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Sports Places Site Selection with Geographic Information Systems: A Review Study

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ABSTRACT

Sports facility management is debatable from several angles, such as design principles, safety, and health principles, sizes and standards, and supervision, among which optimal location and determining the appropriate location to build sports facilities is one of the most crucial and specialized categories. The purpose of this research is a review study of sports places site selection with geographic information system. To achieve the research goal, a review study was conducted on the issue of locating sports venues with GIS. Google Scholar, SJR, and SID databases were reviewed to extract English and non-English language articles on locating sports venues with GIS. The researchers conducted from 2007 to 2023 were reviewed in this study. The search was conducted in December 2022 and led to the identification of 565 records. After two steps of 'screening' and 'eligibility', 17 researches have met the criteria and were included for data analysis. Findings demonstrated that GIS has become very prosperous in the world, huge sums of money are spent to prepare these systems, and it is predicted that billions of dollars will be spent in this field in the future.

Introduction

Sports facilities are the most basic parts of hardware in the field of physical education and sports and are a crucial part of the facilities of human organizations, and optimal location is one of the vital tasks of urban planners and decision-makers. Sports spaces should be built in places where everyone can easily use it, and if competitions are held in any of these sports spaces, the possibility of disrupting the administration of city affairs, such as increasing traffic, should be minimized(Salimi, 2020). The required criteria for locating sports facilities are criteria, such as easy access, desirability, compatibility, fair distribution, and comfort and security of users, which should be observed by the builders of sports spaces following the rules set by the municipalities. A review of clinical and epidemiological studies conducted over the past years shows that regular physical

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activity protects a person against cardiovascular diseases, obesity, blood pressure, type 2 diabetes, and lung diseases(Nadertehrani, Salimi, Rahimi Sarshabadrani, & Nazari, 2022).

Studies also show that physical activity reduces smoking and adopting a healthy diet, and as a result, improves the quality of life and the satisfaction level of people(Marsh, 2019). Today, sport is considered an effective power in social and economic development and an effective tool for the health of society. For these reasons, governmental and non-governmental organizations are attempting to improve the level of physical activity in society at the local and national levels. These efforts include sports incentive programs, creating and developing sports, and completing sports facilities and spaces(Salimi & Soltanhoseini, 2018). Klompmaker et al. (2018) In a study showed that the presence of green space and sports facilities encourages people to physical activity and reduces the risk of diseases, such as being overweight; as a result, the development of sports facilities encourages people in the community to call people to make changes in habits, reduce the risk of diseases and promote a healthier life. Facilities should be built, equipped, and managed to meet the needs, expectations and interests of all groups. In this regard, sports facilities face various risks due to the existence of facilities, equipment, and human resources, as well as customers with different tastes, needs, cultures, and customs, whose correct and efficient management requires continuous evaluation and a suitable and efficient model. According to the main goal of physical education, which is to strengthen the body and soul, it is necessary to implement standards for the safety and environment of sports facilities(Alizadeh, 2019). The first aspect of considering safety principles for devices and equipment is to pay attention to the necessary standards in the design of materials and devices used and the general form of sports halls according to the number of users(Bergsgard, Borodulin, Fahlen, Høyer-Kruse, & Iversen, 2019).

Undoubtedly, doing sports and holding sports events requires sports facilities and stadiums, which in many cities of the world, these stadiums have even created a place brand for that region(Soltanhoseini, Salimi, & Tayebi, 2021). The effort to maintain the physical and mental health of athletes, coaches, and those involved in sports activities increases the duty of the managers of sports venues because sports environments are affected by the environment and health. Occupational health and safety is a tool in the hands of management that helps to prevent, reduce accidents and costs and improve the organizational image. The safety and security of the environment is the vital issues for saving human lives and protecting investments, therefore it is necessary to implement its management to reduce the occurrence of accidents(Ghasemi & Nadiri, 2016). Today, sports venues and large stadiums that have created a brand have attracted thousands of tourists, fans, and spectators in different regions(Salimi, Tayebi, & khodaparast, 2021). Locating is an activity that identifies the spatial and non-spatial talents of land and makes it possible to choose the right place for specific uses. To choose the right place to build sports facilities, special attention should be paid to the following criteria(Salimi, Soltanhoseini, & Taghvaie, 2013).

• Access: It is a critical criterion to increase the efficiency and productivity of sports facilities and spaces, as well as the comfort and satisfaction of users and the easy and quick access of citizens to their desired facilities, special communication networks should be designed to achieve this goal. The place chosen to build sports spaces for all kinds of sports activities should be easily accessible to all strata of people.

• Consistency (cohesion and integration): Cohesion and integration mean logical relation and coordination between sports facilities and nearby facilities.

• Safety: Safety means quick care and handling of the sports space and its users against possible risks. This criterion is aligned with the compatibility criterion so that the appropriate distance between sports facilities and centers, such as the fire department and medical centers should be properly observed.

• Fair distribution: The correct distribution of sports facilities and spaces is the crucial factor in locating. To achieve this goal, special attention should be paid to the principle of the spatial distribution of sports facilities and spaces according to the population density of different parts of the region. Proper and fair distribution of different urban uses will increase productivity in each of them.

