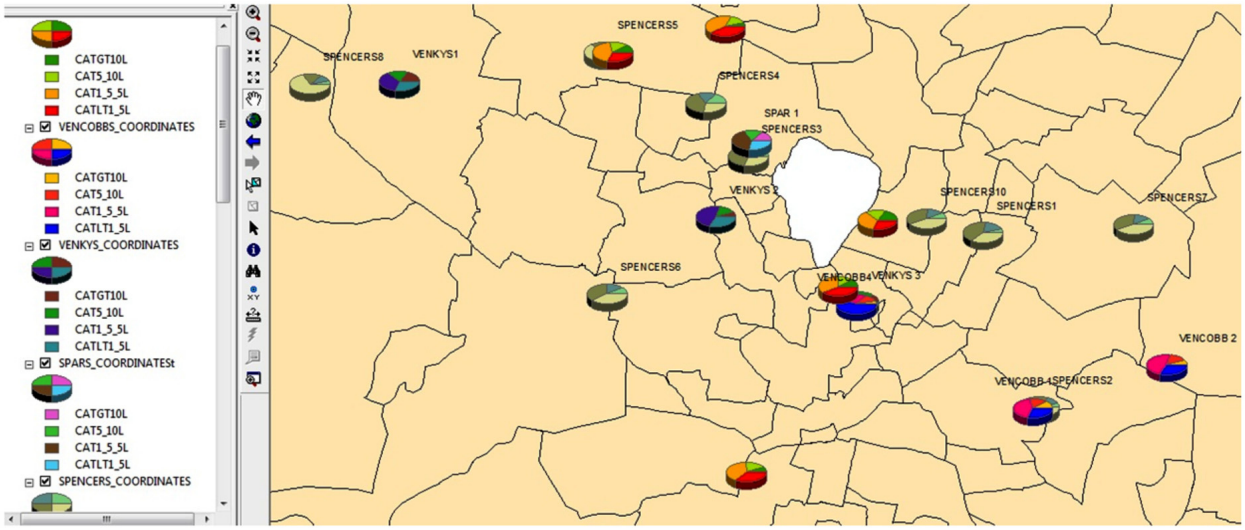

Figure 9: Spatial distribution of households with different income levels in each ward for all the stores

5. COMPETITOR ANALYSIS

In Figure 10, the smaller circles indicate locations of the Suguna stores. The light blue dots inside the larger circles depict the sub localities that are within a 5-km radius. The population distribution layer is depicted by the dark blue, green and yellow-coloured areas. The dark blue areas have the highest population of 2244,406 to 345,781 followed by the dark green areas of 188,671–2244,406. Notably, there are no Suguna

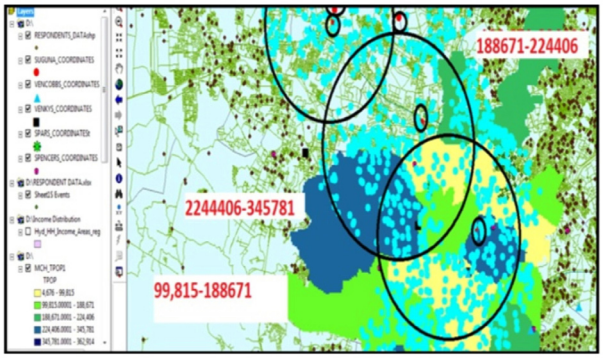

Figure 10: Buffer of sub localities within 5 km of Suguna stores and population distribution

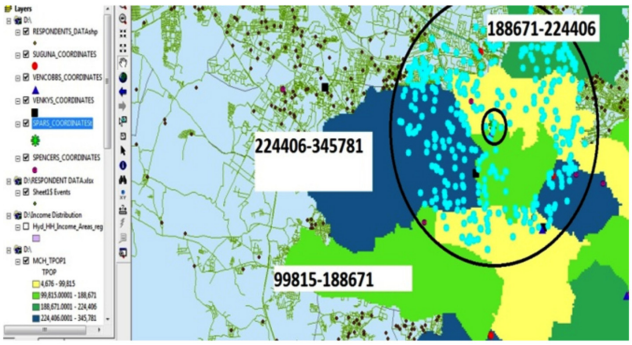

Figure 11: Buffer of sub localities within 5 km of Spar store and population distribution

stores in dark green areas, and a large portion of dark blue area is not covered within 5 km range around the stores.

