

Review and Locating of Health-Care Centers Using Fuzzy-AHP Techniques (A case of Zabol City)

Dr. Gholam Ali Khammar^{1*}, Hossein Majidi Meskin²

¹ Assistant Professor of Geography & Urban Planning, University of Zabol, Zabol, Iran

² MSc student of Geography & Urban Planning, University of Zabol, Zabol, Iran

ABSTRACT : *The location of facilities is critical in both industry and health care centers. In most cities of Iran, the lack of appropriate space allocation and optimal positioning of physical elements and services, particularly health care centers led to increasing of urban and civilian's problems. In order to, the aim of current research is review and locating of health-care centers using Fuzzy-AHP Techniques in Zabol city. Applied methodology is based on qualitative and quantitative methods with point on socio-economic indicators to adjusting the level of settlements in the spatial system of the Zabol region. Results show that almost all medical centers are located in areas 2 of Zabol city and citizens have many difficulties in terms of access to these centers.*

KEY WORDS: *Health facilities, Zabol city, Fuzzy-AHP Techniques, Spatial System*

I. INTRODUCTION

During the 19th and early 20th centuries, the synergies between urban planning and public health were evident in at least three areas: creation of green space to promote physical activity, social integration, and better mental health; prevention of infectious diseases through community infrastructure, such as drinking water and sewage systems; and protection of persons from hazardous industrial exposures and injury risks through land-use and zoning ordinances. During the middle of the 20th century, the disciplines drifted apart, to a certain extent because of their success in limiting health and safety risks caused by inappropriate mixing of land uses (Majidi, 2006). The disciplines recently have begun to reintegrate. During the last 20 years, shared concerns have included transportation planning to improve air quality, encourage physical activity, prevent injuries, and promote wellness. In addition, some original crossover ideas, such as the potential for parks and recreational facilities to contribute to physical activity and mental health, have reemerged. Relatively recently, urban planning has focused on the effects of community design on energy use and greenhouse gas emissions to affect the growing public health concern of climate change. Finally, emergency preparedness (evacuation planning) and access to health care (e.g., assurance of accessibility and adequacy of facilities) are topics important to both disciplines (Refahi & et al, 2003; Qajari, 2008).

In health care, the implications of poor location decisions extend well beyond cost and customer service considerations. If too few facilities are utilized and/or if they are not located well, increases in mortality (death) and morbidity (disease) can result. Thus, facility location modeling takes on an even greater importance when applied to the siting of health care facilities. Everything usually begins with the architects and designers meeting with the clinical staff and other professionals who will be working in the new or enhanced space. A design specification is generated based on considerations such as workflow, patient Volumes, types of activities, proximity to key partners, and the basic necessary infrastructure such as heating, ventilation, and cooling (Xang, 2013; Utnm, 2014). It's critical that IT be involved in the design specification stage before the specification is generated. Key decisions at this point in the process include defining what applications and technology will be used in the new or remodeled space. From an IT perspective, everything that's planned should be within the guidelines of the IT strategic plan for the organization. It is fine to test new technology, but it should be part of a vision for the larger organization (Yama, 2008). To make a balance between different aspects, urban planning is a conventional tool used which also can be a significant tool for promoting the interaction among planners and officials and the local community (Diamantini & Zanon 2000). In making sustainable urban development, urban planning can play an eminent role. In order to make balance between four aspects economic, environmental,

social, and governance is the aim of sustainable urban development. This paper examines the spatial distribution of healthy land use in Zabol city according to urban fabric divisions. Also partly are considered the consistent or not consistent position in relation to the centers of adjacent land uses and because almost all the clinics are located in the city of Zabol in Area 2 and it hasn't an balanced in distribution, our goal is the provide of best locations for the construction of health centers in the Zabol city as balanced. This problem has faced citizens of Zabol with big challenges and led to limit their access to other areas.

Case study Region : Zabol is the second city of Sistan and Baluchistan province and it is the first city of Sistan region. This province is located between $25^{\circ} 3'$ to $31^{\circ} 29'$ northern widths and $58^{\circ} 49'$ to $36^{\circ} 20'$ eastern lengths. It is limited to Sothern Khorasan with the Oman Sea to the north, Afghanistan to the south, Pakistan to the east, and Hormozgan province to the west. According to the census of 2006, the population of this province estimated at 2,405,742 people. Based on the latest division of the country Sis-tan and Baluchistan has 14 counties, 36 cities, 40 boroughs, 102vials, 8908 coded villages (Fanni, khakpour & Heydari, 2014).

