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Original Research

Spatial Analysis and Site Selection of Ardabil Sports Venues Using GIS

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ABSTRACT

Sports venues and spaces are one of the most significant lands uses aiming to improve citizens' mental and physical health, and their optimal location is one of the most important responsibilities of the officials, managers, and urban and sports planners. Wide urban facility networks, population density and distribution, land use, and many other issues of these kinds have increased the complexity of planning for the location of sports venues, leaving planners with no other choice but to use advanced tools such as GIS to collect and process data seeking optimal resource management. Thus, the present study has been conducted to perform spatial analysis and allocate locations for sports venues in the case of Ardabil. This study was a descriptive and field study. The sstatistical population included all sports venues in Ardabil and the sample size was done by census. Spatial distribution and accessibility were investigated and per capita land use distribution was determined using the statistical models form GeoDa and ARCGIS v. 10.4 software. Results of analyzing software outputs indicated that sports venues are distributed unevenly across Ardabil so that the central districts have good accessibility to these venues due to greater concentration of the venues in these districts, while the outer districts of the city –specifically northern and southern districts- are dealing with a lack of access due to the lack of sports facilities stemming from the unfair distribution of sports venues and facilities across Ardabil. Hence, it is necessary to create and build new sports facilities and venues in the required areas to ensure the optimal use of resources and fair access to sports venues in Ardabil.

Keywords: Sports venues, Site selection, Spatial analysis, Ardabil.

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Introduction

Along with the intense population growth and the expansion of urbanization and its resulting concerns and issues, the need for sports venues increased so that people could relieve the stress from their working lives in these venues, improve their mental and physical health, and fill some of their free time. Sports venues refer to the places built for various sports activities, including open-air and enclosed spaces. As the most essential hardware part in the field of sports and physical education, sports venues are considered imperative components of human facilities. Inconsistencies between per capita sports venue area and unbalanced distribution of the sports venues across the districts could reduce citizens' desire to take part in sports and threaten the health and safety of individuals and the community. Professional organization and institutions of public health, physical education, recreational-leisure centers, and urban planners all around the world are currently trying to understand how the design of neighborhoods and leisure and sports spaces make for people's easier and more pleasant activities (1). Numerous studies indicate that people will be willing to take part in physical activities provided they have suitable and easy access to sports venues such as parks, playing fields, and stadiums. In this regard, the CDS institution in America has concluded that building and expanding spaces suitable for activity with good accessibility could increase physical activities by 25% and result in people doing sports at least three times a week (2). One of the most important issues in the cities of the county unfavorable location of land uses and public spaces in general, and the location of space venues in particular, so that many individuals in the community are unable to use sports venue properly due to difficult access (3). Accessibility to parks and gyms have a direct relationship with individuals' tendency to participate in physical sports as recommended (4). The distribution of sports venues across the city and urban districts could directly affect the optimal model and functional performance of the city. On the other hand, diversity and suitable distribution of sports land uses increase citizens' freedom of choice between various sport venues resulting in increased quality of life across the city. Therefore, it seems necessary to note that sports venues must be properly located across the city (5). Building new sports venues requires accurate and scientific studies for location allocation, the ignorance of which will result in wasting resources and time on top of poor performance (6) and will, most importantly, leave a direct negative impact on future performance and the quality of healthy recreation and sports programs in particular.

Given the importance of proper and correct location allocation for building sports venues in urban communities, greater attention has been paid to the scientific study of sports venues and spaces location allocation seeking to make the best out of their operation, and extensive efforts have been paid across the globe and in Iran to perform applied scientific research in the same field as the present study. Hadipour et al. (2014) investigated the design of sports arenas based on an environmental model and reported that one of the most important issues in the cities of the country is the improper location of sports arenas among other land uses so that many of the community members cannot use sports arenas properly due to lack of access, and solving such an issue requires planning and management in the field of sports spaces location allocation and organization (7).Hosseini et al. (2013) examined the location allocation of sports spaces in Saghez using GIS. Their results indicated that most of the sports arenas in Saghez were located weakly or moderately with rare cases of arenas being located favorably and very favorably (8). Nowrouzi Seyyed Hasani et al. (2013) conducted a spatial analysis on all the sports spaces of Tehran urban district 1 and concluded that sports spaces were not completely consistent with the defined standards and their area per capital was lower than the standard amount (9). Taji Faynderi (2011) demonstrated in his study on Rash sports arenas that 26 sports arenas out of the total 148 sports arenas has not adhered to item one, two, or three of the boundary regulations (river, gas lines, or power lines) and 1222 arenas had adhered to all three items. In terms of the functional diameter, few arenas had the desired standards, large sports arenas had a less favorable spatial distribution compared to small arenas (10).