• Desirability and adaptation: The desirability, efficiency, pleasantness as well as adaptation (coordination of the structure with the geographical location, needs, and type of sports activities common in the region) of the created places depend on the full realization of the above criteria(Oh & Jeong, 2007).

The geographic information system (GIS) is used as a system that can combine the information about the hardware and software facilities with the information about the reference place and after analysis, provide various outputs according to the need of the users.(Salimi & Soltanhoseini, 2018).

Locating

Locating is an activity that identifies the spatial and non-spatial talents of land and makes it possible to choose the right place for a specific use. In another definition, locating means choosing a suitable place to implement engineering projects, such as the construction of dams, power plants, military bases, tourist centers, pipelines, railways, and ski resorts, checking the level of water and air pollution, determining suitable areas of agriculture and other analysis(Vafakhah, Salimi, mostahfezian, & Shajie, 2022). The locating theory was first invented by Fan Tanonen (1826) in the field of agricultural activities, and the first scientific framework of this theory was officially introduced by Alfred Weber in 1909. He investigated the problem of locating a warehouse and a set of customers. Since then, several studies have been conducted on locating(Salimi & Soltanhoseini, 2018). Optimum locating by legalizing the indicators and influencing factors in decision-making and providing logical solutions try to help decision-makers and planners in choosing suitable places to perform activities. In optimal locating, it is attempted to link the indicators related to the studied user scientifically and logically(Zhao, 2010). In the beginning, locating theories focused more on locating industrial and commercial uses, but in recent years, as urban environments have become more complex, more attention has been paid to other urban uses in the field of public services, including sports facilities and spaces(Soltanhosseini, Poursoltani, Salimi, & Emadi, 2011). In a general view, all the theories and placement theories can be discussed in two continuous and discrete states. The continuous mode is a mode in which there is no predetermined option and the entire studied range is divided into different spectrums based on the factors to be monitored. This is while in the discrete mode, the researcher ranks the predetermined options according to the factors. Paying attention to location criteria are also different in two continuous and discrete modes. In continuous mode, the studied area can be monitored based on criteria such as compatibility (positive or negative), access, desirability, population (distributive justice) and capacity. On the other hand, in the discrete state, due to the lack of access to information at the macro level, criteria such as geomorphic conditions, difficulty of acquisition, land price, and worn texture are used(Salimi & Taghvaie, 2021). Locating is one of the issues in which the researcher deals with several factors. When faced with decision-making problems that are based on several options and factors, many of them appear vague, elusive and uncertain, especially when these problems are in the real world(Lai, Chang, & Chou, 2010). The management of sports facilities can be discussed from several angles, such as design principles, safety and health principles, sizes and standards, and supervision, but in the meantime, optimal location and determining the appropriate location for the purpose of building sports facilities is among the most important and specialized. These are the categories. The establishment of any urban use in a specific physical-spatial position of the city, in order to optimally exploit that use, must be subject to certain principles and rules(Salimi, Soltanhosseini, & Shabanibahar, 2012). Since sports facilities have a public and service aspect, the issue of location is more important for them than many other urban uses. It should be noted that many sports facilities are built in different places every year, and according to the investigations, it has been determined that in most cases, their location is based on traditional methods(Jamali, Salimi, & Nasr Esfahani, 2022). It seems that in these constructions, by giving the license for establishment, the important points of correct location are not paid much attention, which may reduce the optimal efficiency of these spaces and, in addition to the waste of sports budgets, cause problems for the city and citizens. We can point to many examples of sports spaces that were abandoned after a while or changed in use due to not paying attention to the correct location(Salimi & Soltanhoseini, 2018). The construction of new spaces requires scientific and accurate studies on location determination, which neglecting this issue, in addition to the inefficiency of the built

spaces, causes a lot of budgets to be wasted(Salimi, Soltanhosseini, Salimi, & Lotfi, 2013). Today, many sports facilities can be mentioned which have gone out of the way of productivity for this reason. Optimum positioning tries to help decision makers and planners in choosing the right places to carry out activities by legalizing indicators and influencing factors in decision-making and providing logical solutions. This operation can have inappropriate results without considering the spatial relations and geometry of the space(Sui, Ding, & Wang, 2018). Determining the location of land uses is one of the most key steps in their establishment, because the results of this decision have appeared in the long term and can have tremendous effects in terms of economic, environmental and social issues. The effects related to the location of users can be examined from two internal and external aspects. One of the internal effects will be a direct effect on survival, development and profitability, and from the external dimension, creating a land use with the correct location in an area can affect various economic, social, cultural and environmental conditions. For example, determining the location for the establishment of an industrial unit will play an important role in the amount of initial investment during the establishment of the factory. Also, during the operation of the project, this decision has a key effect on the final price of goods or services. Building one or more industrial units in optimal locations and in the best possible condition not only improves the circulation of goods and services to customers, but also puts the unit in a favorable condition(Salimi & Khodaparst, 2021). Recognizing, analyzing, planning and managing the location of sports venues requires the use of a system that can store all location characteristics in a database and, according to the needs of the planner, provide a special representation of it in the form of maps and information tables(Kumar & Bansal, 2016). The geographic information system is one of the most efficient planning tools in the last few decades in the world in collecting, analyzing and visually displaying the information needed in the field of planning(Goodarzi, Salimi, Jalali farahani, & Taghvaie, 2015). According to the type of activity, size and structure, in order to achieve sustainable excellence in achieving their goals, places need a model based on which they measure and evaluate their success rate in achieving goals and strategies(Soltanhosseini, Taghvaie, Yazdanpanah, & Salimi, 2012).

