

A GIS Application for Location Selection and Customers' Preferences for Shopping Malls in Al Ain City; UAE

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Abstract Geographical Information Systems (GIS) are used today at several planning applications and taking advantage of information technology, this system enable the handling of both spatial and non-spatial data for constructing thematic maps describing a variety of information relating to economic activities. Current research examined the potential of suitable location as well as to study customers' preferences for shopping malls in the area. In this study, evaluation of data concerning the suitable location selection was performed in Geographical information system Arc Info-GIS environment and a number of other criteria were used to evaluate alternative sites, showing four suitable sites for new location of malls. The result shows that the best site choice meeting all the requirements is located in Airport District area. 500 questionnaires were distributed to assess the customer preferences for shopping malls. Even existing in the low population density area, a high percentage of respondents (46%) prefer to shop at Bawadi Mall because it is helpful in servicing large numbers of people and reducing crowds in the city centre. The study concludes that the distribution of shopping malls was generally found to be random and uneven in the city of Al Ain. Therefore, study recommends that there is a need to set the common standards for building malls and carry out more investigation regarding factors such as soil types, land ownership and compensation.

Keywords GIS, Location selection, Shopping mall, Spatial analysis, Database, Decision analysis

1. Introduction

Shopping malls are the most glorious places these days with their attractive shops and a wide variety people where people spend their weekends to relax and shop. With the changing tastes and preferences of customers, shopping malls extend a global impact across metros, cities and towns. Over the last four decades, the UAE has grown exponentially in population, technology and commerce, with Al Ain becoming a major city where people live, work and play. The city of Al Ain has seen population increase from 444,700 in 2005 to 584,800 people in 2011, a growth of 140,100 people this is mainly due to the increase in births and the balance of foreign labour force and this increase generates a changing need for more infrastructures such as schools, hospitals, housing, roads, and malls (Abu Dhabi, 2011).

2. Literature Review and Background

The increase in the population will cause a demand for

easier and quicker access to food, clothing and home products creating an increase in economic business growth. The shopping will rise from small stores to big stores as this increases the need for department stores, which contain many types of products (sporting goods, garden, clothing, market, toy), located within a single building. Therefore, the mall building, which is usually one of the largest in the region, is the ideal way to meet the demand of the shoppers as well as in one building make a shopper friendly environment (Jensen, 2007).

Location is one of the land characteristic of high importance for economic analysis. In fact, location is the crucial spatial characteristic on which estimation and analysis of land value can be transformed and create different types of study. Prior to GIS period, the location determinant impact on land values was difficult to be succeeded due to the existing accuracy levels on positioning. Nowadays, GIS offers techniques in tens to facilitate the analytic spatial reasoning (Arbia, 1989; Tomlin, 1990; Huxhold, 1991; Star and Estes, 1990).

Location selection is a problem faced by all companies, government agencies, education and public services. Al Ain has distributed shopping malls in last few years depending on some criteria in order to protect the natural reserves such as deserts. In this field of business distribution, centre location selection is a very important issue faced by all the companies.

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Even though demand for shopping malls are falling in many part of the world. In UK by the mid-1990s, however, the concept of "the mall" had hit its peak. 140 malls were being built a year, creating too much competition, and discount stores as if Marshall's began popping up, and attracting bargain hunters away from the confines of the mall. Now UK is facing a crisis. The Centre for Retail Research published its analysis of how UK retailing will have changed Retail Futures 2018 forecasts that by 2018 total store numbers will fall by 22 percent, from 281,930 today to 220,000 in 2018 (CRR, 2014).

In USA the decline in sales surprised many, who had seen increasingly positive US economic data as well as lower gas prices as signs that the US holiday shopping season would be better than it has been in the past. USA retailers reported that sales falling 11 percent from the same period last year, according to the National Retail Federation (BBC News, 1 December 2014).

According to Green Street Advisors, a Real Estate and Analytics Firm (REAF) noted that 15 percent of U.S. malls will fail or be converted into non-retail space within the next 10 years. That is an increase from less than two years ago, when the firm predicted 10 percent of malls would fail or be converted (Hayley, 2015). States hit particularly badly include Texas, Pennsylvania, Ohio, New York, and Illinois, according to Deadmalls.com, which tracks mall closures.

