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Location of Sports Venues in Tabriz Using AHP in GIS

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The purpose of this study was to locate the sports venues of Tabriz using AHP in GIS. Samples included all 95 sports venues under supervision of Office of Sports and Youth within Tabriz. Descriptive data was collected using evidences, documents, field studies and spatial data by GPS and database was formed in GIS. Then, factors influencing the location of sports venues were weighted. After combining and analysing, the current situation of sports venues was evaluated and finally the most appropriate locations were proposed using AHP method. The results showed that only 14 sports venues (14.7%) of Tabriz supervised by Office of Youth and Sports are in a good place in terms of population density and 81 venues (85.2%) were established in inappropriate places. In terms of ground slope, 21 (22.1%) of 95 venues were constructed in inappropriate, and 74 (77.9%) in appropriate places. In Terms of access, only 7 (6.3%) venues were constructed in inappropriate places and 89 (93.6%) were constructed in appropriate place. In terms of proximity to medical centers, 15 (15.79%) venues were constructed in inappropriate places and 80 (84.21%) were constructed in appropriate places. Using AHP and GIS is highly efficient in locating sports venues and allows evaluation of different places and selection of the right place regarding given standards.

Key words: GIS, AHP, location, sport venues, Tabriz.

Nothing can replace the sports as heritage of all human beings (Farahani, 2009). Before the industrial revolution, recognition, requirement and analysis of problems related to human settlements was possibly easy because they were simple; afterwards, World population increased by Advances in knowledge and technology and innovation, exploration, development of health and medical knowledge. By increasing population, the city as a dynamic element underwent great changes throughout the history. The ultimate goal of planners has been raising the level of welfare of people and solving the problems of urban communities. In Iran, urban population growth happened in the past 50 years. During this period, urbanites growth was from <10% to >60% and this trend is still continuing. Hence, the growing population facing increasing demands for job, housing, education, health and a variety of crisis has had less opportunity to think about and plan its future (Ghaderi, 2002). The rapid urban population growth increased attention to common sense and particular sense of urban development.

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Labor, housing, communication and leisure explaining modern life are interested by planners of the twentieth century. Meanwhile, leisure is of great importance according to the predictions of previous thinkers. It should be noted that exercise is considered as one of the fundamental theories of urban sociology and urban planning. Psychologists recommend people living in cities who are suffering from depression and anxiety to practice light exercise, such as running in green spaces or heavy sports such as football or tennis, martial arts, etc. These activities require their specific and unique spaces. These activities are important in local, metropolitan, regional and international (Sadria, 2006).

Sports venues are the most basic hardware parts of physical education and sports as well as important components of human organizations. Optimal location of them is the important task of urban planners and decision makers. Location is an activity which identifies Spatial and non-spatial potentials of a land allowing choices for user-specific locations (Salimi et al., 2013).

The main task of urban planners and decision-makers is to determine the optimal location of sports facilities in such a way that all urban residents have easy access to them. In addition, planners try to optimize the distribution of sports venues in urban environments; this distribution is relative to population distribution and demand in different areas (Ibrahimi, 2009).

Spatial and physical urban expansion, increased population and new activities in the city has led many variables come into the city. Thus, analysis of these variables is very difficult and expensive using traditional methods. The only way to deal with this information, proper exploitation and planning is to use computer systems. This problem is solved by geographical information system (GIS) (Rostami, 2004).

In addition to management, query, analyze, and displaying spatial data and descriptive, GIS can be used as a decision supporting system (DSS). In fact, GIS can support planning and management decision (Pirmoradi, 2007).