Geographical Information System (GIS)

Geographic information system or GIS is a computer system for managing and analyzing spatial information that has the ability to collect, store, analyze and display geographic (spatial) information. In a geographic information system, the word "system" indicates that the GIS is made of several parts connected and interdependent for different functions. Also, the word "information" indicates that the data in GIS is organized to provide useful data, not only in the form of maps and color images, but also in the form of statistical graphics, tables and various display answers for the purpose of scientific searches; And the word "geographic" also indicates the location of the data in terms of geographic coordinates (longitude and latitude)(Salimi & Khodaparst, 2021). Geographical information systems have been used all over the world(Salimi, 2017). In Europe, the use of GIS has started in the works of registering property documents and preparing environmental databases. In England, it is mostly used in service works such as telephone, water, electricity, and gas, and in Canada, it is used to plan the volume of wood procurement from forest trees and to determine access ways to these trees. Users in China and Japan mainly use GIS in the field of environmental change monitoring and modeling, and in the United States, the Department of Statistics uses GIS to determine the country's road and transportation network for the access of statistical agents to different points and report the results to the collection centers. In general, it can be stated that according to the predetermined goals and also the ability of the users, geographic information systems can be used in a variety of ways(Warren & Dinnie, 2018). In general, a GIS is used to collect, store and analyze information whose geographic location is considered a main and important feature. In other words, this system is used to collect and analyze all the information that is somehow related to the geographical location(Kim, Walsh, & Park, 2014). The main elements of geographic information systems are built on a pyramid with four underlying layers:

A) Hardware: According to the stage in which the studies are located, users can use the hardware available in the following categories:

- Hardware related to data entry; Such as: keyboard, digitizer and scanner
- Hardware related to information management (computer peripherals); Like: Mouse
- Hardware related to the output of results; Such as: printers and painters

B) Software: A computer program is required to set up GIS. Among the most famous of them, we can mention "Arc View" and "Arc Map", which have many operational functions for the analysis of problems and statistical calculations, and are mainly produced by large computer companies. Each of these softwares is planned for specific studies and has its own limitations and merits.

C) Information: without information, there is neither a goal nor a proposal, focus and attention is on information. In fact, most of the activities are done for data analysis, because data is the heart of GIS. The quality of information is one of the most important and fundamental issues. The quality of information is directly related to accuracy, clarity, scientific foundations, information combination, analysis and modeling.

D) Organization and human resources: It is the most important component of GIS, because it is the organization and human resources that control GIS operations. Very powerful GIS hardware and software will not work properly without the support of skilled staff. For the successful implementation of the system, it is necessary to organize expert and efficient forces that play various roles in order to implement, optimize and ultimately manage the systems(Salimi & Tayebi, 2018).

With the emergence of the Geographical Information System (GIS) in the early 1960s for the first time in Canada and its globalization in the 1980s, the issue of location took on a more serious aspect and gradually in its evolution until the present time by presenting theories the new is on the path of evolution(Salimi, 2023). At first, the presented theories focused more on the location of industrial and commercial uses, but in recent years, as urban environments have become more complex, other urban uses, including sports venues and spaces, have received more attention. In all these theories, in every field, it is tried to establish a logical connection between the effective parameters, which, due to the existence of wider and more complex criteria in the field of sports facilities, managers and researchers in this field face more difficulties. The main role in the majority of location theories is played by GIS(Salimi & Soltanhoseini, 2018).

Methodology

In order to achieve the goal of the research, a review was conducted on the issue of locating sports venues with GIS. Google Scholar, SJR and Jahad University (SID) databases were reviewed to find English and non-English language articles on locating sports venues with GIS. In all the steps of searching and gathering the research data, in addition to paying attention to the researchs done on the topic of the research from the past to the present, the researchs conducted from 2007 to 2023 was reviewed. Also, for the purpose of credibility and reliability of the research, the validity of the sources was specially examined. Our search terms are consistent with the concepts of Sports Places Site Selection with Geographic Information Systems. The search was conducted in December 2022 and led to the identification of 565 records. We applied a variety of inclusion and exclusion criteria (see Table 1). As illustrated in Figure 1, after two steps of ‘screening’ and ‘eligibility’, 17 researchs have met the criteria and were included for data sharing and reporting.