Retail has long been among the engines of economic growth in Russia high inflation and more than 20 percent devaluation of the ruble have hit Russian spending power and foreign retailers' profits. Some retailers have already closed down stores such as Empik Media & Fashion closed its Esprit and OVS stores and those that remain are re-evaluating their development plans. Finnish department store Stockmann also announced plans to close 20 of its clothing stores in Russia (D'Amora, 2014).

Even though the fall of malls is increasing in many part of the world but the demand of malls in UAE and in particular, in Al Ain city are increasing. Al Ain city witnessed rapid development in the last few years mainly due to revenues from oil and booming in the tourism industry. This development together with high consumers leads to increase in the number of malls.

2.1. Shopping Malls

Shopping malls are retail properties with special qualities compared to other property investments (Gerbich, 1998). However, it appears the forces driving retail expansion all over the world have deviated from actual consumer demand. A shopping mall is a collection of retail stores. It is usually the largest building complex in the region. The large shopping centres containing cinemas, entertainment areas, restaurant areas, and parking areas called malls combine many small shopping stores under one roof and include various activities.

The customers go to shopping malls not just for shopping but for all things such as clothing, housing needs (foods,

furniture), educational needs (bookshops), health care (clinic, Pharmacy, beautification), and clubs. Conversely, a mall is a collection of multiple department stores built for earning as much from its customers as possible (Pederson, 2013). The department stores and malls are often located at the junction of major highways and in downtown areas because they are the most populated areas. The development of the emirate be seen as an outcome of a broad range of economic, institutional, political, and cultural factors that function in interaction; that is, this development lends itself to multi-causal explanation (Haviddt, 2009).

Al Ain has greatly expanded in the last few years creating a need for more malls. A current study done by Mohamed, (2004) using satellite imagery (Landsat TM, SPOT HRV, and IKONOS), to detect the direction of expansion of Al Ain and to monitor the change at regional level show that the city was found to have a tendency for expansion in different directions at different rates. As a result, the direction of Al Ain's expansion was governed by natural, legal, and political constraints that have compelled the physical form of the city to be stretched over a wide distance in the western and south-western directions along the Al Ain – Abu Dhabi road. This expansion direction may help in allocating of new malls.

2.2. History of Malls in Al Ain City

Like the United Arab Emirates, Al Ain has grown and changed in many ways; housing, travel and shopping have modernized over the last 42 years. As part of this modernization, Al Ain has opened four shopping malls across the city in ten short years.

Al Jimi Mall was the first shopping mall opened in Al Ain City in 2002; it is located in the Al Jimi area close to the governmental buildings. The building originally built as a vegetable and meat market in the early 80's, but later restored, which earned it an ICSC certificate of merit for innovation in restoration and redevelopment in 2002 (Al Jimi Mall, 2013). This mall becoming the first location where shoppers could purchase a variety of household needs from multiple stores under one roof.

Al Ain Mall is Al Ain's premier shopping and leisure destination opened in early 2001. It has over 175 stores selling everything and became an integral part of Al Ain's identity and daily life. Al Ain Mall is home to 350 world-renowned shops and hosts more than 12 million visitors a year, 55 percent of which are UAE nationals creating the need for a larger mall and, an extension was added (Al Ain Mall, 2013).

Bawadi Mall, in Mazyad area is the largest mall in Al Ain, opened in 2008. It has over 400 shops, representing both international and regional brands. The mall includes a traditional souq called Heritage Village where one can find carpets, animals, plants and trees. Keeping the past in mind, Heritage Village was built using beautiful Islamic architecture (Bawadi Mall, 2013). Bawadi Mall also has a

family entertainment area which includes movies, rides, snow tubing and games for all ages.

Al Foah Mall is strategically located in Al Ain in the centre of a rapidly developing residential area, opened in 2010. Additionally, it is also easily accessible from Dubai and Abu Dhabi. Al Foah Mall has a food court, outlets, coffee shops, and an entertainment area (Al Foah Mall, 2013).

2.3. Application of Geographic Information System (GIS) for Malls

Geographical Information Systems (GIS) are used today at several planning applications including land use planning, health care planning, and transportation planning. Site selection is an issue for many different kinds of businesses. Retailers, banks, savings and loans, and health care and service providers of all types face the common issue of placing sites in close proximity to their customers and prospects (GIS for Retail Business, 2013). Geographical Information Systems (GIS) used today to provide advanced analysis tools and complete data packages for analysing retail and demographic information.