GIS is used for initial selection of an ideal location, because it can manage the large volumes of distributed and spatial data of various resources and effectively manage, store, retrieve, analyse and display data. The use of GIS for site selection not only increases the objectivity and flexibility, but also it makes sure that many spatial data can be evaluated in a short time. Another benefit of GIS is relatively easy display of location results (Lin and Wang, 1996). For example, Sultan Husseini et al (2012) addressed the spatial analysis of sport facilities in areas 5 and 6 of Isfahan using GIS; they found that the construction of new sports buildings and venues by any state or private organization requires a scientific and accurate location; AHP model is suitable for urban location. Locating sports venues of Rasht using AHP in GIS, Taji (2010) showed that the use of AHP and GIS was highly efficient in locating sports facilities and enabled evaluation of different places and suitable sites according to given criteria. Razavi and colleagues (2009) analysed sports spaces of Amol using GIS; they showed that establishment of new sporting spaces must meet the standards determined for distances to allow Easy access for all citizens to these places. Nazari (2007) implemented hierarchical analysis algorithm in GIS for optimal location of urban public places (sports venues in Zone 6 of Tehran); he found that combination of these two tools (AHP and GIS) was very strong in spatial study of current situation and identification of areas as well as providing a solution to meet these requirements. In this paper, four elements (population density, development potential, proximity and accessibility) were studied in order of preference using AHP and GIS to propose locations in addition to existing ones. Javari et al (2010) used GIS in locating training centers (Case study: Payam-Noor University of Khoram Abad); according to their findings, urban planning and architecture experts found agricultural lands and wastelands as the most capable lands to become academic and instructional spaces.

Therefore, it is best for planning and urban development to classify sports venues based on capacity, extent, spatial attraction, usage, accessibility, distance from house and riverside rather than nature and opportunities (Koohsari, 2006). In this study, the most important criteria for locating sports venues include: 1) easy access, which is met in different levels. Unlike other cultural and recreational facilities (e.g., libraries,

playgrounds and alike), clients of these spaces are both users and spectators. Therefore, travel demand to go to these centers increases when competitions are held and the lack of proper access network creates wide traffic disruption around the sports venues (Nazari, 2007). 2) Population density, which is one of the most important indicators for construction or expansion of facilities. This criterion involves the number and rate of urban population growth, the number of immigrants and more importantly distribution of population in cities. This model assumes that places with higher population density have higher priority to establish sports venues. 3) Adjacency (to medical centre), must be considered. The ground must be selected by examining adjacent land users and determining the compatibility or incompatibility of them with sport activities. This model assumes that health and medical facilities are near sporting venues. Therefore, all sites are classified in terms of distance to these types of land uses. 4) low-slope land is the other criteria to locate most sports, Except for sports such as mountain climbing and skiing which require the slopes. Other sports are done in the low-slope lands. One of natural factors highly effective on determining suitable locations for facilities and infrastructures is the slope. According to experts, the cost of construction significantly increases in steep areas; Centers or residential areas should preferably be located in areas with slopes ranging from 2 to 10% (Karimzadeh, 2006). 5) Land use (emphasis on arid lands) refers to how to use, distribute and protect the lands. Urban land use planning, spatial organization of activities and urban functions are based on demands and needs of the urban society as a core urban planning to classify and locate land uses. Hence, the main problem of this study is that whether location of sports venues in Tabriz using AHP and GIS is in good condition.

GIS have been used in various fields such as location of fire stations, hospitals, schools, etc.; in addition, GIS has been effective in locating sports venues. Thus, athletic directors and actors are recommended to use this system to choose the best place for building sport facilities in order to prevent Hazards and defects that are likely to arise by using traditional methods.

Therefore, optimal location assists decision makers and planners in selecting appropriate locations for activities by regulating the parameters and factors effective on decision making and providing logical solutions. the results suggest that sporting venues, which are improperly located, must be avoided to be invested on and expanded, existing investments must be spend on proposed sites for the future. By spatial data analysis related to the existing sport facilities and providing statistics, authorities responsible for construction of sports facilities in various institutions, including municipalities, education and training, physical education and the private sector must be aware of the importance of scientific location. Construction managers in other sectors should also pay special attention to the problem of locating, because neglect, even partial, can have adverse effects on many land uses and cause huge costs.

In addition to evaluating the spatial distribution of sports venues in Tabriz, purpose of this study is spatial analysis by GIS. This study also uses AHP (Analytical Hierarchy Process) to select the best location among places suggested by GIS.

Research Methodology

This research is a descriptive study. Relevant Theories and literature as well as information related to sports facilities were collected from libraries and field surveys. The studied group included all sports venues of Tabriz supervised by Office of Sports and Youth including stadiums, swimming pools, sports hall, football pitches. There were 95 Sporting venues supervised by Office of Youth and Sport in Tabriz until February 19, 2013; the number and address of these venues were provided from Office of Youth and Sport in Tabriz. All 95 venues were considered as samples.

