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Prioritization of Areas for Construction of Aquatics Facilities Using Geographic Information System (GIS) in Esfahan

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Abstract

This study aimed to prioritize areas for construction of aquatics facilities in Esfahan, according to population distribution, land use, accessibility, and fair distribution. This was descriptive-analytic research. The fourteen areas in Isfahan were considered as research location. The collected data classified and organized through creation of data base in Arc GIS software. With respect to each criterion, the plans were prepared. Finally, the plans showed the prioritization of aquatics facilities.

The findings showed that there was pretty much various distribution of aquatics facilities in various areas in Isfahan. However, there was a strong need for construction of aquatics facilities in areas 10 and 14 in Isfahan.

The appropriate construction site is one of the basic requirements for establishment of sport facilities with high productivity. Undoubtedly, this is the most important task of sport managers. According to research criteria, the identified regions in this study would be the most appropriate sites for establishing aquatics facilities.

Keywords: Aquatics, Facilities, population distribution, GIS, accessibility, Esfahan

Introduction

The most fundamental objective of physical education and sports is development of sport to achieve physical and mental health in different sectors of society. The sport and physical activity play a very important role in urban area. On the one hand, it may provide individual physical and mental health; on the other hand, it provides the necessary fields for collective life of citizens. In recent years, the sports facilities per capital has relatively increased due to increasing of public understanding about the importance of exercise and more attention of officials to social and personal health of citizens. In many cases, however, the selection of location for construction of sports facilities is conducted traditionally and tastefully. This is a fundamental problem in sports; it only results in waste of diverse funds. The sport facilities which are constructed for physical activity, recreation, or exercise are social and crucial locations which help to achieve health and well-being. For maximum use of these facilities, they should be available to all segments of society (Shiri, 2009). In other words, the urban environment should be organized in such a way that support physical activity. Most citizens do not exercise as planned and targeted; however, they often move in the city to carry out their daily activities. The movement in city is not possible without physical activity. Due to dependence on motorized vehicles, this activity is minimal.

According to above, all related bodies from local councils to municipalities and urban planning consultants should provide an environment in which the citizens may do physical activity as part of their everyday activities. The parks, green spaces, playgrounds, gyms, and ponds are the places which contribute to increased physical activity of citizens. The studies conducted in center for disease control and prevention (CDC) in America showed that the development of suitable locations for activities may increase people's participation in physical activities by 25 percent, at least three times a week. The researchers show that people who have better access to a variety of natural and artificial resources are 43% more willing to exercise 30 minutes a day than those who have limited access to facilities (Sohrabi et al., 2011).

The sports facilities per capita in European and American countries is, on average, approximately 3 square meters. In Iran, it is less than one square meter; it was 61 cm in urban and rural areas in 2015 and 59 cm was in urban areas. The sports facilities per capita was 42 cm in Esfahan; this is even lower than per capita in Iran (Development and maintenance of sport facilities company, Iran, 2015).

Due to economic problems and necessity of attention to productivity and efficiency, some key factors including construction criteria, locating and positioning, modification, and neighborhoods should be considered to achieve the desired objectives of sports facilities (Sohrabi et al., 2011).

The sport facilities which are constructed for physical activity, recreation, or exercise are social and crucial locations which help to achieve health and well-being. For maximum use of these facilities, they should be available to all segments of society (Shiri, 2009). Therefore, the location is one of the most important considerations in planning of sport facilities. Even a high quality sport facility will fail if people do not use it, do not know its location, and do not travel there. However, the sports facilities location is often overlooked (Zangiabadi et al., 2010).

The swimming is one of the entertaining activities which causes physical and mental health. In addition to medical examinations, drugs uses, and surgeries in the case of different

diseases, the swimming is proposed as a means to recover and promote health. The aquatics mainly focus on social values such as life quality improvement, importance of physical and mental health, satisfaction of personal needs, entertainment, and motivation. All these lead us to believe that there are new trends toward physical activities and sports. These trends, importance of swimming as a physical activity which is recommended by many health experts, and demands of different people have led to increase of aqua activity programs. For this reason, the aqua activities play an important role in physical activities and exercise habits of people. In recent years, the number of people who exercise has increased (Mortezai&Andaam, 2014).