Public Participation in decision-making processes works not only to identify areas of common values or variability, but also as an illustrative and instructional tool (Higgs *et al.*, 2008). It is necessary to find and evaluate any problems, which may affect the structure; the builder needs to determine a suitable location for the mall to ensure a strong customer base for the retailers. It is observed that urban projects evolve according to their location and huge amount of long term investments. This makes some locations the favourites of capital owners because of their location properties such as a central position in the city or ease of transport with automobile (Yırtıcı, 2005; Ozaydin & Ozgur, 2009; Terzi, *et al.*).

The Geographic information System (GIS) is a technological method of organizing and arranging the site location of the mall. GIS provides the framework in which all these techniques can be utilized by first looking at what factors contribute to successful site location. Spatial analysis is one of the most important applications of GIS. It is possible to integrate different analyses via, for example, ArcGIS Model Builder tool that allows the combination of data inputs; interactive and dynamic spatial analysis; and resulting outputs (Onden & Tuzla, 2012; Mishra, 2009). Therefore, this study was designed to examine the potential of suitable location as well as to study customers' preferences for shopping malls in the area and to identify new sites for shopping malls.

- The study hypothesized that the Al Bateen and Zakhir districts will be ideal locations for new malls based on population density and non-availability of malls in these districts.
- It was hypothesized that the Bawadi Mall attracts more customers based on diversity of its stores and entertainments.

2.4. Study Area

Al Ain city was selected for this study because it is located on the junction of two major trade routes, namely the routes between Abu Dhabi and the mountain pass to the Gulf of Oman and between Dubai and settlements south of Al Ain along the foothills of the Omani mountains (Cox, 1986).

Al Ain is the fourth largest city in the United Arab Emirates and the second largest in Abu Dhabi, with a population of 584,800 people in 2011 (Abu Dhabi, 2011). Al Ain is located 155 km east of Abu Dhabi and 140 km southeast of Dubai. This city labelled as the 'Garden City' given the many oases, which are surrounded by magnificent red sand dunes that vary in texture UAE (Al Ain An Oasis City, 2001). Al Ain city is located in the Eastern region of the United Arab Emirates between latitude 24° 03' and 24° 22' north and longitude 55° 28' and 55° 53' east (Barrault, 2013).

Al Ain is one of the major tourist destinations in the UAE with crowd drawing attractions like Al Ain National Museum, Jebel Hafeet, Al Ain Oasis, Fun City, many parks as well as the largest and oldest zoo in the Emirates. These tourist destinations attract many foreign tourists from neighbouring Europe and other countries around the world throughout the year. The mega-projects launched in Dubai, Abu Dhabi and Al Ain have considerably increased the European population in all these Emirates with Al Ain housing a large number of western expatriates who have chosen to work and live in the UAE (Al Ain An Oasis City, 2001).

3. Methodology

GIS integrates geographic and attribute data about population and the methods assessed based on population measures, distance between shopping malls and proximity to the Central Business District (CBD).

In term of population density, the districts were classified to identify the density in each district in Al Ain. It was the most commonly used with a simple math formula whereby one takes the total population of a place according to current census data and divides it by the total physical area.

$PD = N/A$ -population density= number of organisms/area

$PD = N/A$, PD stands for population density; N stands for the number of organisms; A stands for the area

Actually, there was a relationship between the spatial distribution of objects and population density. Therefore, distribution of shopping malls depended on population density, which was the most important factor for evaluating shopping mall distribution. Many researchers such as Ertekin *et al.* (2008) used this factor of feature distribution. The total population was analysed to identify the relationship between population density and existing shopping malls and to check whether there is a need for a new mall.

Distribution of shopping malls throughout the study area was also an important point that needed to be considered by

measuring the distance between shopping malls. The criteria used by Gündogdu (2011), Cheng et al (2007) easily identified the distance between points using distance tools (Euclidean distance) in ArcGIS software. The Euclidean distance tools describe each cell's relationship to a source or a set of sources based on the straight-line distance. It gives the distance from each cell in the raster to the closest source (ArcGIS 10.1).

The geographic database included boundaries of districts from which areas, distances from the CBD and distribution of shopping malls from the CBD were calculated. It indicated the ring, which is called the buffer in ArcGIS software, to be from 3 km to 10 km covering areas occupied by the city to see the distribution of shopping malls with population. The buffer distance parameter can be entered as a fixed value or as a field, containing numeric values because the buffer distance is a constant; all features are buffered to the same width.