Pogio and Raskij (2009) tried to find the best places for building parks and recreation spaces in Grassiaco, Turin, considering the amount of soil contamination. Their study took the criterion of population density into account as well and the locations of new parks were determined based on districts' population density and attention to lack of soil contamination (11). Potwarka et al. (2008) demonstrated that families were 1-8km away from parks, which limits their accessibility to sports, and recreational parks and results in undesirable weight gain in children. Besides, around 50% of the parks turned out to be located relatively out of neighborhood boundaries (12).

Panther and Jones (2008) investigated the environmental impacts on physical activity in their study. Logistic regression analysis indicated the respondents who reported their neighborhood to be highly walkable had also reported higher levels of physical activity (13). The identification of spatial patterns of geographical phenomena enables us to understand what patterns the desired phenomena follow. Are they distributed evenly or are they concentrated in clusters across the studied city or place? Understanding these patterns could provide urban managers with useful information that could be used in urban planning.

Material and Methods

The present study has adopted a quantitative approach, employs a descriptive method, and has been conducted through field survey. Statistical population includes all sports arenas across Ardabil. To conduct a spatial analysis of the sports arenas, data on the arenas were collected and mapped as individual points in the geographical database. After data collection, statistical models from ARCGIS 10.4 and GeoDa were used to investigate the spatial distribution patterns of sports arenas in Ardabil, their access desirability and functional diameter desirability, their spatial association in terms of per capita area distribution, and spatial association between the variables of population density and the amount of sports space allocated to each of the neighborhoods in the city. A univariate local Moran model was used to assess the association of neighborhoods in Ardabil in terms of the amount of sports spaces allocated. Besides, a bivariate local Moran model was used in GeoDa software environment to investigate the appropriateness of sports land uses' allocation concerning population and population density. Thyssen polygon model was used to investigate the desirability of access to Ardabil sports centers and a parallel coordinate plot was drawn in GeoDa software environment to assess the relationship between population density and sports spaces allocated to neighborhoods. The Nearest Neighbor index is among the clustering tests used to determine the distribution pattern of phenomena. It is also a simple and fast way for testing the accumulation of place-oriented phenomena in a geographical area. An index called Rn (proximity rate) ranging between zero and 2.15 is obtained because of suing this method. This index indicates the scatter of settlements and other elements across an area (a city or any other geographical area) regardless of the factors shaping it. As a result, Rn values closer to zero indicate clustered and dense distribution patterns while values closer to 2.15 indicate regular patterns and Rn=1 indicates the random distribution of settlements.

Elliptical distribution of standard deviation was used the measure the trend of a set of points or areas. This elliptic enables us to discover whether there is a directional pattern in the distribution of features in the space. Local Indicator of Spatial Association (LISA) is among the best indicators to identify the clustering of features. Moran's value ranges between -1 and 1, with values closer to one indicating that areas with similar values (high or low) have a clustered pattern, values closer to minus one indicating that distinct values have been placed together, and zero indicating a random pattern. The higher the value of this index is, the more clustered the pattern will be while zero indicates randomness and negative values indicate scattered patterns (14).

Given that Moran's coefficient is incapable of distinguishing local differences and it could be implied that both areas with high concentration of values and areas with low concentration of values were located in the proximity of one another, the cluster and non-clustered analysis has been used to overcome this issue (15). This model –which is also known as Moran local insulin index- is among the useful tools to demonstrate the

spatial distribution on phenomena across the space. Assuming several weighted geographical features, this model could determine which area have low or high amounts of features distributed in clusters and which features have significantly different values compared to the features around them.

Results

Study of sports arenas and spaces in Ardabil in terms of the distribution pattern criterion:

The present study has used the nearest neighbor model to examine the distribution pattern of sports arenas and spaces in Ardabil. According to the most recent investigations, about 68 parcels with a sports function have been identified in Ardabil. Land use investigation revealed that most of the sports arenas in Ardabil are concentrated in the central areas of the city on terms of distribution pattern, which was confirmed by the calculation of the nearest neighbor index. The index was calculated to be 0.71 and its z score was -4.49. Given that P-value was calculated to be smaller than 0.001, one could argue that the sports arenas in Ardabil are distributed in clusters with a confidence level of 99% considering the parameters influencing location allocation in the present study, data of sports arenas locations, and spatial distribution weights.

As demonstrated in Figure 1, elliptic standard deviation analysis revealed that Sports arenas in Ardabil correspond to the city's center of gravity and are distributed mostly along northeast-southwest which results in better accessibility for the neighborhoods in these directions and unfavorable accessibility for other neighborhoods.