Data required for this study is divided into two types of spatial and non-spatial data. Spatial data includes available urban maps and Non-spatial data includes documents from the Office of Youth and Sports on the sports venues. The author recorded latitude and longitude of the studied locations using GPS. To record the location of studied sport venues, the researcher kept GPS device at the entry of the considered location for several minutes until the device received waves sent from satellites. Then, GPS data was transferred to a computer to analyze by GIS.

RESULTS

In this study, the studied criteria included accessibility, population density, slope, land use, proximity (closeness to medical centers). Distance of sports venues was considered 0 to 500 meters and more; the distance more than 1000 meters was zero weighted. Distribution of venues in Tabriz was studied for determining population density. Another criterion for locating sports venues was slope classified in five levels. Slope was overall 0 to 15 and higher; the less steep a land was, the more weight it was given. In this study, the level (0 to 3%) was most weighted. Wasteland and derelict lands were suggested for construction of sport facilities. Accessibility was considered in five levels (0 to 1000 m and higher). The highest weight was given to the level (0 to 50 m). The criterion related to medical centers was also examined in five levels (0 to 1500m and higher). The distance lower than 200m was most weighted and the distance higher than 1500m was zero weighted which meant it was unacceptable.

According to results, 14 sports venues (14.7%) were constructed in a proper place in terms of population density and 81 venues (85.2%) were constructed in inappropriate places. In terms of slop, 21 venues (22.1%) were constructed in improper locations and 74 venues (77.9%) were constructed in the right place. Only 7 venues (6.3%) were in non-accessible places and 89 venues (93.6%) were constructed in the right place. In total, 15 venues (15.79%) were not in the proximity (to medical centers) and 80 venues (84.21%) were approximate to medical centers.

DISCUSSION

The purpose of the present study was to evaluate sports venues supervised by Office of Youth and Sports in Tabriz in terms of meeting standards including population density, land slope, accessibility, and proximity to medical centers. It is noteworthy that Yadegar-Imam Sports Complex was the only facility which was not located,

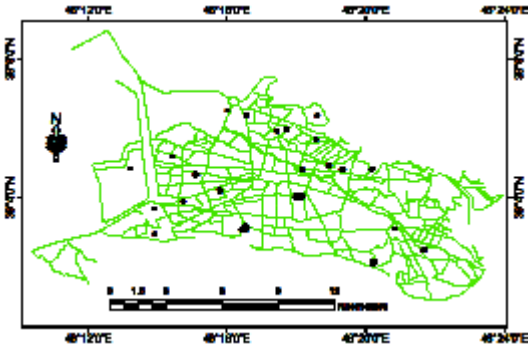

Fig. 1. Distribution of sports venues in Tabriz

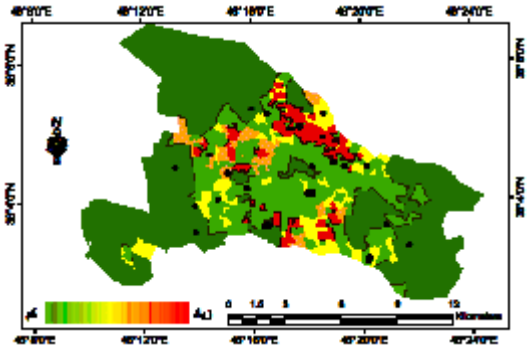

Fig. 2. Integration of distribution of sports venues and population density

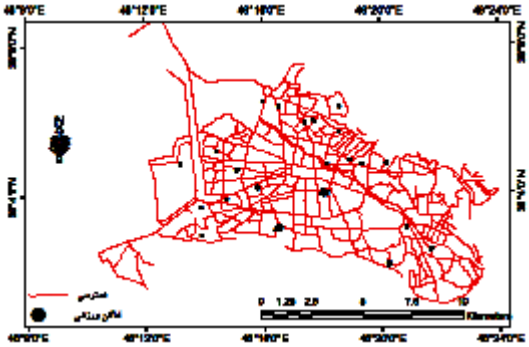

Fig. 3. Integration of distribution of sports venues and accessibility

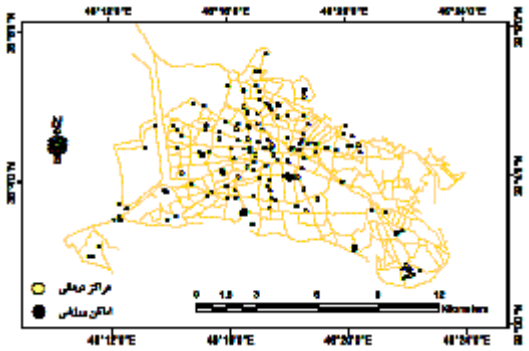

Fig. 4. Integration of distribution of sports venues and proximity (to medical centers)

because it was constructed outside the city. However, it was mentioned in the study because the complex was listed among sports venues supervised by Office of Youth and Sports of Tabriz.