The growing population of urban settings required selection of new shopping malls and selection depends on

many factors such as population, road networks, existing shopping malls, land use, available vacant land, elevation, parks, fire and police stations, and airports. Criteria were entered into a model builder to discover suitable locations for shopping malls.

This model concentrates on shopping malls and consists of three main processes, which are:

- Suitability Modelling Process
- Exclusion Modelling Process
- Final Modelling Process

The criteria of site selection for the new shopping malls have been compiled from many previous researches around the world (Table 1). The researcher had a meeting with the people in Municipality. Specifically with Bakri Abd Al Raheem and Laila Al Rashidi from Al Ain Town Planning (11/11/2013) and asked whether there are standards for establishes new malls. They mentioned there are no standards for establishing new research ushered part of the world (Table 2).

Table 1. Summary of criteria for locating a new shopping mall

Factor	Criteria	Source
General	Mall size >1000000 sq feet, with > 14000 population, major airports, major entertainment centers, Arenas & stadiums, hospitals, visibility & accessibility.	Panda Express (2013)
General	Prototype size, parking requirements, trade area extent, population requirements, traffic/access requirements, demographics	Burbaker (2004) & Ladle, et. al. (2009).
General	Distance from education, neighborhood, relaxation, big retail centers, governmental & convenience.	Onden & Tuzla (2012)
General	Allowance for commercial area, far from petrol station, accessibility, area size > 1000 m ² .	Municipality of KSA (2013)
General	Criteria for choosing a store location are performance measures, population structure, economic factors, competition, saturation level, magnet, and store characteristics.	Turhan, et al. (2013)
Demographic	30,000–50,000 minimum population within 3 mile radius, 2–4% annual population growth, \$50,000 median household income	New Store Location Criteria (2010)
Commercial area	Protect natural area, provides sufficient parking, near the population area, accessibility.	Al Ain 2030 (2007)
Rural buildings	Fifteen sub-criteria are involved in the computation process, these are elevation; slope; aspect; vegetation type; visibility; nature and biodiversity policy; water source; surface water; land use, urban area; site access; population density; proximity to residential tourist & to agricultural area.	Jeong, et. al. (2013)

Table 2. Criteria used for locating a new shopping malls

Factors	Criteria	Sources	Layer
Population	>14,000 population	Panda express (2013)	District
Vacant land	>0.092km ²	Panda express (2013)	District
Existing shopping malls	Far enough from existing shopping malls (4000 m)	Gündogdu (2011)	Shopping malls
Existing shopping malls	Far enough from existing shopping malls (4000 m)	Gündogdu (2011)	Shopping malls
Road	250 meters buffer for major and arterial roads	Şen, et al., (2013)	Road
Police station	Buffer 1000 to 2000 m	Ahmed et al.,(2013)	Police station
Fire station	Buffer 1000 to 2000 m	Şen, et al., (2013)	Fire station
Land use	Buffer from 50 m to 1000m:		Land use
Elevation	Classification	Jeong et al., (2013)	Elevation
Airport	Buffer 4000m	Cox (1986)	Airport

The most important factor that effects the selection of new locations for shopping malls is population density. High-density areas are preferable because the shopping malls will serve large numbers of people. The Panda Express (2013) estimated the population should be more than 14,000 in the district. This way it can select the location to establish the new mall using these criteria. After that, reclassify tool was used to allocate suitability values on utility scale 1 to 5.

The distance between shopping malls is a very important factor in the distribution of the existing shopping malls. The method of Euclidean distance between shopping malls (4000 m) used by Gündogdu (2011), was adapted in this study. Then, reclassify tool was used to allocate suitability values on utility scale 1 to 5.

By selecting main roads to find the easiest and the fastest accessibility to shopping malls, Ahmed, et. al. (2013) used Euclidean Distance tools. Next, reclassify tool was used to allocate suitability values on utility scale 1 to 5.

Proximity to police stations is important in case of crime, accidents, and theft inside or outside of the shopping malls. Therefore, the police station must be within 1 km to 2 km of the shopping malls (Ahmed et al., 2013). In Raipur to understand the consumer behaviour towards shopping malls Sen, et al., (2013) first used Euclidean distance from police station to determine location. Then, they used reclassify tool to allocate suitability values on utility scale 1 to 5.