The Geographic Information System (GIS) is a computer system for management and analysis of spatial information. It is able to collect, store, analyze, and display geographical information. In GIS, the data are shown based on their position. The geographic information system technology collects and collates the information of database and uses the visualization and geographic analysis to provide data for mapping. These data are used to clearly show the events, predict outcomes, and develop maps (Development and maintenance of sport facilities company, Iran, 2015).

There have been conducted many research in this area in Iran and other countries. In a research project titled (A model to identify potential settlements for skiing based geographic information system), a number of rival locations were measured and evaluated using GIS to identify the locations with a potential to construct ski terrain in Rocky Mountains in America. In this study, the researchers also found that this model may help the growth of winter sports around the world (Jordan et al., 2010). In a research on sport facilities localization using GIS, Hosseini and colleagues (2013) showed that most of the sport facilities in area have poor and average conditions; and in some rare cases, they have suitable condition. This may prove that the managers do not use new and computer methods in locating and constructing sport facilities. The collected data were analyzed in software. The findings showed that the sport facilities do not fully comply with defined standards and sports per capita in this area is less than standard sports per capita. Generally, the GIS is a suitable method to analyze sports facilities locations. In a study on (Selection of optimal location for construction of open sports facilities in zones 5 and 6 in Isfahan using GIS), Salimi et al (2012) showed that these locations have better condition in terms of communication routes and population density than other areas. Given the needs and current policies of increasing sports facilities per capita in Iran, the public and private sectors have conducted many large investments to build and develop sport facilities. The results, however, show improper location of sports facilities, waste of funds, and more importantly, lack of meeting people sport needs; the aquatics facilities are not an exception. Therefore, this study aims to identify proper location for construction of new aquatics facilities using proper method and statistical analysis.

Methodology

This was an applied descriptive-analytic survey research. The geographic information system was used for determining objectives, database creation, and data analysis. The fourteen areas in Isfahan were considered as research location (Legal area= 18370 hectare, approximate legal area= 48167 hectare). The population of these areas is 1796197 people (electronic port of Isfahan Municipality, 2011).

The maps were taken from central Municipality in Esfahan and in some cases, from satellites. They were coordinated by software. The pool information was taken from Lifeguard Organization in Esfahan; they were located using satellite data software. According to previous studies, the fair distribution, population density, availability of land, and accessibility were selected as research criteria. In this regard, the Adobe Photoshop, Google Earth, Arc GIS, and Arc Catalog were used in this research. The collected data classified and organized through creation of data base in Arc GIS software. With respect to each criterion, the plans were prepared. Finally, the plans showed the prioritization of aquatics facilities.

Findings

The fourteen areas in Isfahan were considered as research location; the map is provided as shape.