Figure 1 shows the distribution of sporting venues in Tabriz. Higher population density requires more sport services to citizens. Areas with high population density have greater priority to establishment of sports facilities. Based on Figure 2, however, distribution of sporting venues is more in low populated areas. According to the Figure, only 15 sports venues have been constructed in places with 6000 people per district in the north of the city. Most venues have been constructed in the central and southern parts of the city with low population densities. Due to the low population density in the central and southern parts of the city, location of built facilities in relation to population is incorrect. In addition, there is a need to build more sports facilities given the high population density in the northern half of the city. Due to less existing sport facilities in the northern half of the city, access to the constructed facilities in the Southern and central half of the city is difficult for citizens. Results show that most sports venues have been constructed in low populated areas of Tabriz. This is consistent with Taji (2010) in Rasht. He found that large sports facilities are constructed in low populated areas. This finding is also consistent with Sultan Husseini (2012) in Isfahan; he found that majority of sports venues have been constructed in improper places in terms of population density. The finding is also consistent with Nazari (2008) and Taji (2011); they both found that highly populated areas are the most important criterion for building sports facilities. Sports venues built near to Communication routes are more convenient for athletics and other clients. People less tend to use sports venues which are less accessible. Considering the extent, traffic and weather of Metropolitan Tabriz, more distance from facilities causes problems and costs for citizens. This may lead to lack of tendency to use sports venues.

Figure 3 shows distribution of sports venues on access lines. Only 7 venues did not meet the standard 0-50m. Focus of these venues on south and southwest suggests improper location of these venues. While this standard has been met in other parts of the city. The venues built in those parts can be well used by citizens. This finding is consistent with Sultan Husseini (2012) who found that most sports venues built in Isfahan were accessible. Majority of studied sports venues are large facilities. Findings of the present study are inconsistent with Taji (2010) who found that large sports facilities of Rasht were not accessible. Findings are also consistent with Nazari et al (2013), Ibrahimi (2009) and Taji (2010). Findings

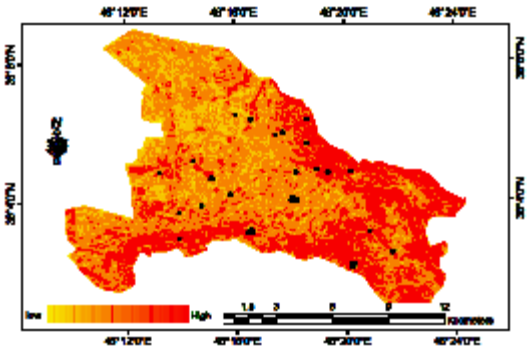

Fig. 5. Integration of distribution of sports venues and slope

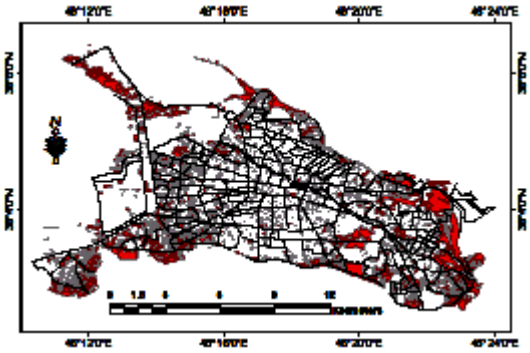

Fig. 6. Bare and abandoned lands of Tabriz

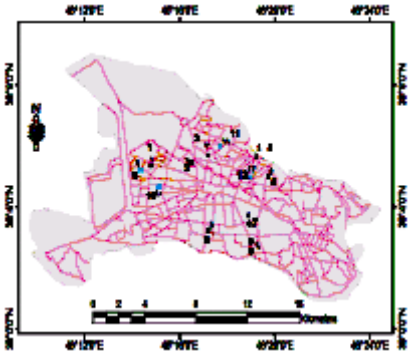

Fig. 7. Result of AHP (priorities) in Tabriz (optimal sports venues)