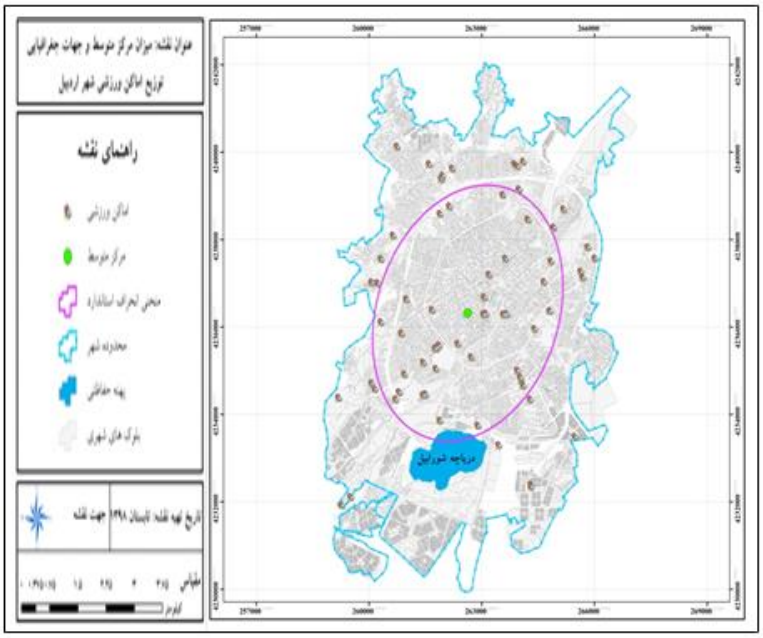

Figure 1. Mean center and geographical directions of sports arenas' spatial distribution in Ardabil

Univariate local Moran model was used to examine the spatial association between Ardabil's neighborhoods in terms of the amount of sports land uses. Figure 2 demonstration the clustering map obtained from this model.

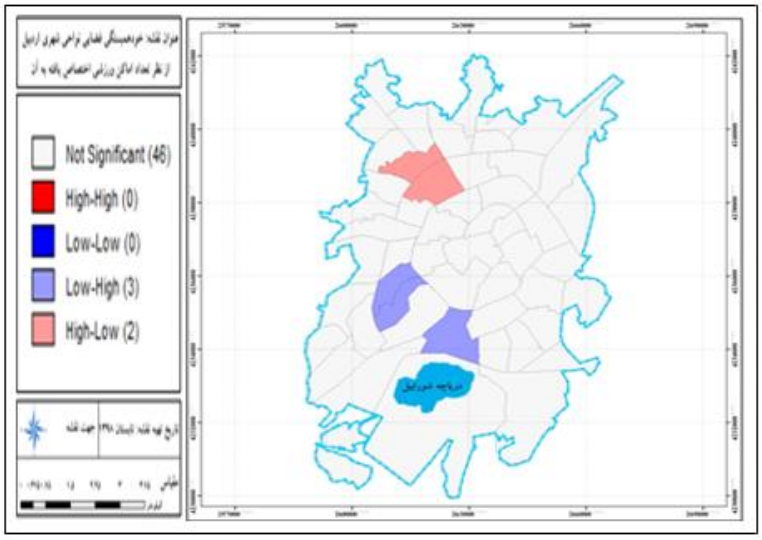

Figure 2. Spatial association between Ardabil's neighborhoods in terms of the amount of sports land uses

The figure above illustrates that five neighborhoods out of the 51 neighborhoods in Ardabil are significantly place3d in low-high and high-low categories. Being placed in the low-high category indicates the placement of neighborhoods with a low area of sports arenas in the proximity of neighborhoods with a high area of sports arenas. On the contrary, being placed in the high-low category indicates the placement of neighborhoods with a high area of sports arenas in the proximity of neighborhoods with a low area of sports arenas. It is worth mentioning that the local Moran coefficient calculated to examine the spatial association between Ardabil's neighborhoods in terms of the amount of sports land uses was 0.51. Although the positive value of this coefficient indicates the spatial clustering of the neighborhoods in terms of access to sports arenas, its low value indicates its insignificance. As Figure 2 demonstrates, 46 neighborhoods in Ardabil were not categorized at the insignificant level in this regard.