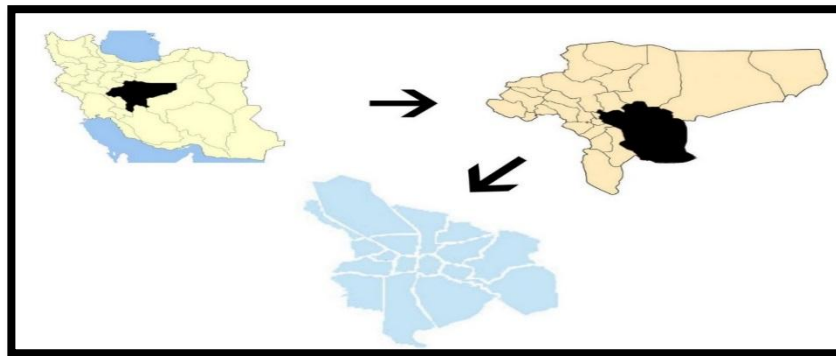
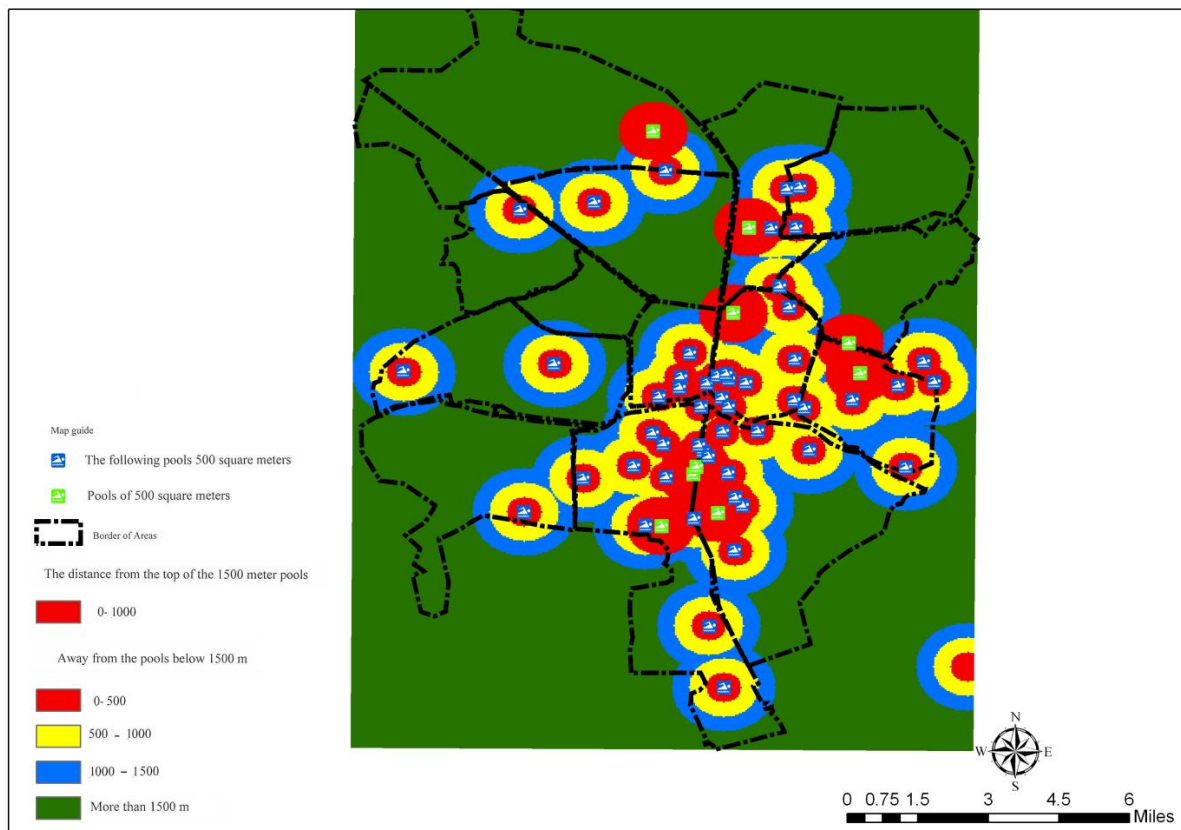


Figure 1. Study location

Inferential statistics:

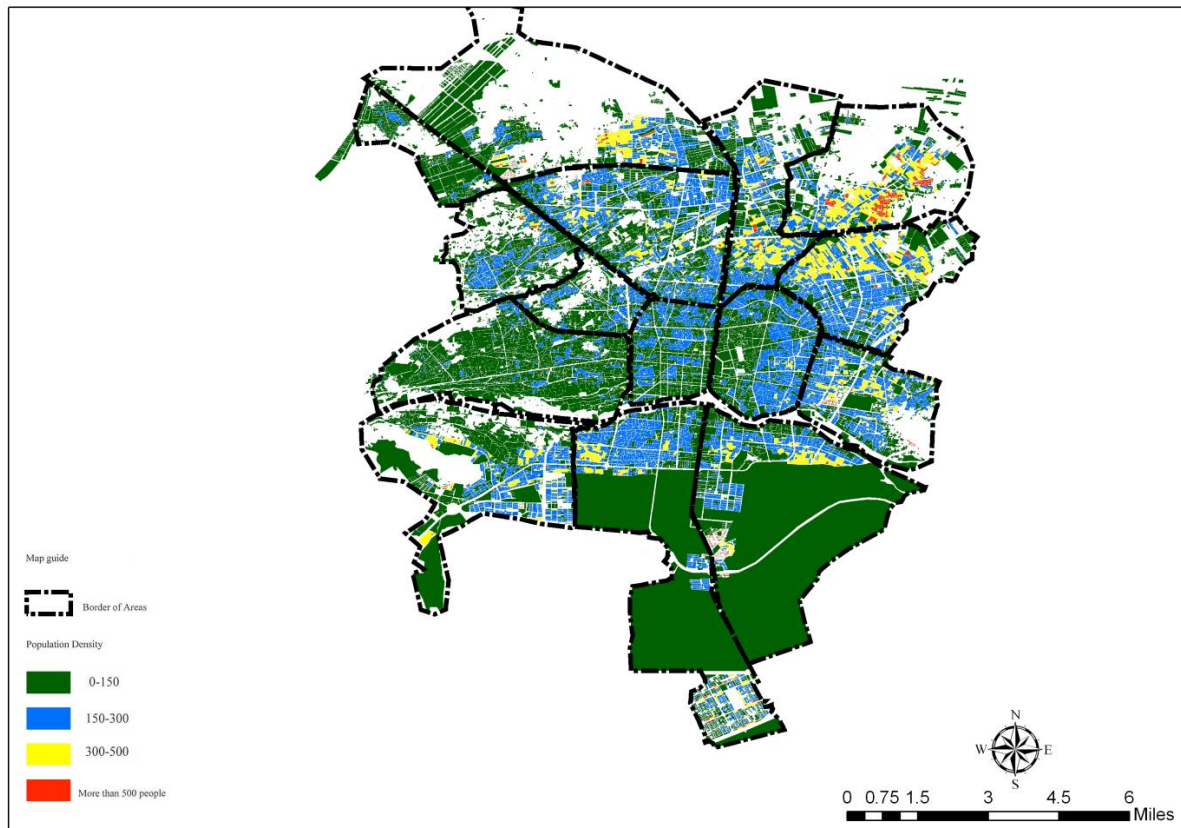
According to following map (distribution of aquatics facilities within study scope), a large area of city suffers from shortage of these facilities. This is consistent with the statistics which was provided by Development and Maintenance of Sports Facilities Company, Iran in 2015 and indicated a lack of aquatics facilities and unfair distribution of these services within study scope. Also, the green spaces which are within the border areas indicate great distance from pools and therefore, lack of these facilities in these areas (see Map 1).

Map (1). Aquatics facilities distribution in 14 regions in Isfahan



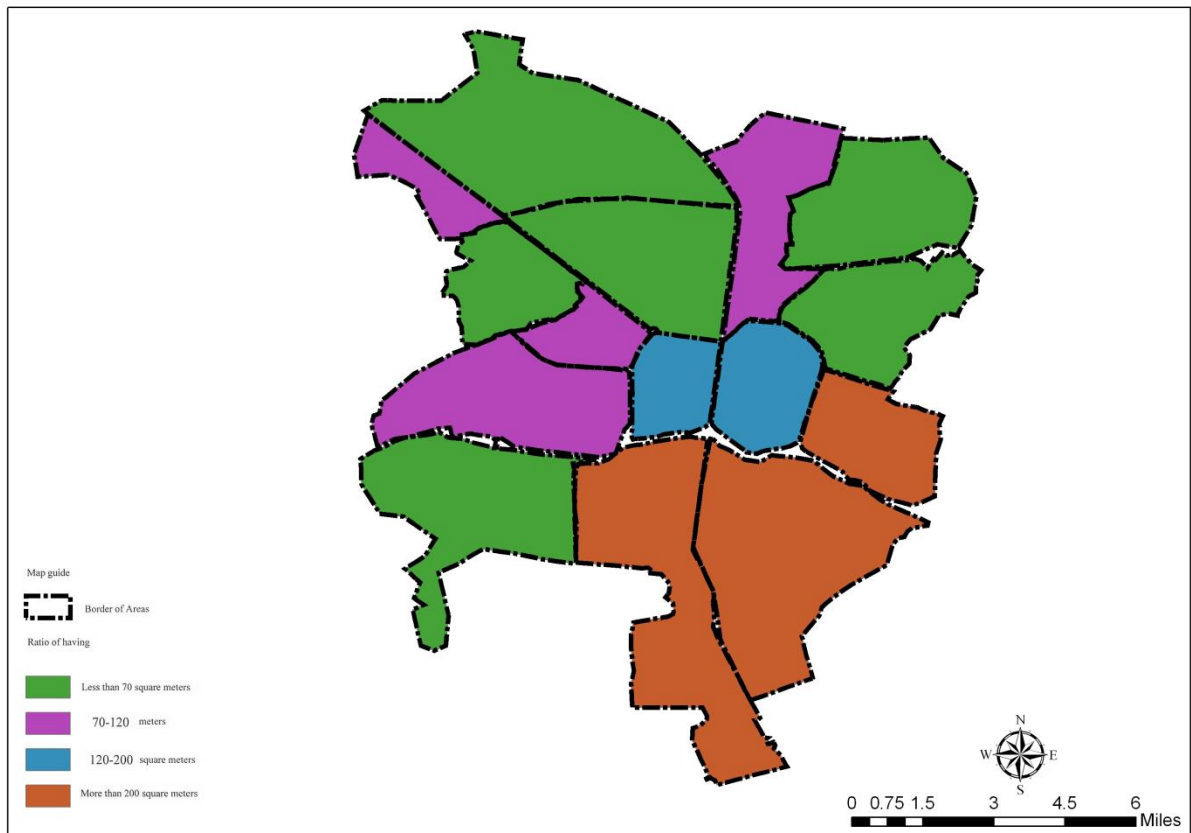
According to map of population density, the 4 regions have different densities. The red spots have the highest density and they are the first priority in construction of aquatics facilities. Most of these areas are in region 14; this emphasize on the need of this region to build these facilities (See Map 2).