Table 1. Inclusion and exclusion criteria

	Inclusion criteria	Exclusion Criteria
Language	English and Persian	Non-English and Non-Persian
Text availability	Full-text papers	Unavailable (e.g., abstract only papers)
Source type	Journal (empirical investigation), peer review	Perspective, comment and response letter, conference paper

Subject of investigation	Geographic Information System, Locating, Sports Facilities	Not relevant to the subject
Users	Sports managers	People other than sports managers

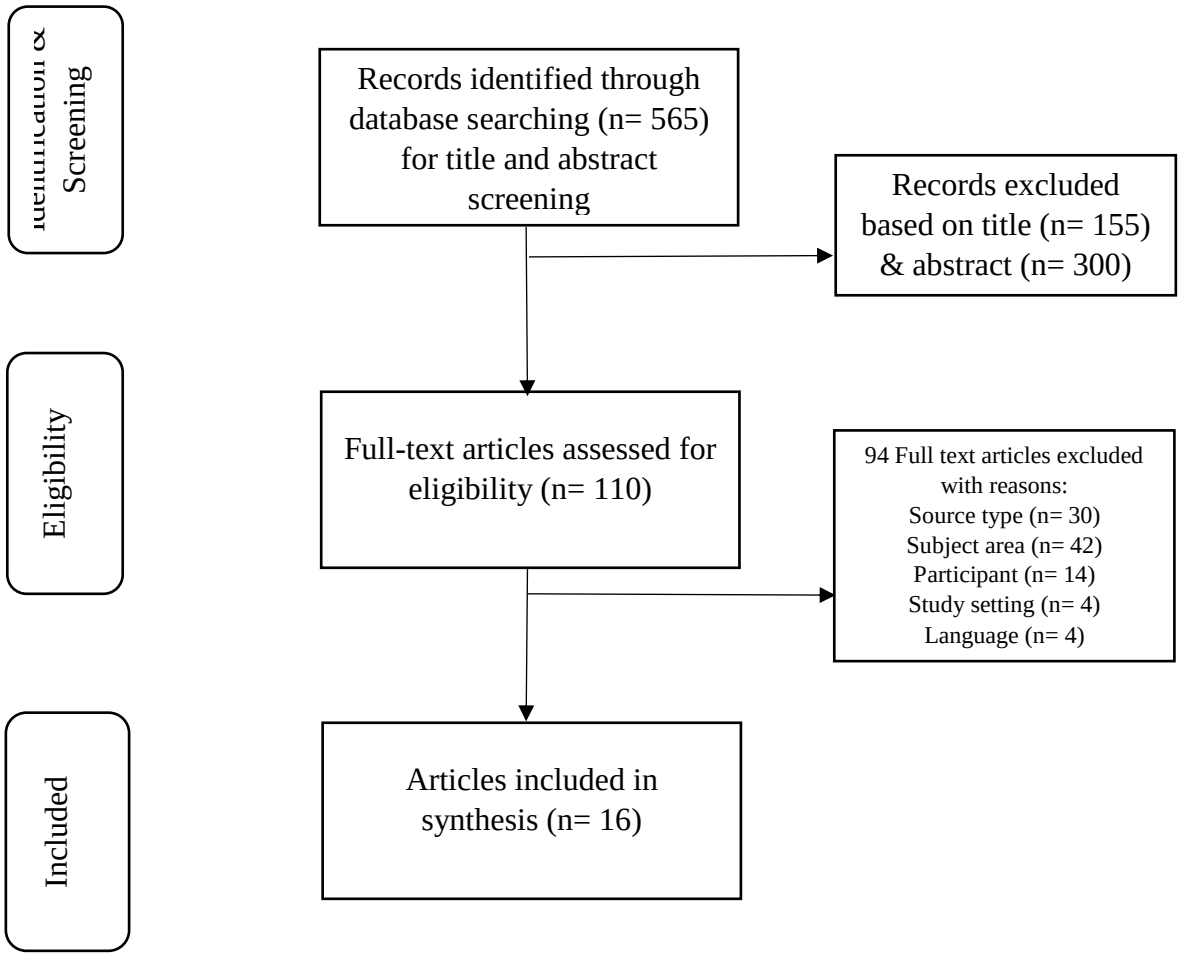

Figure 1. Study selection process

Results

Salimi (2023) conducted a research with title "An Analytical Model for Spatial Developing of Sports Places and Spaces". One of the matters that can be considered as the basic information required to develop and construct sports facilities is determination of per capita, which can be used as the most vital information to plan and develop this type of urban utilities. In the history of contemporary urbanization, the use of the per capita concept is one of Reinhard Laumeister's innovations, a founder of modern urban engineering in Germany, hence, the use of per capita was triggered in 1876, almost 133 years ago. The underlying information of the research in two spatial and descriptive sections was analyzed in the geographic information systems (GIS) software. After the division and network distribution of the boundary by the Thiessen Networks analytic function in the Arc GIS, per capita of each polygon was separately calculated using the presented formula and the population of the related blocks.

Salimi and Khodaparst (2021) in research entitled providing the optimal method for choosing sports venues based on GIS analytical functions after building a study database including data related to urban uses and elements, sports venues, population density in the study area and drawing

Map of the area, by entering the data into GIS, the environment was prepared for use as separate layers. In the next step, the final map was made by overlapping the layer resulting from the combination of the determining factors in the selection of sports venues and a layer of the sphere of influence of the existing sports venues.

