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Using geographical information system and analyzing hierarchical pattern for optimized location finding for sport pools of Bojnourd city

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ABSTRACT

Swimming is one of the popular sports and its nature is such that it causes relaxation in mind and muscles. In this study we will investigate the present status of sport pools of bojnourd using geographical information system (GIS) and analyzing hierarchical pattern (AHP) for optimized location for sport pools of bojnourd city. Having study of the present status of sport pools, it was determined that present distribution of sport pools in urban hierarchy is not appropriate; such that there are no pools in districts 313, 14, 14 B, although more than 50000 people live there. Generally, distribution of sport pools in bojnourd city was not appropriate. So, in location finding scenario, optimized location of bojnourd's sport pools were 968856/58 hectare (32%), inappropriate fields were 1320820 hectare (43.6%), normal fields 500877/75 hectare (16.6%) and appropriate fields were 236261.5 (7.8%). In this study, consistency matrix is used for analyzing adaptation of usage and evaluation of alignment method of adjacent usages.

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INTRODUCTION

In modern society, growth and improvement of sport is undoubtedly indebted to several factors and precise determining share of each of factors is serious and difficult. Clearly no success can be achieved just by or a limited factor. So an appropriate and extensive context is necessary to one sport field respecting its specific characteristics and nature, becomes pervasive in a human society and grows such that achieving success result in national proud and glory (kouzechian, 19)

Swimming is one of the most popular sports which is welcomed more and more due to causing hilarity and refreshment. Specially in order to enrich leisure times for teenagers and young people and also guiding them to sports, building of swimming pools is of importance. Swimming is one of the healthy and useful recreations and is one the very effective ways of treatment of physical and mental disease. In designing swimming pools, providing safety, hygienic condition and convenience of swimmers or bystanders and also optimized and proper application of energy and equipments is obligatory. Unfortunately, since now no reference or standard has not yet published so calculation and designing of mechanical installations is done tentatively (sheikh al eslami, 1388).

Fast increase in population and improper physical extension in large cities had caused complicated and insolvable problems. In past decades, urban extension was such that leaded to imbalance in methods of using urban lands so has converted the villages to small towns and small towns to large cities; Whereas most of these conversions is done without planning and improper to societies' necessities. Meanwhile no valid planning has been done in usage distribution and relevant activities. Improvement of this situation has weighted the responsibility of urban planners and enforced them to answer to the inconsistencies. Finding appropriate and optimized location of different usage of urban lands by utilizing scientific techniques, models and tools and proportionate with principals and rules of urban planning, can be effective in solving the problems of urban land usage. Fluor status of swimming has a positive effect on one's nervous system and balance the mentality. Washing the face by water leads to mental focus. Swimming cures most of diseases including diseases relative to joints and spine. Swimming helps to athletes' and the others recovery period. In this study we have investigate it scientifically.

Optimized designation of urban lands usage can solve most of urban problems (services, traffics and etc). This designation, in respect to cities' rank and size, is very important; such that the bigger is the city, the more

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complicated is the usage designation and the urban necessary areas. As present study is about bojnourd city and urban extension has a slow procedure, so it is very important to be careful in finding urban necessary spaces. Urban areas are the main parts of a city. These areas are located in shelters frameworks and are distributable in various scales in cities. They make reference points in cities. Urban areas are subsidiaries of human objectives and collective activities and urban collection is a tool for improvement of collective thought sprite, collaboration, amity and hearty relation and creating a safe, comfortable area. So paying attention to necessary areas which are sponsor of citizens' body and soul health, is considered very important in urban planning and urban structures (Maranjati, 1385).

One of the effective areas in this respect is sport places. Sport places are types of social places in human habitat. These places can be considered as an important constituent of urban life for society health in which there are following applications: simultaneous and dense presence of human population, mobility, leisure time and recreation of citizens of big cities, face to face relationships, sport competitions between different groups, non sport meetings with social and sometimes political purpose (Krimi.1385).

Since now, many scientific and applicable researches have been done in all around the world and also in Iran in order to find different usage by GIS. But in urban areas using just GIS was not effective because of effective processes being complicated and the role of various factors and indexes in finding locations as many researches have been done in recent decades and it is clearly observable in scientific and applicable levels. So, many executive and scientific parties have noticed to synthetic tendency of capability of GIS with applicable models and techniques in solving the urban problems, specially finding optimized urban usage. But this situation in Iran's cities was not considered consistently because it is less than one decade that combining AHP with GIS is used in Iran.

sehnaz and *et al*, 2010 have conducted a study on combining AHP with GIS for landfill site selection in the Lake Beyşehir in Turkey. Also in 2010 Fernández, D.S. and et.al conducted a study on urban flood hazard zoning in Tucumán Province, Argentina, using GIS and multicriteria decision analysis. Tims, Willem, 2009 had a precise study on the Land Use and Development Master Plan in Rwanda by GIS model. Taleai and et.al have developed combining method by GIS and SWOT technique and combining AHP in a different way in geology. Hossain, M. Shahadat and et.al 2009 had used GIS and multicriteria decision analysis more precisely. Chen, Y. and *et al* 2010 had used AHP and multicriteria GIS for evaluating the making land appropriate in order to analyze the rate of location sensitivity. Vahidnia, Mohammad H *et al*, 2009 by Fuzzy AHP و GIS tried to find the locations of hospitals in urban areas. In 1389 Fazelnia and *et al* tried to find the locations of sport areas in Zanjan by combining AHP with GIS. In Iran there are many scientific researches by combining AHP and GIS including urban planning which is observable both separately (Tghvaei, 1385) (Zebardast, 1380) and in combination (Goly and *et al*, 1389). The results of investigating the resource data and universal experiences shows that combining other models and techniques with GIS capabilities in recent decades, had a progressive growth in solving the urban problems and urban planning but what is clear that there is no researches in small fields and sport usage (swimming pools).