Study of Ardabil sports arenas and spaces in terms of the desirability of access

The present study has employed network analysis to investigate the accessibility to sports arenas in Ardabil. Urban streets and passages that play a crucial part in urban mobility are considered as line features in network analyses, which is why the results of these analyses are more reliable compared to simple spatial analysis determining the smallest distance between two points in space (16). Urban areas are considered as smooth surface with no obstacles in simple analyses and boundary calculations are carried out based on Euclidean distances, considering the direct distance between points A and B to calculate the area of coverage. Meanwhile, network analysis is carried out differently, taking the streets and obstacles into account and using the Manhattan method to calculate the distances, so that the shortest distance is not necessarily the most desirable distance. Given that the speed of a pedestrian is generally considered to be 0.75-2.1m/sec according to technical transportation calculations (17), the mean value of 0.97m/sec (about 5.3kmph) was considered as the pedestrian speed for network analysis calculations. An 877.5m coverage area was first considered for sports arenas in Ardabil given the mentioned pedestrian speed and the 15-minute walking distance an individual must walk between their house and the sports arenas so that the areas covered by these arenas are identified. Figure 3 indicates the area covered by sports arenas within 15-minue walking distance. Central areas of the city had desirable accessibility and were covered by these arenas due to the concentration of sports arenas in these areas. However, the outer areas of the city, specifically northern and southern areas, were dealing with lack of accessibility due to the lack of sports facilities.

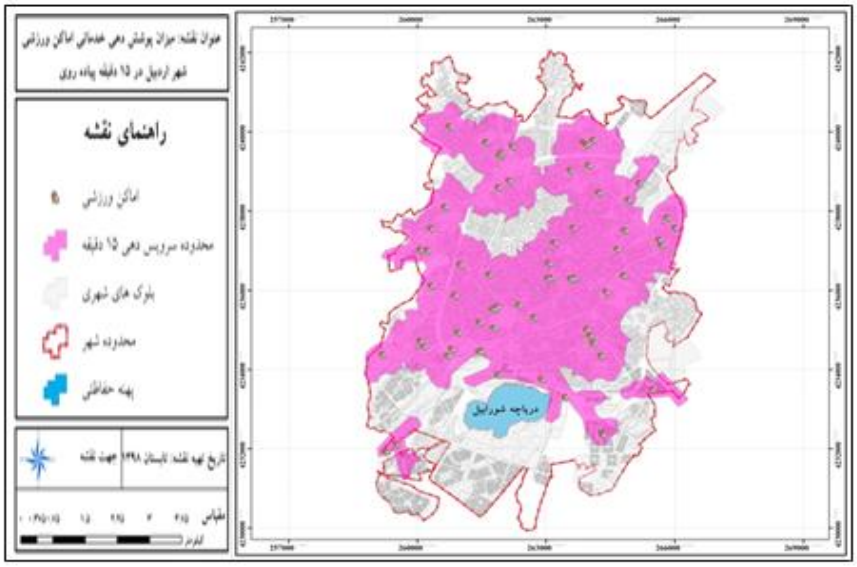

Figure 3. Accessibility to Ardabil sports arenas within a 15-minute walking distance

Figure 4 indicates the maps obtained from Thyssen polygon analysis. Results have been categorized in red and green spectrums indicating the desirable functional diameters. The areas displayed in red indicate unfavorable areas and areas displayed in green indicate favorable areas. The figure indicates that the central neighborhoods in Ardabil have a more favorable status in terms of the sports arenas' functional diameter while the southern areas and parts of northeaster and northwestern areas have unfavorable status.

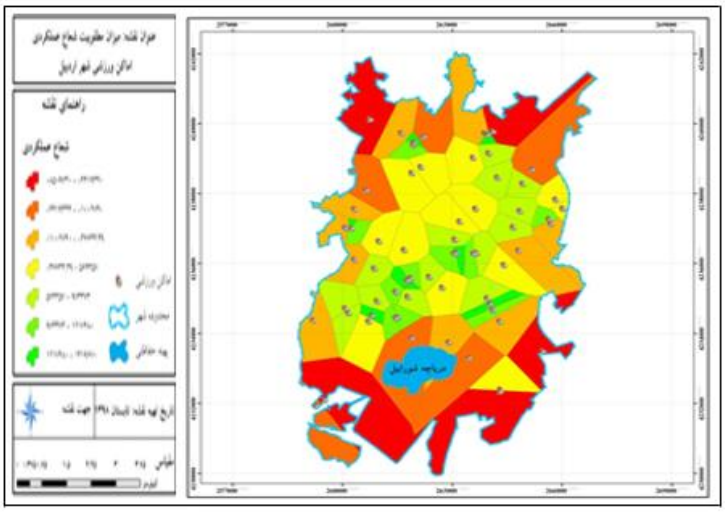

Figure 4. Functional diameter favorability of Ardabil sports arenas

Study of Ardabil sports arenas and spaces in terms of sports land use per capita

Univariate Moran model was used to examine the spatial correlations between Ardabil neighborhoods in terms of sports land use per capita. Figure 5 indicates the clustering map resulting from this analysis. Sports areas per capita have not been distributed evenly across Ardabil. Results of the spatial correlations between Ardabil neighborhoods in terms of sports land use per capita reveal that sport areas per capita have been randomly distributed. The Moran index obtained from the calculation of sports areas per capita correlation was -0.14 that indicates the adjacency of features with dissimilar properties.