Salimi and Taghvaie (2021) in research they conducted with the aim of locating sports venues in discrete mode, used Arc\View, Arc\GIS, Auto\Cad and Excel software for data analysis, as well as programming in MATLAB, and for location selection in discrete mode, they presented an algorithm to implement the gray clustering analysis method. The results showed that due to the complex urban environment and the uncertainty regarding the location criteria for sports venues, the gray clustering analysis method is able to provide reliable results by controlling all factors simultaneously, which this control is in the form of other methods. It is not possible at the same time.

Jamshidi, Doostipasha, Razavi and Gudarzi (2018) in research titled "Optimizing indicators for selecting the optimal sports place for the elderly" using the Analytical Hierarchy Model (AHP) and GIS showed that the three indicators of accessibility, proximity to other urban uses and safety from the point of view of ranking experts they got better in terms of influencing the choice of sports venues.

Khanjari, Shoaie and Bahmanpour (2018) conducted research titled locating and placing sports spaces using the combined technique of AHP hierarchical analysis method and GIS geographic studies system, which indicates that in order to locate sports uses, it is better First, based on general and general geological indicators and distance and proximity to faults, underground and surface water sources, slope, direction and height, did a preliminary screening and eliminated areas without points. Then, based on specific and more detailed indicators, did the final screening and identification of suitable stains.

Salimi, Soltanhoseini and Khalili (2017) in a research entitled combining decision-making methods in GIS environment in order to locate sports facilities, in order to locate sports possibilities from criteria such as price, geomorphic conditions, acquisition capability, existing use value, population, Access and distance from nearby sports facilities were used, and finally, land plot C among the four land plots (A, B, C & D) that were selected among the lands with very suitable conditions was recognized as the best place to build a sports facility.

Salimi (2017) conducted research entitled providing a model to determine and analyze per capita sports venues based on the distribution of Thiessen networks in the geographic information system environment. In order to implement the model, the study area of the research was three districts 5, 6 and 13 of Isfahan city, and indoor swimming pools were considered as the sample sports place. Maps in DWG format of the range as well as its population blocks, location information and precise geographical coordinates of indoor pools and population information of the blocks were the underlying information for the research implementation. After division and grid distribution of the range by Thiessen function in Arc GIS environment, using the provided formula and the population of related blocks, the per capita of each polygon was calculated separately. Finally, with the quality of the per capita data obtained in the previous stage, the study area was classified into three spectrums, rich, semi-rich and deprived, based on the need to develop indoor swimming pools.

Azimi, Razavi, Bromand and Dezh (2016) in research entitled "Review of location criteria in the design and construction of urban sports facilities" stated that all the location indicators examined in this research, the available facilities regarding urban services, the location and characteristics of the land, compatibility and incompatibility. Uses, density and functional radius and weather are important and influential in locating for the design and construction of urban sports facilities.

Ghorbani, Yaghoobi, Moradi and Ghorbani (2016) conducted research titled optimal location of sports centers using GIS, case study: Miandoab city. The findings show that the sports spaces of the city are not located according to the correct principles of urban planning, and in terms of having compatible and incompatible neighborhoods, the citizens have faced serious limitations.

Salimi, Soltanhoseini and Taghvaie (2013) conducted research titled choosing the optimal location for the construction of outdoor sports facilities using GIS. GIS technology was used for modeling, based on which, after collecting the spatial and descriptive data, a database was formed and a map was prepared for each criterion. Finally, by summarizing the maps, the lands of the area were divided into five spectrums with the degree of desirability of very suitable, suitable, medium,

unsuitable and completely unsuitable for the construction of all kinds of outdoor sports facilities. After the field observation of these lands, it was found that they are located in areas where communication routes, population density and compatible urban elements are more than incompatible urban elements compared to other areas and the density of sports facilities of the same type is less.

Salimi, Soltanhosseini and Shabanibahar (2012) conducted research with the aim of providing a scientific method for choosing the optimal location for the construction of sports facilities. In order to locate sports facilities, continuous and discrete spatial models based on the combination of two models of analysis hierarchy (AHP) and TOPSIS (TOPSIS) were used. Information modeling was done in the Arc\GIS software environment. In this way, the lands of the area were first classified into five discrete spectrums using the AHP model, and using field observations and researchers' opinions (according to the actual conditions of the region), four plots of land (A, B, C & D) from among the lands with A very suitable situation for the construction of indoor swimming pools (statistical sample) was chosen. Finally, using TOPSIS spatial discrete model, these lands (TOPSIS inputs) were prioritized, and input C with the highest score was selected as the best input. The selected piece of land in terms of price indicators, difficulty of acquisition, existing use value, geomorphic conditions (soil, slope, underground water level, etc.), cohesion and integration, safety, access, fair distribution and population compared to other lands. It was in a more suitable condition for the construction of sports facilities.

Taraszkiewicz and Nyka (2017) in research entitled the role of sports facilities in the process of revitalizing brown areas, concluded that creating the possibility of sports next to rivers, canals and other waterways attracts more and more people to sports.