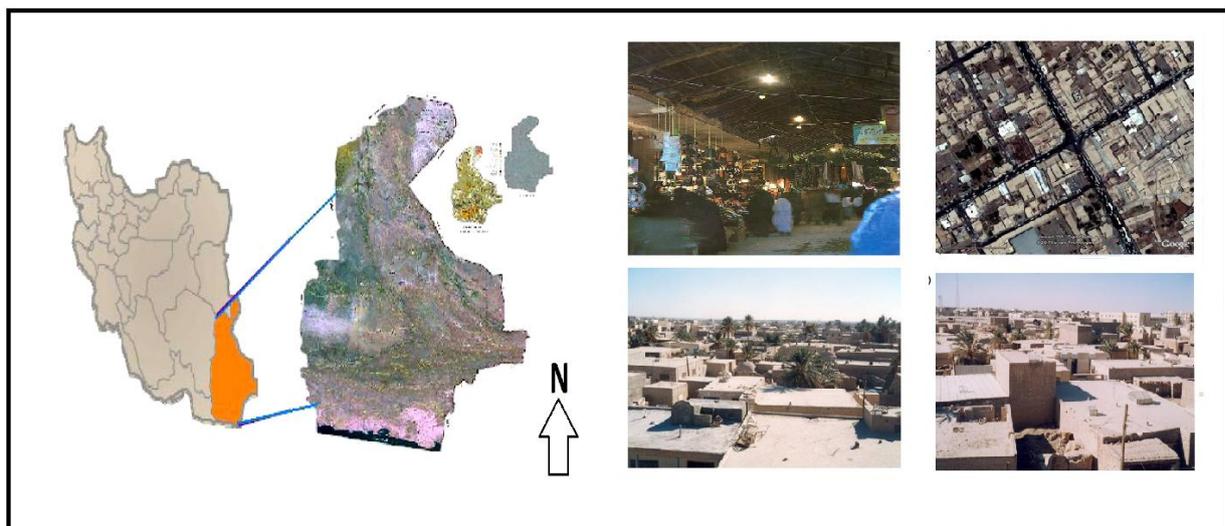


Fig. 1. Case study region.

Also Zabol city is located in the near of Hamon Lake and the region agriculture lands are irrigated by Hirmand River water. Lake Hamun is a seasonal lake that is often dry. The people of Zabol speak a Persian language variant known as Sistani or Seistani which is very similar to Dari, also known as Afghan Persian. The tribes of the area include the Shahraki, Arbabi, Narui, Barahui, Gorgij, Herati, Ghanbari, Afshar, Barani, Sarani, Fakhireh, Mir, Dahmardeh, Rashki, Sanchooli, Pahlevan, Faghiri, Divaneh, Gorg, Nohtani, and Sayyadi. In recent years these tribal names appear in the surnames of the inhabitants of the area. There are also hundreds of Baluchis, Brahuis families and some Pashtuns in this city. Zabol area is well known for its "120 day wind", a highly persistent dust storm in the summer which blows from north to south. Zabol is connected by road to Zaranj across the border in Afghanistan. The Delaram- Zaranj Highway provides road connectivity to the rest of Afghanistan. Zabol thus provides Afghanistan access to the Arabian Sea and Persian Gulf via the Port of Chabahar.

II. METHODOLOGY

In present study the data were collected from libraries, documents and field study. In the case of library, data were collected by studying books, articles and internet. Then, field study was done and including observation, discussion and filling questionnaire and data were analyzed by using a qualitative range. For further clarification of the issue data were analyzed in AHP and Fuzzy techniques. In current research according to surveys and current information's and for combined criteria were used of GIS and the main methods of data fusion, fuzzy logic and Analytic Hierarchy Process (AHP) and the map of the best locations for the construction of health centers was obtained. Then, using inference functions and fuzzy operators were ranking these criteria to Fuzzy measures.