Map (2). Population density in 14 areas in Isfahan



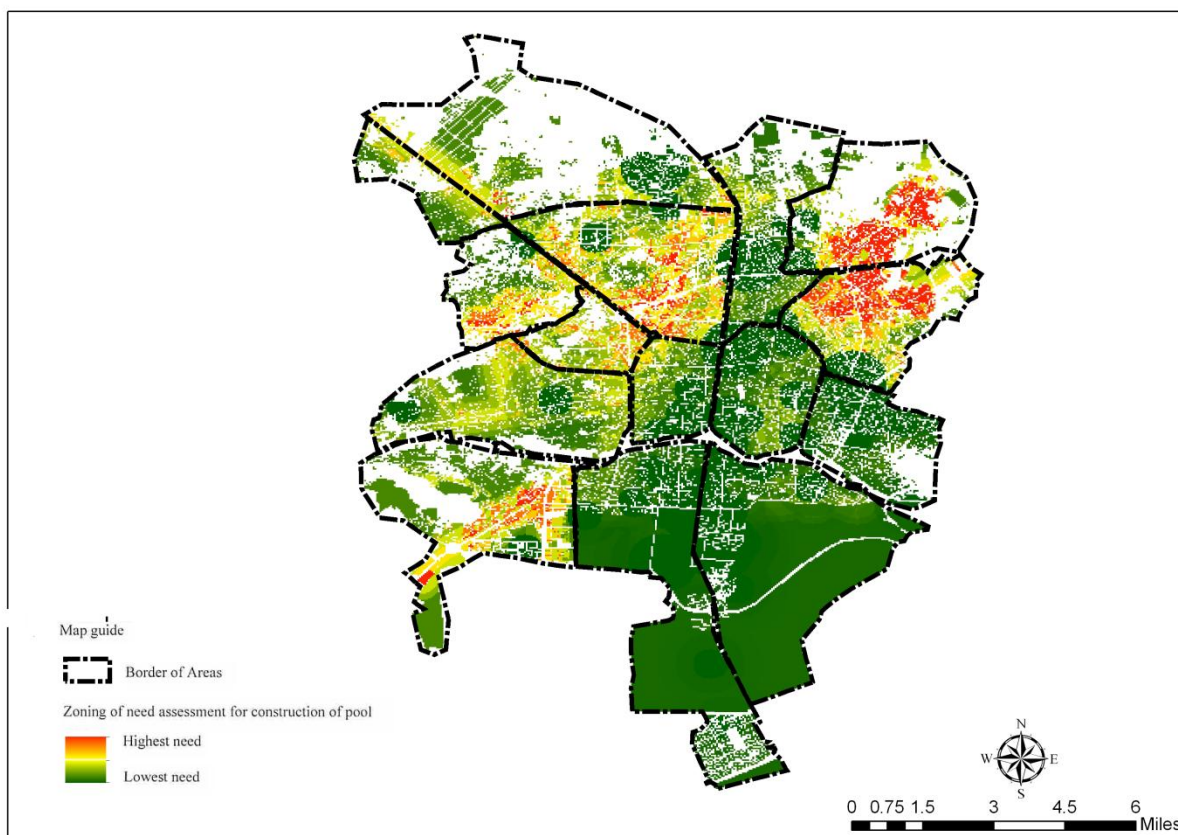
The following map classifies 14 regions into 4 groups. It is clear that the green areas have low-level aquatics facilities and include areas 5, 6, 8, 10, 11, 12, and 14 (see Map 3).