Oh, Kim, Kim, Baik and Hwang (2016) conducted research titled choosing the optimal site for building sports complexes using important factors according to regional characteristics. The results show that for the selection of sports venues, one should pay attention to the participation of the local government, comprehensive local plans, the needs of the residents and the opinions of relevant experts.

Trong Duc (2013) in an article entitled using GIS and AHP techniques in land suitability analysis, considered GIS to be a very powerful tool in this field, but said that this technique alone cannot do this and with Combining with AHP is a suitable method for proper analysis.

In a research, Huntley, Liue, Dougall and Gibbings (2011) used GIS software to prepare a map of cycling routes and located the easiest route from the University of Southern Queensland to the business district in Toowoomba based on energy laws and regulations.

Potwarka, Luke and Andrew (2008) used geographic maps and GIS software in research to analyze the location of recreational-sports parks and the relationship between access to parks and optimal weight of children. In their research, they came to the conclusion that the distance of families from parks is 1 to 8 kilometers, which limits their access to recreational-sports parks and causes unwanted weight gain of children. Also, about 10% of the parks were located relatively outside the neighborhood boundaries.

In research, Despotakis and Economopoulos (2007) used GIS to select a landfill site and stated that the selected site should maintain its distance from industrial, sports, educational and ancient areas.

The research findings are shown separately in Table 2.

Table 2. Research findings

Study	Title	Findings
(Salimi, 2023)	An analytical model for spatial developing of sports places and spaces	The underlying information of the research in two spatial and descriptive sections was analyzed in the geographic information systems (GIS) software. After the division and network distribution of the boundary by the Thiessen Networks analytic function in the Arc GIS, per

		capita of each polygon was separately calculated using the presented formula and the population of the related blocks.
(Salimi & Khodaparst, 2021)	providing the optimal method for choosing sports venues based on GIS analytical functions	After building a study database including data related to urban uses and elements, sports venues, population density in the study area and drawing Map of the area, by entering the data into GIS, the environment was prepared for use as separate layers. In the next step, the final map was made by overlapping the layer resulting from the combination of the determining factors in the selection of sports venues and a layer of the sphere of influence of the existing sports venues.
(Salimi & Taghvaie, 2021)	Using Gray Cluster Analyze (GCA) Method in Site Selection of Sport Places in Cessation Spatial Status (Case study: Isfahan city)	Used Arc\View, Arc\GIS, Auto\Cad and Excel software for data analysis, as well as programming in MATLAB, and for location selection In discrete mode, they presented an algorithm to implement the gray clustering analysis method. The results showed that due to the complex urban environment and the uncertainty regarding the location criteria for sports venues, the gray clustering analysis method is able to provide reliable results by controlling all factors simultaneously, which this control is in the form of other methods. It is not possible at the same time.
(Jamshidi, Doostipasha, Razavi, & Gudarzi, 2018)	Optimizing indicators for selecting the optimal sports place for the elderly	Using the Analytical Hierarchy Model (AHP) and GIS showed that the three indicators of accessibility, proximity to other urban uses and safety from the point of view of ranking experts they got better in terms of influencing the choice of sports venues.
(Khanjari, Shoaie, & Bahmanpour, 2018)	Locating and placing sports spaces using the combined technique of AHP hierarchical analysis method and GIS geographic studies system	Which indicates that in order to locate sports uses, it is better First, based on general and general geological indicators and distance and proximity to faults, underground and surface water sources, slope, direction and height, did a preliminary screening and eliminated areas without points. Then, based on specific and more detailed indicators, did the final screening and identification of suitable stains.
(Salimi, Soltanhoseini, & Khalili, 2017)	Combining decision making methods in GIS environment in order to locate sports facilities	In order to locate sports possibilities from criteria such as price, geomorphic conditions, acquisition capability, existing use value, population, Access and distance from nearby sports facilities were used, and finally, land plot C among the four land plots (A, B, C & D) that were selected among the lands with very suitable conditions was recognized as the

		best place to build a sports facility.
(Salimi, 2017)	providing a model to determine and analyze per capita sports venues based on the distribution of Thiessen networks in the geographic information system environment	In order to implement the model, the study area of the research was three districts 5, 6 and 13 of Isfahan city, and indoor swimming pools were considered as the sample sports place. Maps in DWG format of the range as well as its population blocks, location information and precise geographical coordinates of indoor pools and population information of the blocks were the underlying information for the research implementation. After division and grid distribution of the range by Thiessen function in Arc GIS environment, using the provided formula and the population of related blocks, the per capita of each polygon was calculated separately. Finally, with the quality of the per capita data obtained in the previous stage, the study area was classified into three spectrums, rich, semi-rich and deprived, based on the need to develop indoor swimming pools.
(Azimi, Razavi, Bromand, & Dezh, 2016)	Review of location criteria in the design and construction of urban sports facilities	Stated that all the location indicators examined in this research, the available facilities regarding urban services, the location and characteristics of the land, compatibility and incompatibility. Uses, density and functional radius and weather are important and influential in locating for the design and construction of urban sports facilities.
(Ghorbani, Yaghoobi, Moradi, & Ghorbani, 2016)	Optimal location of sports centers using GIS, case study: Miandoab city	The findings show that the sports spaces of the city are not located according to the correct principles of urban planning, and in terms of having compatible and incompatible neighborhoods, the citizens have faced serious limitations.
(Salimi, Soltanhoseini, & Taghvaie, 2013)	Choosing the optimal location for the construction of outdoor sports facilities using GIS	GIS technology was used for modeling, based on which, after collecting the spatial and descriptive data, a database was formed and a map was prepared for each criterion. Finally, by summarizing the maps, the lands of the area were divided into five spectrums with the degree of desirability of very suitable, suitable, medium, unsuitable and completely unsuitable for the construction of all kinds of outdoor sports facilities. After the field observation of these lands, it was found that they are located in areas where communication routes, population density and compatible urban elements are more than incompatible urban elements compared to other areas and the density of sports facilities of the same