For the Spar store, there is clearly much competition from Suguna stores as they operate in same areas tapping the same sub localities. There is scope to open new stores in the densely populated areas depicted by dark green and blue area as in Figure 11. Similarly, the buffered localities of Vencobb's stores are shown in Figure 12, which depicts that these stores are also located near about in the same localities and the 5 km buffered areas include some common localities. The dark blue and green areas are highly populated areas and have a potential for opening up new stores. By comparing Figures 11 and 12, it can be summarised that several stores are competing for the same customer base. Interestingly, there is no store in highly populated areas represented by dark blue and dark green shades. The buffered localities show that there is competition from other retail stores. Spencer's stores are well distributed to catch the populated localities (Figure 13).

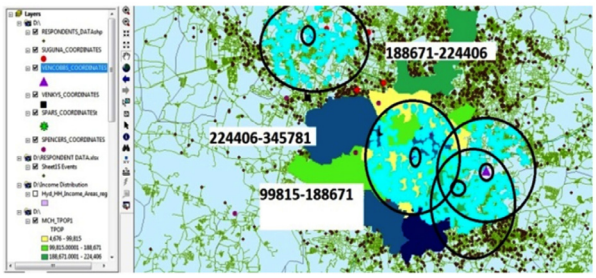

Figure 12: Buffer of sub localities within 5 km of Vencobs stores and population distribution

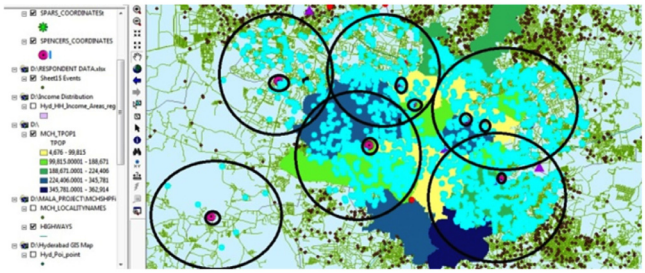

Figure 13: Buffer of sub localities within 5 kms of Spencer stores and population distribution

For performing bulk consumer analysis, fast food chains are considered as bulk consumers. Two major fast food chains are selected as bulk consumers of chicken meat. Total sixteen outlets of McDonald's and KFC geographical locations were collected. A total of 14out of 16bulk consumers are within 5kmrange of Suguna stores, all the 16bulk consumers are within 5km range of Spencer stores, 15bulk consumers come within 5km range of Venkys stores, 11 bulk consumers are within 5km range of Vencobb's stores. Noneof the bulk consumers are present within 5km range of three Vencobb stores, which may be a disadvantage for Vencobb. Only nine bulk consumers are within 5km range of Spar store. But Spar definitely has location advantages as only one store can meet the requirement of the nine stores.

To assess the potential demographic demand, total five types of demographic data by ward number are used. The variables are total number of households, total population, total working population and income data.

In case of income groups, two categories namely, Rs. 5–10 lakhs and >10 lakhs are included. These variables are considered to be strong indicators of demand for chicken meat. While examination of each of the demographic criteria alone is useful, it is the spatial concurrence of the data that is most indicative of demand. The index score was calculated based on each variable that is equally classified into fiveranges, each range containing 20% of the data and a weight was assigned to each class of data, according to its relative importance (Table 1). The best possible demand index score is 25 and worst possible demand index score is five. Lower index scores represent areas that have a lesser contribution from one or more of the five components. An index score greater than eight is considered to represent a good demand.

Table 1: Class intervals for demographic data and the respective values assigned

Weights	Households	Population	Working Population	Income (Rs.) 5 to 10 Lakhs	Income (Rs.) >10 Lakhs
1	0–15,000	0–75,000	0–25,000	0–600	0–400
2	15,000–30,000	75,000–1.5lakhs	25,000–50,000	600–1,200	400–800
3	30,000–45,000	1.5–2.25lakhs	50,000–75,000	1,200–1,800	800–1,200
4	45,000–60,000	2.25–3lakhs	75,000–90,000	1,800–2,400	1,200–1,600
5	60,000–75,000	3–3.75lakhs	90,000–1.5lakhs	2,400–3,000	1,600–2,000

Based on the demand index, the areas (wards) are classified as high potential areas (demand index 11.01–19.00), medium potential areas (demand index 6.01–11.00) and low potential areas (demand index 5.00–6.00). Based on this demand index, Faluknama, Golconda Fort, Indira Park, Santoshnagar, Reign Bazaar, Karvan Lungerhouse Surroundings, Kachiguda, Amberpet, Malakpet to Dilsukhnagar, Jubilee Hills and Secunderabad Cantonment areas are high potential areas. The medium potential areas are including HimayatNagar, Lingampally, Regimental Bazaar, Methuguda to Lalapet, Syedaliguda, Mehdipatnam, Vijayanagar, Chiniabasti, Khairtabad, Secretariat, Somajiguda, Sanjeeva Reddy Nagar and Sanathnagar. The low potential areas are Clock Tower Second Bazaar, Dhoolpet, City College, High Court, Maredpally, Bansilalpet and Sultan bazaar.