Map (3). Existence ratio of aquatics facilities in 14 regions in Isfahan



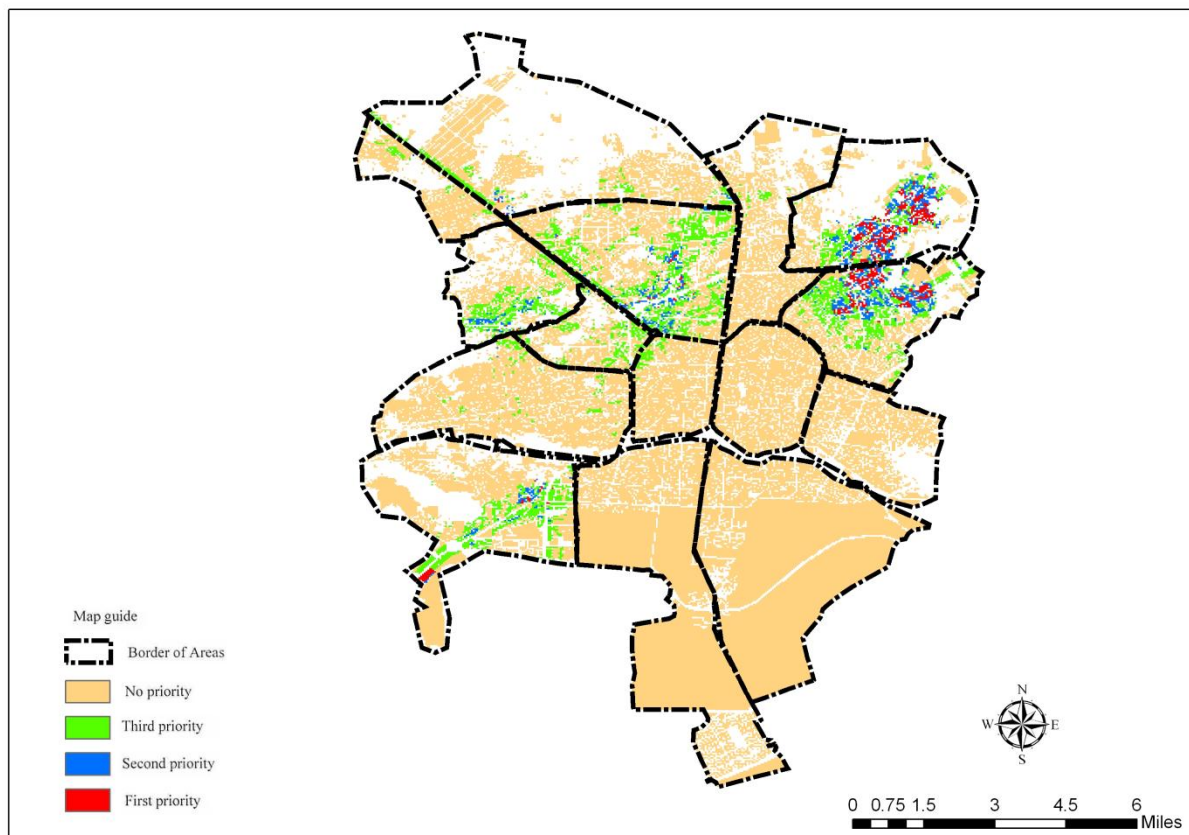
Overlaying different layers of information of research criteria, a map is obtained which shows the zoning of need for aquatics facilities. According to guide of this map, the areas marked in red have highest need for construction of these facilities. The areas 10 and 14 are two regions with most red color (see Map 4).