		type is less.
(Salimi, Soltanhosseini, & Shabanibahar, 2012)	Location of sports facilities using continuous and discrete spatial models based on the combination of AHP and TOPSIS models	In order to locate sports facilities, continuous and discrete spatial models based on the combination of two models of analysis hierarchy (AHP) and TOPSIS (TOPSIS) were used. Information modeling was done in the Arc\GIS software environment. In this way, the lands of the area were first classified into five discrete spectrums using the AHP model, and using field observations and researchers' opinions (according to the actual conditions of the region), four plots of land (A, B, C & D) from among the lands with A very suitable situation for the construction of indoor swimming pools (statistical sample) was chosen. Finally, using TOPSIS spatial discrete model, these lands (TOPSIS inputs) were prioritized, and input C with the highest score was selected as the best input. The selected piece of land in terms of price indicators, difficulty of acquisition, existing use value, geomorphic conditions (soil, slope, underground water level, etc.), cohesion and integration, safety, access, fair distribution and population compared to other lands. It was in a more suitable condition for the construction of sports facilities.
(Taraszkiewicz & Nyka, 2017)	The role of sports facilities in the process of revitalizing brown areas	Concluded that creating the possibility of sports next to rivers, canals and other waterways attracts more and more people to sports.
(Oh, Kim, Kim, Baik, & Hwang, 2016)	Choosing the optimal site for building sports complexes using important factors according to regional characteristics	The results show that for the selection of sports venues, one should pay attention to the participation of the local government, comprehensive local plans, the needs of the residents and the opinions of relevant experts.
(Trong Duc, 2013)	Using GIS and AHP techniques in land suitability analysis	Considered GIS to be a very powerful tool in this field, but said that this technique alone cannot do this and with Combining with AHP is a suitable method for proper analysis.
(Huntley, Liue, Dougall, & Gibbings, 2011)	Mapping cycling pathways and Route selection using GIS and GPS Faculty of Engineering and Surveying The University of Southern Queensland Toowoomba	Used GIS software to prepare a map of cycling routes and located the easiest route from the University of Southern Queensland to the business district in Toowoomba based on energy laws and regulations.
(Potwarka, Luke, & Andrew, 2008)	Places to play: association of park space and facilities with healthy weight status among children	Used geographic maps and GIS software in a research to analyze the location of recreational-sports parks and the relationship between access to parks and optimal weight of children. In their research, they came to the conclusion that

		the distance of families from parks is 1 to 8 kilometers, which limits their access to recreational-sports parks and causes unwanted weight gain of children. Also, about 10% of the parks were located relatively outside the neighborhood boundaries.
(Despotakis & Economopoulos, 2007)	A GIS model for landfill site	Used GIS to select a landfill site and stated that the selected site should maintain its distance from industrial, sports, educational and ancient areas.

Table 3 shows the characteristics of the included articles.

Table 3. Characteristics of included articles

Author (Years)	Country	Method	Theory
(Salimi, 2023)	Iran	Quantitative	Data-driven
(Salimi & Khodaparst, 2021)	Iran	Quantitative	Data-driven
(Salimi & Taghvaie, 2021)	Iran	Quantitative	Data-driven
(Jamshidi, Doostipasha, Razavi, & Gudarzi, 2018)	Iran	Quantitative	Data-driven
(Khanjari, Shoaie, & Bahmanpour, 2018)	Iran	Quantitative	Data-driven
(Salimi, Soltanhoseini, & Khalili, 2017)	Iran	Quantitative	Data-driven
(Salimi, 2017)	Iran	Quantitative	Data-driven
(Azimi, Razavi, Bromand, & Dezh, 2016)	Iran	Quantitative	Data-driven
(Ghorbani, Yaghoobi, Moradi, & Ghorbani, 2016)	Iran	Quantitative	Data-driven
(Salimi, Soltanhoseini, & Taghvaie, 2013)	Iran	Quantitative	Data-driven
(Salimi, Soltanhosseini, & Shabanibahar, 2012)	Iran	Quantitative	Data-driven
(Taraszkiewicz & Nyka, 2017)	Poland	Quantitative	Data-driven
(Oh, Kim, Kim, Baik, & Hwang, 2016)	South Korea	Quantitative	Data-driven
(Trong Duc, 2013)	Florida	Quantitative	Data-driven
(Huntley, Liue, Dougall, & Gibbings, 2011)	Australia	Quantitative	Data-driven
(Potwarka, Luke, & Andrew, 2008)	Netherlands	Quantitative	Data-driven
(Despotakis & Economopoulos, 2007)	Greece	Quantitative	Data-driven