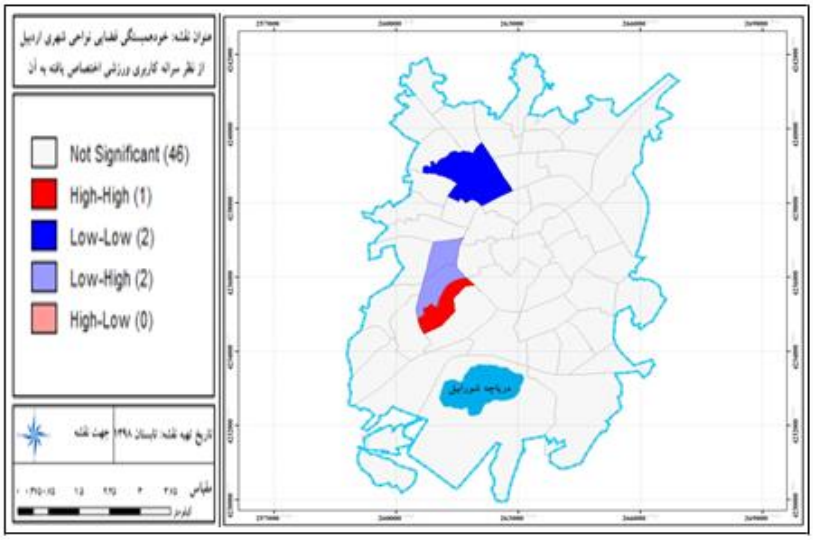

Figure 5. Spatial correlations between Ardabil neighborhoods in terms of sports land use per capita

Thus, one could not argue that the spatial clustering of these land uses is significant. However, one urban neighborhood was placed into the high-high category, two were placed in the low-low category, and two were placed in the low-high category. Being categorized into the high-high category indicates the placement of neighborhoods with a low per capita sports arenas in the proximity of neighborhoods with high per capita sports arenas. On the contrary, being placed in the high-low category indicates the placement of neighborhoods with high per capita sports arenas in the proximity of neighborhoods with low per capita sports arenas.

The presence of an initial population to use the land uses across the city, districts, and neighborhoods is usually among the primary principles of allocating locations to urban land uses and facilities. Sports land uses are no exception to this rule, and population must be considered when allocating them to a specific area. Bivariate Moran model has been used in this section of the study to assess the relationship between population density and sports spaces allocated to each neighborhood in Ardabil. Figure 6 illustrates the results of using this model.

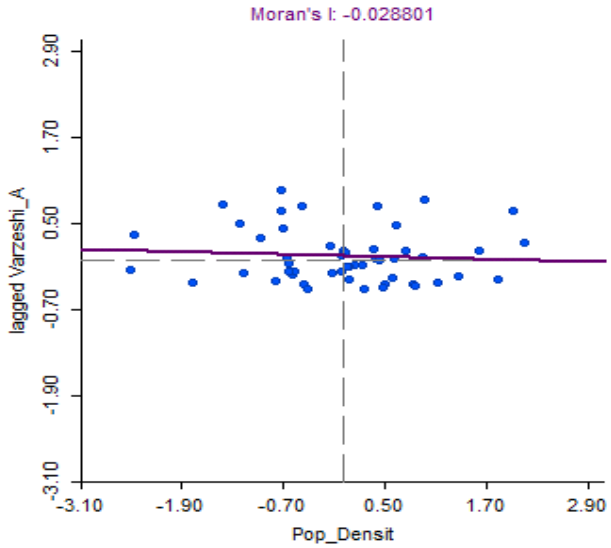

Figure 6. Spatial association between population density and sports spaces allocated to each urban neighborhood

According to the results of bivariate Moran analysis (-0.0288), one could conclude that between population density and sports spaces allocated to each urban neighborhood are inversely correlated, which means that the neighborhoods with a high population density have smaller amounts of sports areas and vice versa. However, the value of the resulting index is quite small and one could not confidently argue that the neighborhoods are significantly clustered in this regard. Besides, study of the association between the two mentioned parameters using an exploratory regression model indicated the inverse relationship between them. The adjusted R2 obtained from this model was 0.02. Figure 7 indicates the clustering of Ardabil neighborhoods to better understand the aforementioned.