The distance between fire station and shopping malls is very important for emergencies because the shopping malls included electrical equipment, gas, and other flammable products. Accordingly, Sen, et al., (2013) used Euclidean distances between fire station and then, reclassify tool was used to allocate suitability values on utility scale 1 to 5.

This is the second step to exclude unsuitable area. It uses airport and some geographical variables such as topography (i.e. mountains and wadis) and land use (i.e. residential, commercial, agriculture and industrial) to determine suitable

sites.

The airport must be at least 4000m away from shopping malls because of noise pollution (Cox, 1986). Oh et, al. (2007) used Euclidean distance to airport to help determine the new location. Then, reclassify tool was used to allocate suitability values on utility scale 1 to 5.

Topography, especially land elevation, was an important factor for selecting new shopping mall sites. In the Al Ain Master Plan (1986), a buffer zone of 1000 meters from mountain base and wadi banks was used to exclude unsuitable areas (Cox, 1986). Euclidean distance around wadis and mountains was used by Oh et, al. (2007) showing most of Al Ain has an elevation suitable for malls. Jabel Hafeet is the only location with an elevation too high for suitability. The, reclassify tool was used to allocate suitability values on utility scale 1 to 5.

Al Ain Master Plan excludes unsuitable areas and located vacant land by analysing land use. Land use consists of four layers, which are residential, commercial, industrial, and agriculture layers (see Table 3). The criteria first determined residential and commercial areas should be approximately 50m away and agriculture and industrial area should be at least 1000 m away. Again Şen, et al., (2013) used Euclidean distance to determine residential, agriculture, commercial and industrial areas. Then, reclassify tool was used to allocate suitability values on utility scale 1 to 5.

The suitable areas based upon the criteria (population, existing malls, roads, police station, fire station), and unsuitable areas (airport, topography) were overplayed to determine the most suitable location for new malls. Then all layers were converted to raster format and the modelling process was carried using the Grid tools to identify the size of the site selection area. KML tool was used in order to use Google Earth for checking the selected sites on recent satellite image.

Table 3. Data used in this study

Layer	Reason for using the data	Type
Population	To select high density district	Polygon
Existing shopping malls	To select new location far enough from the existing shopping malls	Point
Roads	To be near major road	Line
Agriculture	To exclude from new location	Polygon
Industrial	To avoid the vicinity of industrial area	Polygon
Commercial	To be in/near commercial area	Polygon
Residential	To be near residential area	Polygon
Wadi (valley)	To exclude from new location (flooding)	Line
Airport	To be far from Airport	Point
Police station	To be near police station	Point
Fire station	To be near Fire station	Point
Elevation (Mountain)	To exclude High and low areas and To exclude from new location (erosion)	Raster
Satellite image	Give more detail	image

Sources of Data: Al Ain Town Planning Department

Our rating scale question type will function in a very similar way. Likert scales are given scores or assigned a weight to each row in the matrix; usually from 1 to 5 (Johns, 2010). This process is called reclassification. It is done in order to get values into ranking scale of 1 to 5, with 1 being lowest suitability and 5 being the most suitability (see Table 4). The range of suitability values are:

- 1 = Lowest suitability
- 2 = Very low suitability
- 3 = Moderate suitability
- 4 = High suitability
- 5= Highest suitability

Table 4. Ranking

Population	
Number of people	Rank
0 - 500	1
500 - 1000	2
1000 - 7000	3
7000 - 14000	4

Existing Shopping Malls Airport

Distance in meter	Rank	Rank
0 - 1000	1	1
1000 - 2000	2	2
2000 - 3000	3	3
3000 - 4000	4	4

	Police station	Fire station	Road
Distance in meter	Rank	Rank	Rank
0 - 50	5	5	5
50 - 100	4	4	4
100- 200	3	3	3
200-500	2	2	2
> 500	1	1	1

Distance in meter	Land use	Rank
50m	Residential	5
100m	Commercial	4
900m	Agriculture	2
1000m	Industrial	1
Distance in meter	Topology	Rank
50m	Mountain	1
50m	Valley (Wadi)	1

In this study, a self-administrated questionnaire was prepared. The questionnaire included two parts, the demographic and shopping behaviour of customers. The first part of the questionnaire included four questions about the

demographic details of the respondents (such as gender, age), name of the shopping malls they visit, and the name of district where they live. The second part of the questionnaire included the shopping behaviour of the respondents and the factors affecting their selection of shopping malls, number of visits and average spending. The questionnaire was distributed by two ways using online Survey Monkey website and offline. In the offline, hardcopies of the survey were distributed face to face to people in schools and banks. The samples size used in this study was 500, which were distributed in two ways, 250 online and 250 offline.