Discussion and Conclusion

One of the primary requirements for establishing sports facilities with high productivity is choosing the best place to build them, which is undoubtedly one of the most important duties of sports managers. The construction of new spaces requires scientific and accurate studies in connection

with location determination, which neglecting this issue, in addition to the lack of optimal efficiency of the built spaces, causes a lot of budgets to be wasted. Optimum positioning tries to help decision makers and planners in choosing the right places to carry out activities by legalizing indicators and influencing factors in decision making and providing logical solutions. Locating is a decision-making process with a long period of time, because a large number of available indicators must be tested and the result of possible decisions evaluated. Appropriate positioning is done when there is an accurate, homogeneous and quick assessment of the attractiveness of different locations for a specific user. If the location of a specific type of use is intended, its optimal location should be provided along with the conditions and status of neighboring uses and possibly some suggestions for changing the uses in order to coordinate and match with the located use; And if the location of several users is involved, evaluating the degree of coordination and compatibility and measuring the proximity of all users will provide the best location. Determining the exact principles of locating various activities in the city is undoubtedly very difficult, if not impossible, due to the dynamic nature of urban issues. As mentioned before, the main goal of the series of urban land use planning measures is to provide the social and economic well-being of the citizens. The location theory was first invented by Fan Tanonen in 1826 AD in the field of agricultural activities, and the first scientific framework of this theory was officially introduced by Alfred Weber in 1909. He investigated the problem of locating a warehouse and a set of customers. Since then, many and varied studies have been carried out regarding location. With the emergence of the geographic information system in the early 1960s for the first time in Canada and its globalization in the 1980s, the issue of location took on a more serious aspect and gradually in its evolution until the present time by presenting new theories in the path of evolution. takes a step At first, the presented theories focused more on the location of industrial and commercial uses, but in recent years, as urban environments have become more complex, other urban uses, including sports venues and spaces, have received more attention. In all these theories, in every field, it is tried to establish a logical connection between the effective parameters, which, due to the existence of wider and more complex criteria in the field of sports facilities, managers and researchers in this field face more difficulties. The main role in most of the positioning theories is played by the geographic information system. Geographic information system is a computer system for managing reference location data. The word location in GIS indicates the fact that the location of the data is known or can be known in terms of their spatial coordinates. The word information indicates that data in GIS is stored and organized to provide information, not only in the form of maps, satellite or aerial images, but also in the form of statistical graphs, tables and various outputs. The word system also indicates that GIS is created from several parts connected and dependent on each other with various functions. The ability to analyze data in GIS can be used for important decisions and planning by officials. GIS systems use a database management software (DBMS) to store and manage their descriptive and graphic information. Geographic information systems are computer systems that are used to store and use geographic information. These systems have been accepted as a necessary science and technology for the effective use of geographic information in all organizations. Managers at different levels of organizations, by knowing and using GIS in the relevant organization and using its various applications, can use GIS in optimizing facilities and allocating budget and credit and identifying problems and bottlenecks. In the past and due to the traditional methods for determining the location for the purpose of building sports facilities, by sending a group as an expert group, areas were proposed and evaluated, and if one or a number of them were suitable as a place or places They were introduced appropriately. This method directly relied on the personal experiences and opinions of the experts that there were many cases that did not correspond to the scientific and logical aspects of relocation and as a result caused irreparable problems and damages. At the present time, with the irregular expansion of cities, the limitation of resources, the lack of localization of service users in the past, the growth and dispersion of built-up areas in the outskirts and frequent trips throughout the city, sports experts and managers are required to provide scientific solutions. and practical in the direction of locating sports places, which can imply the maximum efficiency of the built spaces, proper planning for the construction of such spaces and preventing the creation of urban anomalies (for its part) in the future. It should be noted that the operation of collecting, storing, combining information related to the location and analyzing them,

taking into account the parameters effective in locating in a traditional and manual way, requires a time-consuming and exhausting activity and may result does not reach the desired Because the necessary information about the goals, methods and standards for any type of urban use requires abundant and diverse subject data. Geographic information systems have dramatically changed the production, timing and dissemination of geographic data. Scheduling of maps that used to take months is now done by the hour, and analysis activities that were once very limited are now commonplace. Today, the operation of scientific location in many fields, including geography and geology, is integrated with the concept of geographic information system. This system can have key applications in the field of physical education and especially in the location of sports venues, which sports managers can increase the productivity of sports venues built in the present and future, and also prevent Waste of huge budgets. Due to the computer nature of the geographic information system, which is one of the most important parts of the information technology industry, it is possible to store a large amount of information about a specific point or region at the same time and in an integrated manner and use it in the analysis. Therefore, the first and most important application of the geographic information system in sports can be considered in the field of sports facilities. Topics related to optimal positioning, spatial analysis, access to stadiums, traffic control and forecasting, and the economic and social effects of sports venues on the urban environment are all issues that can be better studied, evaluated, and developed or control using these systems.

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