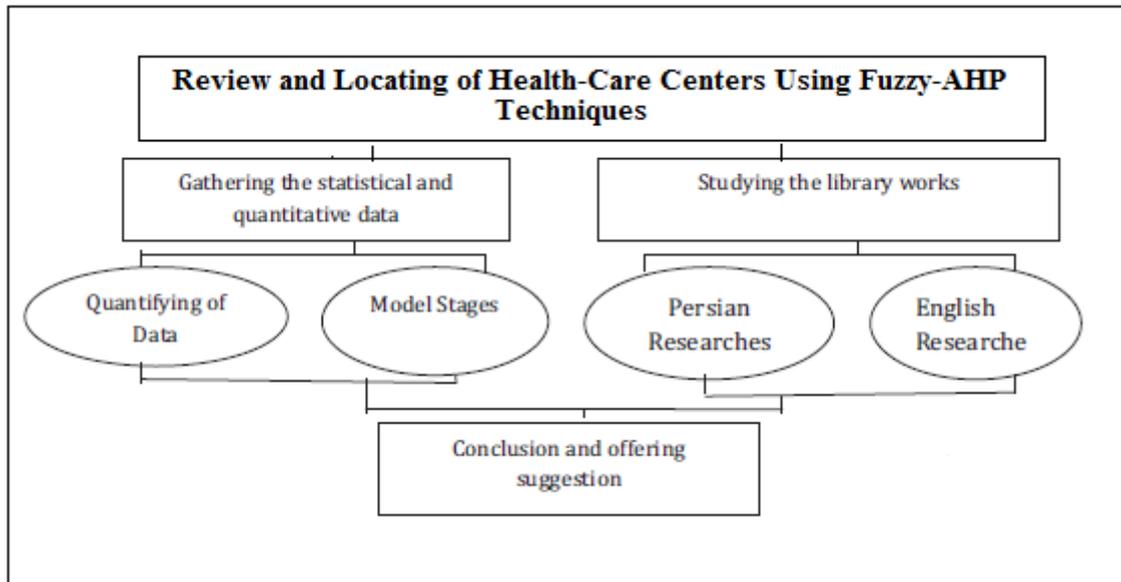


Fig. 2. Conceptual research diagram.

III. RESULTS

World-wide cities are growing at a rate of 2% annually (UN, 1999). While in 2000 about half of the world’s population lived in cities, almost 2/3 (60, 3%) will reside in urban areas in 2030. Especially African, Asian and Latin American cities are characterized by high urban growth rates (3,5% for Africa, 2,4% for Asia and 1,7% for Latin America) caused by natural population growth and rural-urban migration as well as by the underlying pull- and push factors such as the lacking infrastructure in rural areas and the hope for employment in the cities. As a result of the uncontrolled and uncoordinated growth of urban agglomeration characterized by informal land acquisition, fragmentation of peri urban land, inefficient use of land, poorly functioning land markets etc. urban development is far from being sustainable.

Consistent with compatible land uses : In term of urban planning, land use which placed in the sphere of influence should be consistent with each other in terms of authenticity and coordinates and Causing a nuisance and do not work together properly. For land use rate layers, current land uses in Zabol city have divided to six classes. Then the degree of compatibility between land uses were determined and classified based on land-use map of the city and in some cases field observations. Then specific point was awarded to each class.

Table (1) Land use valuation based on their fitness degree

Land use	Value
Bayer, Farming, garden	6
Parks, educational, administrative	5
Sports, industrial, cultural	4
Military Facilities	3
Commercial and Residential	2
Sanitary	1

Proximity to residential centers : Human life place is the most important part of the city and it is allocated a major portion of the land use. So that more than 60 percent in small towns and about 40 percent of large cities are covered by residential land use (PourMohammadi, 2003).

Accessibility to main transportation networks : Fast and timely access to medical care is considered as the basic needs of families because timely delivery of patients to these centers is of crucial importance (Azizi, 2004).

Distance from industrial sites : Industrial land uses are incompatible with health centers and cause problems such as buildup noise pollution. However, these land uses can cause environmental pollution, Therefore comply with the basic principles of location is an important factor.

Proximity to Urban Green Space : In current research, whatever the distance between green spaces and health care centers be closer, it can get good grades and the opposite of this situation is probably too.