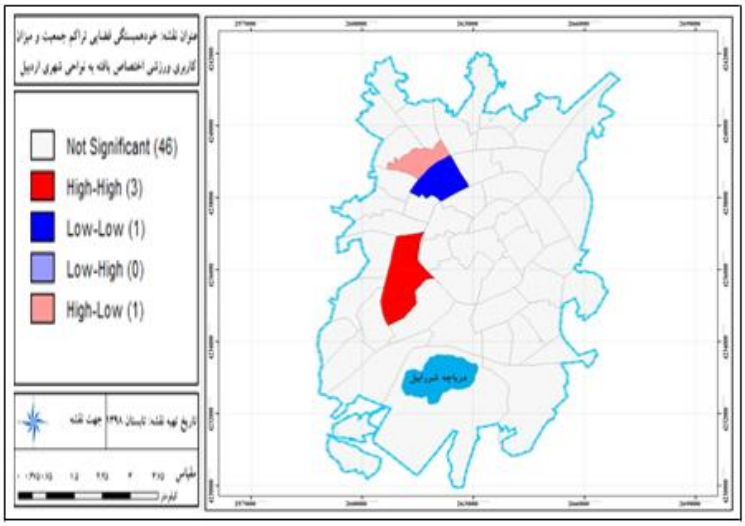

Figure 7. Clustering map of Ardabil neighborhoods in terms of the presence of population density and sports land use area factors

According to the figure above, one could argue that 46 neighborhoods out of all the neighborhoods in Ardabil were identified as insignificant, three neighborhoods were placed in the high-high group, one neighborhood was categorized into the low-low group, and one neighborhood was also placed in the high-low group. Being categorized into the high-high group refers to the clustering of neighborhoods with both population density and sports space area higher than the average, while being in the low-low group indicates the contrary, i.e. both population density and sports area density being lower than the average. However, the high-low group refers to the neighborhoods with high population density and low sports arena areas. Figure 7 indicates these categories in various color spectrums. The parallel coordinates plot from the GeoDa software environment was used in the final stage of the study to measure the relationship between population density and the area of sports spaces allocated to urban neighborhoods.

Figure 8 demonstrates the results of this analysis. In this analysis, the concentration of the lines at the left indicates the low amount of the variable and the inclination of the lines to the right indicates the higher amounts of the variable in those areas.

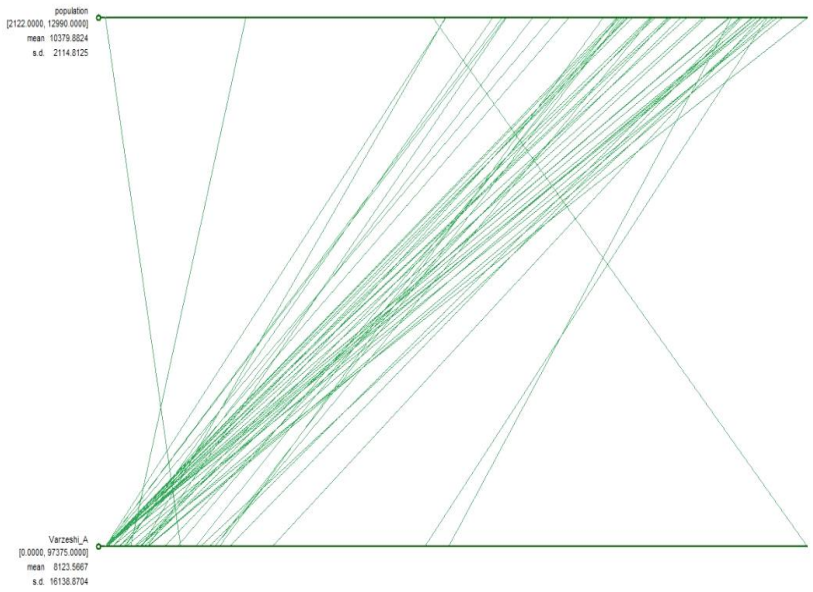

Figure 8. The parallel coordinates plot resulting from the analysis of the relationship between neighborhoods' population density and their area of sports spaces

Figure 8 indicates that except for a few neighborhoods, most of the neighborhoods with high population density have a low area of sports spaces. The top part of the plot above indicates population density and its bottom part indicates the amount of sports areas allocated to the neighborhoods. As mentioned before, if a line (each line represents one neighborhood) inclines to the right, it means the studied variable has higher values. A brief at glance at this plot indicates the inverse relationship between neighborhoods' population density and their area of sports spaces, which means the variable of population density and the needs of the neighborhoods, were neglected in allocating location to sports centers in Ardabil.