4. Result Analysis

Excel software version 2010 was used to analyse the survey results for the study, ArcGIS 10.1 was used for spatial analysis, Photoshop was used for graphic finishing, Survey Monkey was used for online survey, and Google Earth to check location of selected site. Following are population measure, distance between shopping malls and proximity to the center business district (CBD) used in our investigation.

The population of the central districts of Al Ain in 2010 was 284,736. Of the 34 districts, the largest population number is 41,056 in the Central District, which represented 14 percent of Al Ain. The population is broken down into the number of males and females in each district. The district with the highest population density is Al Jahili with 3820, while the district with the lowest population density is Bida Bint Saud with six residents. 94.4 percent of the districts have more males than females while some are heavily populated with males (Sanaiya, Bida Bint Saud and Airport East, and Al Ain International Airport. Though Al Jahili has the largest population density, the residents are mostly male (69.5 percent). There are a few areas where the ratio is close to 50 percent male and female with Al Maqam being the most evenly divided (330 female and 333 male). Asharej has the highest percentage 68 percent) of females with Al Agabiya being the second highest (63 percent), probably due to the woman's university and the hospital being in the districts.

Based on (Mohamed. (2006) research, the increase of population in 2001 was from the CBD toward western direction (see Figure 1) presents the CBD, which is very important to determining the direction of increase of population in Al Ain as the city grows. The mean centre of population was in Central District. The direction of population increase was to the northeast because it has more attraction than the urban areas. In the south, there are industrial areas and conservation zones such as Hafeet Mountain and the zoo that limit boundaries for residential areas. The most suitable location of new malls would be in the north and northeast areas of Al Ain as this is where the population growth is occurring.

Distances to the CBD and distribution of shopping malls with the population of districts were not found to be

significant (Ertekin *et al.*, 2008). The correlation between population density and malls is positive in the areas that have the highest population density, Al Ain Mall and Al Jimi Mall. Meanwhile two other malls (Al Foah Mall and Bawadi Mall) located in the lowest population density area have negative association (see Figure 1). Although located in lowest population density area, Bawadi has the highest percentage of respondents in the survey.

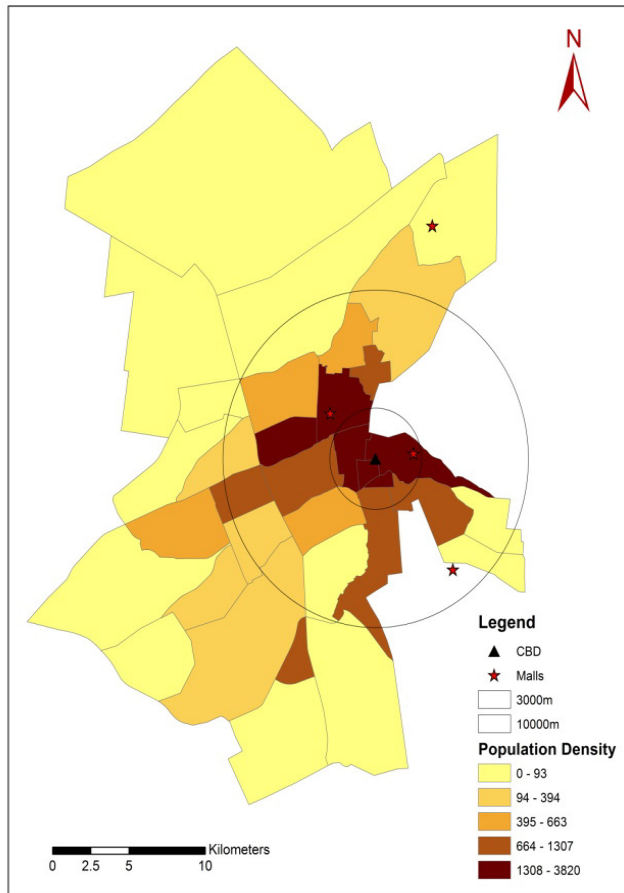


Figure 1. Al Ain Population Density

The distance between shopping malls gives a good indication of distribution of the malls and the areas served. The closest distance is 5 km between Al Ain Mall and Al Jimi Mall. The furthest distance is 20 km between Bawadi Mall and Al Foah Mall (see Table 5). The malls are randomly distributed thereby helping large numbers of people.