Table (2) Rate of data layers based on the Distance

Score	Distance from data layers				
	Industrial workshops	Residential centers	Medical Centers	Green Spaces	Main ways
1	0-300	More than 500	0-300	More than 1000	More than 500
2	300-600	500-400	300-600	1000-800	500-400
3	600-900	400-300	600-900	800-600	400-300
4	900-1200	300-200	900-1200	600-400	300-200
5	1200-1500	200-100	1200-1500	400-200	200-100
6	More than 1500	100-0	More than 1500	200-0	100-0

After the value of existing data layers, the data's will be weighted. Weight of the layers was done using analytic hierarchy process.

Healthy land use : Zabol city has one municipality region and five districts with attention to its size in Iranian urban system (20845200 Km²). One district with an area equivalent to 48/331 acres, in generally is include of south and southeast part of Zabol city. The district has only one hospital in medical facilities (Amir Al Moemenin Hospital). The two districts have an area equal to 8/457 hectares. This area has many hospitals consist of Imam Khomeini and all its clinics in the Zabol city (Al Zahra, Salamat, Shafa, Beheshti & Shohada). Three Zabol city district has cover an area with 308 hectares based on Tash Consulting Engineers. This area doesn't have suitable area in status of medical facilities. Four district of Zabol city has an area with equal to 31/711 hectares. In general, in the current situation Zabol city has two hospitals and five clinics. The total area of these centers is about 54,955. Calculated per capita, according to the centers of population in 2006 is equal to 0.42. As shown in the figure 2, the healthiest facilities are located in the central part of Zabol city. However, in other areas of the city are deprived of health facilities and account for a small percentage of it. Amir Al Momenin's hospital has located in the entrance road of Zabol to Zahedan city. This hospital has multifunctional services to whole of Zabol city due to its role and due to its 2 Km² distance of residential area. If at least one clinic covered population (10,000 people) and the minimum radius of its access to the residential neighborhoods (750- 650 m) to require clinics to consider the criterion, one area with 36,971 inhabitants, has minimum required three clinics. District 2 with 41,619 populations and taking the five clinics in this area and it has very suitable status quantities scale. Three district with 35,546 inhabitants is requires three clinic. Four areas with 7391 inhabitants needed to one clinic. Finally, district five, with 22,732 inhabitants needs two other clinics.

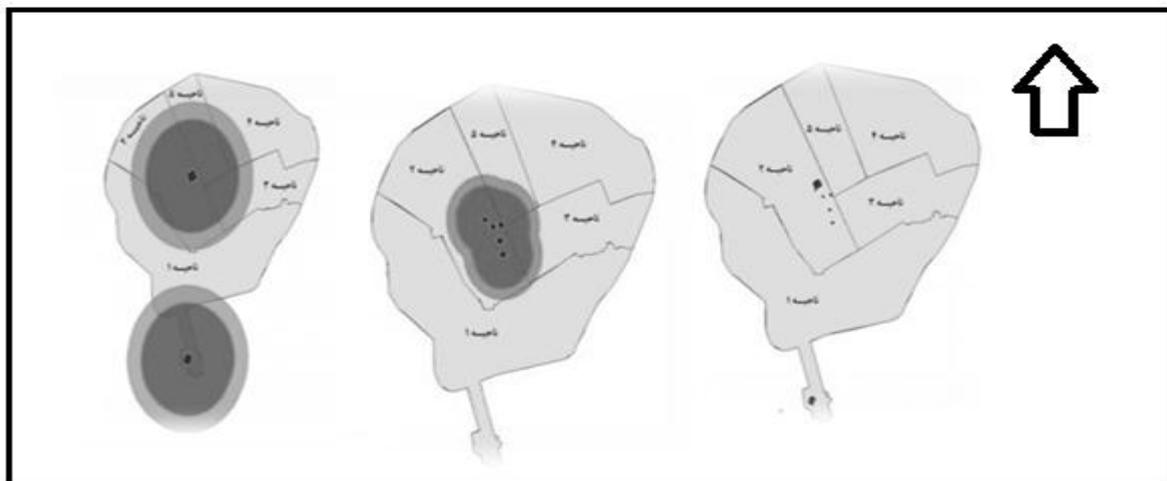


Fig. 3. location of health centers in the districts of Zabol city.