Discussion

Sports spaces are a part of public spaces considered a need given the population growth and the high percentage of leisure time across the community. The construction of sports arenas and spaces requires tremendous costs and optimal location allocation so that all citizens can take advantage of them effectively and safely (18). Results of the present study using the indices of nearest neighbor, mean central average, and elliptic standard deviation indicated the uneven and unbalanced distribution of sports spaces across Ardabil so that these centers correspond to the location of the city's center of gravity and are mostly placed in northeast and southwest. Besides, the spatial association between Ardabil neighborhoods in terms of the number of sports areas in each neighborhood was positive, which means that neighborhood with similar properties were adjacent and in proximity of one another. The clustered pattern of land uses' and urban facilities' spatial distribution could result in inequality in access to land uses and make it difficult for citizens to access specific land uses. Thus, this must be considered when determining the location of new land uses. Five neighborhoods out of the 51 neighborhoods in Ardabil were significantly categorized into the low-high and high-low groups. Being placed in the low-high category indicates the placement of neighborhoods with a low area of sports arenas in the proximity of neighborhoods with a high area of sports arenas. On the contrary, being placed in the high-low category indicates the placement of neighborhoods with a high area of sports arenas in the proximity of neighborhoods with a low area of sports arenas. It is worth mentioning that the local Moran coefficient calculated to examine the spatial association between Ardabil's neighborhoods in terms of the amount of sports land uses was 0.51.

Although this value being positive indicates the spatial clustering of neighborhoods in terms of having sports arenas, but the value is insignificant given that it is quite small. As figure 2 indicates, 46 neighborhoods out of total neighborhoods in Ardabil were categorized into the insignificant level.

Fazelnia et al (2010) pointed out that the distribution of sports spaces in Zanjan was not desirable at the urban hierarchy level (5). Saraii et al. (2012) reported that sports centers were concentrated in the north and west of Khorram Abad so that residents in the southern and eastern areas of the city are deprived of the proper distribution of sports space (19). Results of this section are consistent with the results of Fazelnia et al (2010), Hosseini (2013) in Saghez, and Saraii et al (2012).

Accessibility is among the most important criteria to increase efficiency and usefulness of sports arenas. Besides, citizens' comfort in accessing their desired places must be considered for achieving this purpose, based on which special communication networks must be designed. The place selected for building a sports space must be easily accessible to all social classes (20). Results of the present study using network analysis and Thyssen polygons indicated that the central areas of Ardabil had a desirable accessibility to sports arenas and were located in the areas covered by these centers due the higher concentration of sports spaces in these areas while the outer areas of the city – especially southern and northern areas- deal with lack of accessibility due to the lack of sports arenas. Thus, citizens residing in these areas find it more difficult to access sports centers which could be accompanied by higher expenses for accessing these centers and could play a negative role in the participation of Ardabil citizens in sports. The sports centers in Ardabil currently cover a total area of over 3,511 hectares of this city as their service area, which amounts to 56% of the total area of the city with a population of over 350,383 people. This amount of population makes up 66% of the total population residing in Ardabil. The desirability of servicing level and accessibility of sports arenas is expected to increase across Ardabil in the coming years due to the location allocation of new sports arenas in the outer areas of the city, specifically in the southern and northern neighborhoods of the city.

Study of the desirability of sports centers' functional diameter in Ardabil also confirmed the large functional diameter in the central neighborhood and unfavorable functional diameters in southern areas and parts of the northeastern and northwestern areas of the city.

Overall, it could be said that the results of both network analysis and Thyssen polygons indicated the undesirable status of the peripheral areas and the high desirability of functional diameter and accessibility to the mentioned land uses in the central areas of Ardabil. This indicates the inequality in access to sports land uses across various neighborhoods of this city.

Ahmari (2009) used GIS and the two criteria of population and distance to analyze the scatter of public and private sports arenas in several urban districts of Tehran, which indicates that people's accessibility to sports arenas based on the criterion of distance was almost the same in northern and southern areas (21). Soltan Hosseini et al. (2012) reported that urban districts 5 and 6 in Isfahan had suitable accessibility to sports arenas (22). Results of this section are inconsistent with the results obtained by Ahmari (2009) in Tehrna, Soltan Hosseini et al. (2012) in districts 5 and 6 of Isfahan, but consistent with the result of Alizadeh et al. in Kahnouj and Hosseini (2013) in Saghez.