Table 5. Distance between malls (km)

Malls Name	Al Jimi Mall	Al Ain Mall	Bawadi Mall	Al Foah Mall
Al Jimi Mall	0	5	12	13
Al Ain Mall	5	0	7	14
Bawadi Mall	12	7	0	20
Al Foah Mall	13	14	20	0

This study used two rings; 3 km and 10 km from the CBD based upon the study conducted by (Ertekin *et al.*, 2008). The first ring covers 9 districts out of 34 (26.5 percent) with 25 percent of malls and the second ring covers 24 districts out of 34 (70.5 percent) with 75 percent of malls, both with the CBD as the focal point. As a result, the first ring has one mall and second ring has two malls (see Figure 1).

New site selection of shopping mall locations is a multifaceted issue because there are many criteria, which need to be taken into account. The processes were followed using GIS spatial analysis. These are; Suitability Modelling Process, Exclusion Modelling Process and Final Modelling Process.

There are five input layers for determining suitable areas, which are population, existing malls, roads, police and fire stations. Mountain, valley (wadi), residential, agriculture, industrial, commercial and airport areas were excluded in order to select suitable and vacant land for the shopping malls.



Figure 2. Suitable locations for new shopping malls

The final process contains all input layers of suitable modelling and exclusion modelling using Weighted Overlay tools. The results from the modelling process indicated that the most suitable areas are small in size (less than one square kilometre). Therefore, it is recommended to choose areas with moderate suitability. The total size of the moderate suitable area was 42.6 km² (see Figure 2). As a

result, four sites were identified and rated based on population, existing shopping malls, roads, police, fire stations, airport, topography and land use. Based on these factors, the total size of the four suitable areas was 0.77 km² that included three districts. The most suitable site found in the Airport District (see Figure, 2).

The size of the Airport District area (site one) was 0.26 km² which is approximately equal in size to Al Ain Mall area (0.23 km²). The site location fulfils a majority of the requirements. Even the site in the low population density area, based on the survey, showed that people are attracted to malls (Bawadi Mall) even if it is far from where they live (see Table 6).

Table 6. Area of the new selected sites (km²)

Site No.	Name of District	Population	Area (km ²)	% area
1	Airport District	2908	0.26	34.2
2	Al Tawayya	8588	0.18	22.8
3	Al Maqam	11920	0.11	13.7
4	Airport District	2908	0.23	29.2

Site one is the most suitable location for building a new mall as shown in the (see Figure 3), complementing the future desert reserve area. The master plan of Şen, et al., (2013) designates the site area as a desert reserve. However, the addition of a mall to the area will be beneficial to tourism and desert reserve by providing easy access to food, clothing and indoor entertainment. This site can also provide services for tourists and desert activities such as camping, animals, plants and sports. This information can be detailed in travel guides and brochures about the desert reserve.



Figure 3. The Best Site Location of the proposed mall (site 1)

It was hypothesized that Al Bateen and Zakhir districts would be ideal locations for new malls. The results disagreed with the hypothesis because there are many factors affected on selection process. The best site is in the Airport District area (site one) (see Figure 3). The second two sites are close to Al Tawayya and Al Maqam districts (site 2 and 3). The second and third sites (see Table 6) all have small area with high population.

The sample size of this study was 500, which was distributed two ways, 250 online and 250 offline. Out of the 250 online surveys distributed, 206 responses were received (82.42 percent) whereas all offline respondents were received (100 percent). The overall respondents received were 456 (91.2 percent).

The majority of the respondents in this study were females (63.4 percent). The result almost agreed with the study-conducted by where they found out that 60 percent of females participated in the survey. In general, the result shows that young people between the ages of 18 – 22 participated more in the survey (43 percent), the fewest participates were people above 40 years of age (8.1 percent) (see Table 7). The average participant spent between 500 – 1000 AED (45.8 percent) per trip.