In this research, proximity to the main road is the most important factor in the location of health centers and then the standards of living in residential care, suitable use, away from industrial centers; health centers and close to the green were next factors.

Table (3) Weights to the criteria's

Criteria	Weight	Priorities
Close to main road	0.366	1
Close to residential area	0.310	2
Suitable land use	0.132	3
Distance from industry centers	0.122	4
Close to green space	0.047	5
Distance from healthy centers	0.023	6

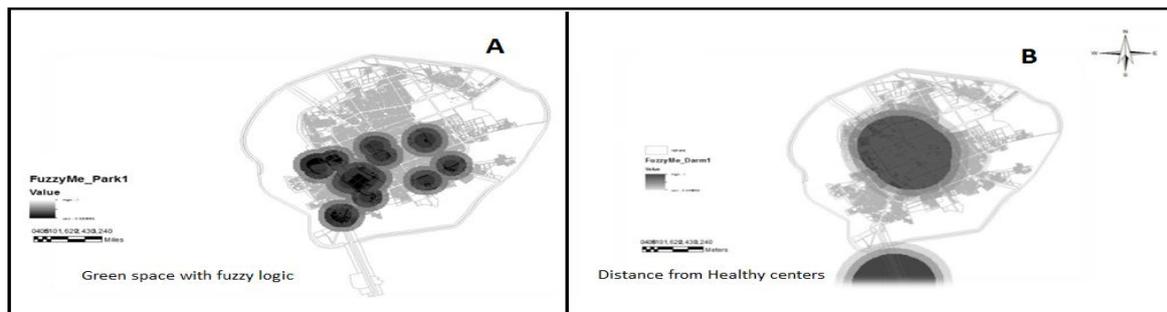


Fig. 3. Fuzzification of layers (Green space & Health center).

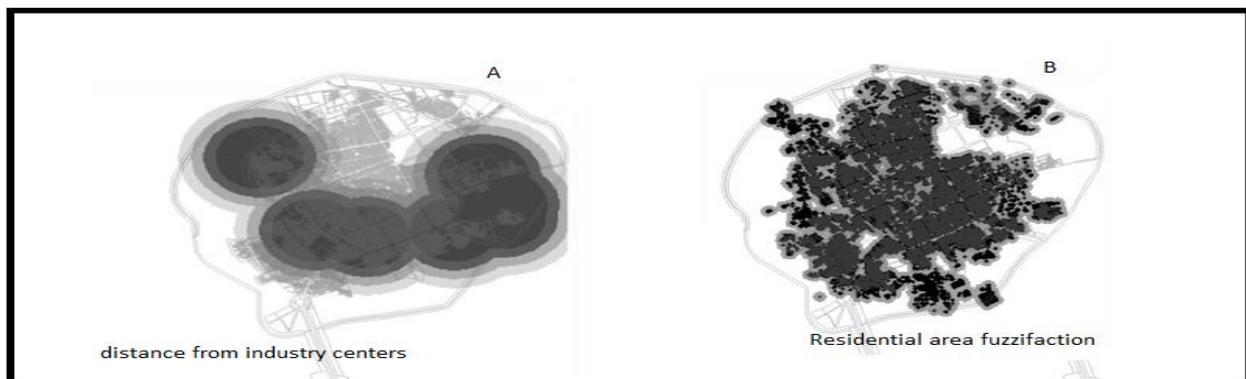


Fig. 4. Fuzzification of layers (industry centers & Residential area).



Fig. 5. Fuzzification of layers (Land use layer & distance from main roads).

IV. CONCLUSION

In this paper the problems of health centers in Zabol were realized and it was found that medical centers in Zabol not balanced distribution. (Hypotheses), and almost all health centers are located in district 2 in the Zabol city and this problem led to created trouble for people from other areas in terms of access to these facilities. In order to, the best place to build a new health center in the city is first group of locations (4.0 to 5/0).

Suggestions

- [1] municipality as the responsible organization about master plans, must provide more suitable laws about urban land use and urban land use allocation.
- [2] Making the proper medical facilities in the city, to reduce the volume of referrals from other parts to the Zabol city.
- [3] Use the experience of other countries in locating of health facilities.

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