Results of univariate Moran model indicated that the sports arenas in Ardabil had a total area of 414,302 square meters which equals 0.78 square meters of sports arenas per capita and is largely lower than the standard per capita sports land use determine by the Iranian high council of architecture and urban planning (1.5-2 square meters per capita). The point worth mentioning in this regard is that this amount of sports areas per capita in the city has not been distributed across the city evenly in proportion to the population of areas and neighborhoods, and significant differences are observed between Ardabil neighborhoods in term of their area of sports arenas. For instance, some neighborhoods have per capita sports areas as high as 13 meters squares while some neighborhoods down even have 0.5 meters square of sports spaces per capita. Study of

the results of analyzing the spatial association between Ardabil neighborhoods in terms of sports areas per capita indicate the random distribution of sports areas per capita.

The Moran index obtained from the calculation of the spatial association between per capita sports land use was -0.014 which indicates the adjacency of features with dissimilar properties. However, it could not be argued that the spatial clustering of the mentioned land use's distribution is significant. Results of the study indicated an inverse correlation between population density and the area of sports arenas in Ardabil neighborhoods, so one could argue that sports land uses in Ardabil are not distributed across the city in proportion to the population density in its neighborhoods.

Conclusion

The unbalanced spatial distribution and improper location of sports areas are among the most significant problems in the country and Ardabil in particular so that many citizen are unable to use the sports spaces properly due to the lack of access. Solving this problem requires planning and management of location allocation and spatial organization of land and sports arenas. Proportionate spatial distribution of sports sites across the city and its districts could result in increased efficiency and effectiveness of these spaces as well as influencing the urban functional efficiency directly. On the other hand, proper distribution and diversity of sports land uses results in increased power and freedom of choice for citizens in using sports spaces and therefore increase the desirability of urban life. given the necessity of creating balance between supply and demand for urban facilities, it is suggested that future plans regarding the placement and location allocation of sports land uses in proportion to the population and the area of sports arenas allocated to each neighborhood are paid special attention so that the gap between the standard and actual per capita sports areas is filled and facilities corresponding to the actual needs of neighborhoods are allocated to them also, provincial planners and authorities in the head office for sports and youth affairs must pay the required attention to the fair distribution of sports arenas so that all citizens could use them spending the smallest amount of time and money.

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چکیده فارسی

تحلیل فضایی و مکان یابی اماکن ورزشی شهر اردبیل با استفاده ازGIS

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چکیده:

اماکن و فضاهای ورزشی از مهم‌ترین کاربری‌های شهری در جهت افزایش سلامت جسمانی و روانی شهروندان می‌باشند که مکان‌گزینی بهینه آنها از مهمترین وظایف مدیران، مسئولان و برنامه‌ریزان امور ورزشی و شهری است. شبکه‌های وسیع امکانات شهری، توزیع و تراکم جمعیت، کاربری زمین‌ها و بسیاری از موارد نظیر این، چنان بر پیچیدگی این برنامه‌ریزی و مکانیابی از جمله مکانیابی اماکن ورزشی می‌افزایند که چاره‌ای جز استفاده از ابزارهای پیشرفته از جمله GIS برای گردآوری این اطلاعات و پردازش آن‌ها برای مدیریت بهینه منابع وجود ندارد. از این‌رو، تحقیق حاضر با هدف تحلیل فضایی و مکانیابی اماکن ورزشی با مورد نمونه شهر اردبیل انجام گرفته است. این پژوهش یک مطالعه توصیفی و میدانی می باشد. جامعه‌ی آماری آن شامل کلیه‌ی اماکن ورزشی شهر اردبیل می‌باشد و حجم نمونه به صورت کل شماری انجام گرفت. با استفاده از مدل‌های آماری موجود در نرم افزار ARCGIS 10.4 و نرم افزار GeoDa به بررسی الگوی توزیع فضایی، وضعیت دسترسی و توزیع سرانه‌ها پرداخته شد. یافته‌های حاصل از تجزیه و تحلیل خروجی نرم‌افزار نشان داد که فضاهای ورزشی اردبیل دارای توزیع نامتوازن می‌باشد و نواحی مرکزی شهر اردبیل به سبب تمرکز بیشتر مراکز ورزشی در این نواحی، سطح دسترسی مطلوبی دارند، اما نواحی پیرامونی شهر، مخصوصاً نواحی جنوبی و شمالی آن بدلیل فقر امکانات ورزشی با فقر دسترسی مواجه هستند و توزیع سرانه ورزشی اماکن و فضاهای ورزشی شهر اردبیل مناسب نمی‌باشد. نتیجه اینکه برای استفاده بهینه از منابع و دسترسی عادلانه به فضاهای ورزشی در شهر اردبیل، احداث و ایجاد اماکن و فضاهای ورزشی جدید در نواحی مورد نیاز ضروری می‌باشد.

واژه‌های کلیدی: اماکن ورزشی، مکان‌یابی، تحلیل فضایی، شهر اردبیل