suggest that sports venues should be built in places which are accessible for citizens. Medical and health centers are important urban facilities which are directly involved with health in society. Considering the fact that users of sports facilities are always exposed to sport damages, these facilities need to be built in places compatible with facilities which provide health services. According to Figure 4, only 15 sports venues were not constructed in proximity to medical centers (0-100m) and 80 venues met the standard 0-100m. This finding is not consistent with Sultan Husseini (2012) who evaluated sports venues of Isfahan in terms of safety and compatibility. They found that most sports venues of Isfahan were not adjacent to medical centers. Low slope is the other criterion for locating most sports except for climbing and ski which need steep ground. Other sports are practiced in lowly steep grounds. Increase in slope of the ground increases the capability for morphologic changes, although some sports are practiced in highly steep grounds. Special attention is required to prevent damage to sports venues due to Steep slope and soil erosion caused by steep slopes. According to Figure 5, only 12 sports venues of Tabriz were constructed in improperly steep areas. It is noteworthy that slope of Tabriz is toward center of the city. Among 95 sports venues, 21 were built in slopes >3% and 74 were constructed in proper places. Ghaderi (2002) studied urban sustainable development and location of sports venues and found that slope was an important criterion for locating sports facilities, which is consistent with findings of the present study. This study showed that majority of sports venues were constructed in proper places in terms of slope. In support of these findings, Sultan Husseini (2012) used slope as an effective element to locate sports facilities using spatial discrete and continuous models based on AHP and TOPSIS in order to suggest proper lands for building sports venues. Land use refers to how to use and exploit a land. As noted previously, land uses include residential, business, administrative purposes in Bare, settled and barren lands. This study measured the available places by indicators of land uses. Indicators of settled and bare lands were used for suggested places in future. For example, Takhti Complex is in the middle of the city within a business area; therefore, two standards including land use and population density were not satisfied. Figure 6 shows bare and abandoned lands of Tabriz. This Figure was used for suggested places in the future. Results of this study are consistent with Javari et al (2010). In Figure 7, the most suitable places were prioritized based on population density, slope, accessibility, proximity to medical centers and land use (bare lands) using AHP. The first priority is the most proper places for building sports venues by meeting standards of population density, land use and slope. Initially, the matrix of population, bare and abandoned lands, slope, medical centers and accessibility model was designed. Then, priority of criteria was determined.

According to Figure 7 in which the most proper places were determined by AHP, criteria of land uses (bare and agricultural lands), slope (0-3%) and population density (6000 in each district), distance (0-100m), proximity to medical centers (0-50m), accessibility were suggested as standards for proper location of sports venues. According to the Figure, 12 areas were suggested for establishing sports venues. Sports facilities were built in 4 of these 12 areas, shown by blue. It is noteworthy that they are magnified in the map for clarity. The suggested areas are considered as the best locations chosen from residential land uses, approximate to medical centers, proper slope, with the minimum access to main routes on bare and abandoned lands.

CONCLUSION

Higher population density requires more sport services and more sports facilities for citizens. The results showed that only 14 venues were constructed on a proper place. Considering the lower population density in the central and southern part of the city, location of the built venues is incorrect. Considering the high population density in the northern part of the city, sports venues need to be built. Because there are less sports venues in the northern part, the built facilities in southern and central parts are not accessible for citizens. Results of this study show that majority of sports venues are built in locations with lower population density. In Easily accessible venues, access to main routes are easier, participation of users in sport activities is more, and citizens are more likely to welcome sports

events. In addition, there would be less problems related to traffic for citizens and authorities. Studies show that 7 venues focusing on south and southwest are not properly accessible. Thus, sports facilities must be built in easily accessible locations to avoid these problems. Users of sports facilities are prone to sport damages. Injured users need to be transferred to medical centers. According to this study, 15 venues are not properly approximate to medical centers; this threatens health of the uses. Thus, it is important to consider proximity to medical centers. Highly steep lands lead to fast erosion of soil and fast changes in the surface. For sports venues, the slope (0-3%) is suggested to prevent deteriorating effects of erosion. Findings show that 21 venues are built in improper steep lands which are threatened by erosion and geological changes. Therefore, future sports venues should be constructed in lands with proper slope to provide more safety for users.

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