Map (4). Zoning of need for aquatics facilities in 14 regions in Isfahan



Taking into account four research criteria and overlapping information layers, the priority of areas for construction of aquatics facilities was classified in 4 ranges as following map. According to this map, it is clear that the regions 10 and 14 with most red dots are the first priority for construction of sports facilities (see Map 5).

Map (5). Prioritization of areas for construction of aquatics facilities



Conclusion

In current global system, the improvement of urban environments by construction of proper sports facilities without spending much time and cost is one of the important strategies of active and alive organizations. These objectives play a particular decisive role in entities such as Ministry of Youth and Sports, sports federations, and other executive organizations which have sport facilities. The selection of proper location to build them is one of the primary requirements to construct sport facilities with high productivity. This is undoubtedly the most important task of sports managers. In this study, the current status of aquatics facilities, their distribution condition, performance radius, and localization model of aquatics facilities in Isfahan were investigated using geographic information system.

According to analysis of fair distribution of aquatics facilities in Isfahan, it was determined that there is a significant difference in level of aquatics facilities in different areas. This difference indicates that the distribution of sports facilities is not proportional to population size; the sports facilities distribution has not logical pattern. In some areas, there was a need to build new facilities. This is consistent with study of Hosseini and colleagues (2013) on sport facilities localization in Sagez province and study of Goudarzi et al (2012) in Boroujerd.

In another analysis, the population density was investigated in Isfahan. The pools distribution was assessed according to population density in each region. It was determined that the

distribution is not logical. The areas 5 and 6 had lower density than other areas; this is consistent with findings of Salimi et al (2012).

The findings also showed that there was significant difference among regions in terms of having aquatics facilities. This is consistent with findings of Hosseini and colleagues (2012) in Sagez and statistics of Development and Maintenance of Sports Facilities Company, Iran (2015).

The findings showed that areas 10 and 14 had need for construction of pool; the areas 5 and 6 had the lowest level of need for construction of these facilities. This is consistent with findings of Salimi et al (2012). The accessibility of sports facilities is one of the priorities which is considered in this research and its impact on locating aquatics facilities was investigated. This is consistent with research of Zohrevandian and Ebrahimi (2013), Azani et al (2012), Salimi et al (2013), and Sohrabi et al (2011).

According to above, however, it can be concluded that the localization is not conducted by variables which may increase the use of these facilities. In general, it was concluded that GIS may consider different factors to conduct the localization systematically and help managers in making decisions about the location of sports facilities. This is consistent with findings of Salimi et al (2012), SeyedHoseini (2012), Sohrabi et al (2012), Zohrevandian and Ebrahimi (2013), and Azani and colleagues (2012).

Since this study had different parameters, the valuation of these parameters in terms of distance and determination of appropriateness of locations for establishment of aquatics facilities needed a long time and great care, and the main activity of GIS in comprehensive evaluation and analysis is making decision in minimum time and accurately by processing numerous parameters, this system helped us greatly in accurate localization of aquatics facilities. Analyzing the parameters, the right places for construction of aquatics facilities were localized. It is hoped that the managers will consider them.

This study tried to combine new technologies with experience and knowledge of specialists to create a method which will replace the traditional localizations. The following recommendations were provided according to characteristics of planning, localization, execution, and management of sport facilities:

- Using modern methods of locating sport facilities such as GIS.
- Issuing sport facilities building license by scientific and detailed investigation.
- Selecting proper criteria for locating with respect to actual conditions of area.
- Paying attention to standards and safety in construction of sport facilities.
- Considering population density and accessibility in localization of sports facilities.
- Considering public and private means of transport and communication routes in localization of sports facilities.

It should be noted that since the study scope was wide, this required a large volume of information, and the large volume of information needed time consuming analyses, some variables which may determine the location of new facilities more accurately were not considered.

Conflicts of Interest

The authors have no conflicts of interest to acknowledge.

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