Table 7. Demographic Details of the participants in the survey

Demographic Details		% of respondents
Gender	Female	63.4
	Male	36.6
Age	18 - 22	43
	22 - 30	30.5
	30 – 40	18.4
	40 - >	8.1
Purchases	100 - 200	24.6
	200 - 500	22.1
	500 - 1000	45.8
	1000 >	7.5

The secondly customer behaviour the majority of participants (45.8 percent) prefer to visit Bawadi Mall. This may be due to the fact that Bawadi Mall is much bigger, has more shops and is a more comfortable place to spend time. The second mall preferred is Al Jimi Mall (24.6 percent) because it is located near the governmental buildings and near high population areas. The least visited mall is Al Foah Mall (7.5 percent) (see Table 8). This may be because it is located far from the city centre, has fewer shops and it is the smallest mall in Al Ain.

According to the result majority of the respondents, explain distance is the most important factor (38.2 percent) when choosing where to shop with feeling comfortable being second, regardless of price. The study also shows that the next most important factor is feeling comfortable (34.9 percent) in the mall and least important factor is price (11 percent). This may indicate that people may have a high income (see Table 9).

Table 8. Preference of malls in Al Ain

Type of Malls	% of respondents	Area Size (km ²)	Number of shops
Al Jimi Mall	24.6	0.026	65
Al Ain Mall	22.1	0.23	More than 200
Bawadi Mall	45.8	0.12	Over 400
Al Foah Mall	7.5	0.041	94

Table 9. Attraction Factors

Attraction Factors	percent of respondents
Products	26.3
Closeness	38.2
Activates	17.3
Price	11
Restaurant	31.6
Special stores	27.6
Entertainment	14.7
Cinema	28.5
Parking	11.8
Best Sales	19.5
Feeling more comfortable	34.9

The result shows that the majority of participants prefer to visit the mall only when necessary (31.4 percent) and on weekends (29.5 percent). This frequency result may indicate that a large portion of the respondents have their own business or are working. Few participants visit on a daily basis (5.9 percent) with more visiting at least once a month (21.5 percent). The result of frequency visiting disagreed with the research-conducted by (Tiwari & Abraham 2010). They found 40 percent of respondents visited the malls at least once a week and Survey Monkey, (2013) found many customers visit twice a week (25 people) (see Table 10).

Table 10. Frequency of visiting malls

Frequency visiting	% of respondents
Daily	5.9
Twice a week	12.1
Weekend	29.2
Monthly	21.5
Only when necessary	31.4

When the respondents were asked about the time of day and the length of time they usually visit the malls, timing of the visit was not important (32.9 percent) and they usually spend 2- 4 hours (41 percent) in the mall when they visit. When timing is important, most respondents prefer to visit the malls in the evening (30.3 percent). It is interesting to note that that 0 – 2 hours and 4 – 6 hours duration of visits the same result obtain (25.2 percent), (see Table 11). The

result disagreed with the results of Tiwari, & Abraham, (2010) who found respondents (30.1 percent) spend about one and a half hours to two hours for shopping purposes.

Table 11. Suitable time for visiting mall and Duration of visit

During the day	% of respondents	Duration of visit	% of respondents
In the morning	15.1	0 - 2	25.2
In the afternoon	21.7	2 - 4	41
In the evening	30.3	4 – 6	25.2
In any time	32.9	6 - >	8.6

5. Conclusions

GIS method is consider as useful and important analytical tool used to study the distribution of shopping malls in Al Ain city. The application help to identifies new sites for shopping malls, geographical distribution of customer and generation of maps for customers' preferences of shopping malls. The study found out the large proportion of customer prefers to visit some malls by using their car, which are far such as Bawadi mall. This may be attributed to available more facilities and indicates improved socio economic status. In addition to that it also indicate that to build a new mall is in the Airport District area and the customers prefer going to there, even if it located far from where they live. In this case, the opening of a shopping center in a consolidated area can hardly become an articulating piece of the urban space. As the investigation reveals, responses from customers indicate the number of shops, size of the area and atmosphere play the most important roles in determining locations for new malls.

According to the current study, a random and uneven distribution of shopping malls is found in Al Ain. The study suggests that adding more malls would be a viable salutation and site 1 is area that is more suitable. The study also suggests that carrying out more investigation regarding factors such as soil types, land ownership and compensation. Currently, there are no standards for building malls and it is highly recommended that standards to be set. The result also indicates that the majority of the respondents prefer malls that are entertain to them. Therefore, it is recommended to build mall with large area that can provide various services and entertainment. The public should have an awareness of honesty in their responses and participate in the surveys in order to ensure their preferences are recognized.

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