5.1 Consumer Demand

Using simulation modelling, a consumer demand was generated as classified in Table 2. This process showed the areas where the meat consumption pattern is four times or three times per month. Figure 14 shows the

Table 2: Demand index class and allocated values for consumer preference factors

Consumer Preference Factor	Demand Index Class			
	6.01–8.01	8.01–11.00	11.01–16.00	16.01–19.00
Home delivery	No	No	Yes	Yes
Frequency of consumption(times/month)	1	2	3	4
Preference of wholesale cuts	No	No	yes	Yes
Preference of new recipes/dish	No	No	yes	Yes
Travel time	10 min	10 min	15 min	20 min

Wholesale cuts include separate portions of chicken meat like chicken breasts, wings, drumsticks and others. Values for No=1 and Yes=2.

areas where customers are likely to prefer meat four times a month and these areas are being highlighted in light blue colour (shown by arrows). In the areas highlighted in light blue colour borders, consumers are likely to prefer chicken four times a month. These areas are high potential areas having a large consumer base. It can be seen that only one Spencer outlet is located within that area. These areas (Golconda Fort, Tolichowki, Faluknama and Mirjunla Tank) have a high potential for the organised chicken retailers to open up new stores. The areas where the consumers are likely to prefer chicken three times a month are depicted by light blue borders in Figure 15. It can be clearly seen that areas in dark blue to dark green that is high potential and medium potential areas have a high consumer preference to consume chicken more frequently. These areas include Jubilee Hills, Banjara Hills, Krragadda, Amberpet, Kachiguda, Dilsukhnagar, Maddanapet, Reign Bazaar, Zoo area, Santoshnagar and Secunderabad Cantonment.

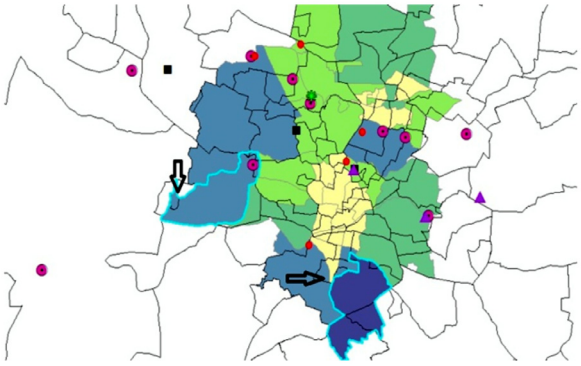

Figure 14: Areas where customers are likely to prefer meat four times a month

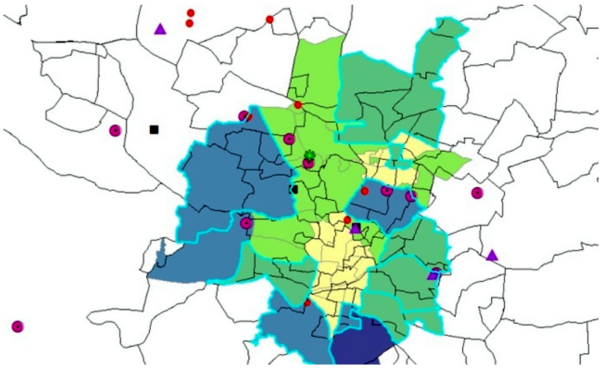

Figure 15: Areas where customers are likely to prefer meat three times a month

6. CONCLUSION

A prototype of a GIS-based DSS was developed to support strategic decisions to locate retail stores for non-veg foods with reference to chicken meat in Hyderabad city using demographic data of the population residing in various localities, income data, spatial locations of the non-veg stores and others. A systematic and analytical procedure was developed to identify possible locations for opening new stores that have potential reliable consumer base. Using the processes developed in this study, retailers can gain competitive advantage by leveraging geographic advantage using GIS. Based on these results, business plans and marketing strategies for chicken meat retailing can be formulated. It is important to integrate a good marketing strategy based on consumer preference as outlined in this DSS. Such retail marketing strategies can allow the businesses to concentrate their resources on the greatest opportunities to increase sales and at the same time achieve a competitive advantage. Using the present study, a potential retail chain's store location can be identified not only keeping in view the future retail setting of the market, but also getting fully acquainted with the regional shopping areas and consumer orientation.

This study can be further developed to improve upon through integrating site selection location research tools for successful site selection of retail outlets. To make informed site location and retail location decisions, this study helps as a more efficient approach for on-site assessment and evaluation of customers/markets as well. Further, data regarding the buying behaviour of the consumers, sales data, ethnicity, religion and others and inclusion of additional analysis such as regression models for identifying patterns in the meat consuming population will add more value to the project.

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