Research methodology:

In this study we have studied the finding optimized location for swimming pools using comparative method in apriori logic. Also, in respect to visiting the sport venues we have determined the levels and capitation of swimming pools in urban hierarchy of Bojnourd. In addition we have used the geographical information system (ARC GIS, ARC VIEW, IDIRSI software) and analyzing hierarchical pattern for achieving the desirable results.

Concepts, viewpoints and theory principals

Finding the location:

Finding the location in sciences related to the ground is a process through which a professional is to achieve the best choice among existent choices for favorite usage by presenting requirements, objectives, present status information to the other experts; information like traffics, economy, sociology, psychology, geography, geology, meteorology, biology and conclusion of them in their objectives and perspective's frameworks.

Optimized and proper location finding is possible only when the researcher can establish a scientific and logic relationship between information and data received by experts relevant to location finding in respect to priorities (Razavian, 1381). Nowadays because of the role and effects of various indexes and parameters in location finding, this work is done more real and more scientifically in urban environments by GIS or combination method.

Hierarchical model (AHP)

Analyzing Hierarchical process (AHP) is a simple, powerful method which is used when opposite decision making scales, makes the selection difficult. This method of multicriteria evaluation was proposed first time by Tomas l. in 1980 and since now it had different usages in different sciences (Zebardast, 1380).

A basic way for A.H.P test is the double comparative method. This method decreases the comprehensive complication of decision making significantly as it assesses only two factors simultaneously.

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This method includes 3 main steps in executive process of GIS software: a) providing a double comparative matrix, b) calculating standard weight, c) approximation of compromising ratio. These steps are followed in finding the locations of sport areas and its results are used in GIS environments to determine the proper and improper places for establishment of sports venues and producing location finding output maps.

Geographical information system) GIS)

Nowadays Geographical information database are considered as a decision making tool through development of decision making models by researchers and urban planners. In fact, in recent years, by developments of supportive decision making systems in models framework has caused use of Geographical information system as a decision making tool (Makhdoum, 1380). Geographical information system is considered as a useful tool in land usage management and by having different capabilities, provides convenience and necessary data for land usage. This type of planning as a special usage because of having capabilities such as information inputs, information management, information process and data outputs (Ziari, 1381). Nowadays, completion of urban problems has caused that several variables be effective on location findings of usages which cannot be analyzed by traditional methods such as manual overlapping of maps because of high volume data. As such, using a powerful tool such as GIS in usage location findings in cities is essential. GIS along with its techniques and tools, have the capability of reconciliation of different information layers in different models in the least possible time in location findings and allocation of proper areas necessary for applicant. In other words, Geographical information system (GIS) can present an appropriate blend of service place election models in a short time, decreases the expenses; meanwhile the results are more valid.

MATERIAL AND METHODS

Boundary of studied material:

Bojourd is the center of the province and it is located in 35 degree and 40 min of north width and 47 degree and 18 min eastern length and in 1513 m height upper than sea surface. This city is surrounded by height and mounded and topography and inequality of city is reflex in urban structure and skeletal texture and a huge portion of city is located in east-west and also north-south inclination.

In studies, this city (according to general plan) is divided to 3 urban areas, 21 realms and 88 sectors. First area includes the entire city's north texture in mold of 8 realms and 34 urban sectors which has 175935 (28.7%) population. Second area includes center part of the city with 9 realms and 36 sectors with 114372 (46%) population. Third area includes 3 south parts and city new textures with 4 realms and 18 sectors and 32143 (25.3%) populations.

According to the studies conducted, it was determined that there are 7 pools in the city from which 2 is the university reservation. Also the way of their distribution is inappropriate and many of the realms lack of pools. According to the findings and evidences and also according to the objectives, this study is dedicated to location findings in 3 realms including 13, 14, 14 B.

Findings:

In order to recognize the present status of Bojnourd's sport pools, we investigate the sport pools in respect to hierarchy.

Realm sport pools:

Indexes used in optimized location findings of Bojnourd's sport pools

In order to find the most appropriate location for establishment of sport usage by A.H.P model, the most important indexes for sport usage location findings in Bojnourd should be selected. In respect to present status of the city and the research objectives, 8 indexes were selected for determining the optimized location findings of sport places:

- Population density: in this model the places where Population density is high, are in priority for establishment of sport usage.
- Structural density: as the population in one area increases, access to open fields and spaces for different usage decreases and Structural density go high. As a result, the price of lands increases and the habitants are forced to live in the small buildings. In this model, the places where the Structural density is high have more priority for establishment of sport venues (map NO.1).

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Map NO.1- values of Structural and population density

Map NO.2- price of urban lands

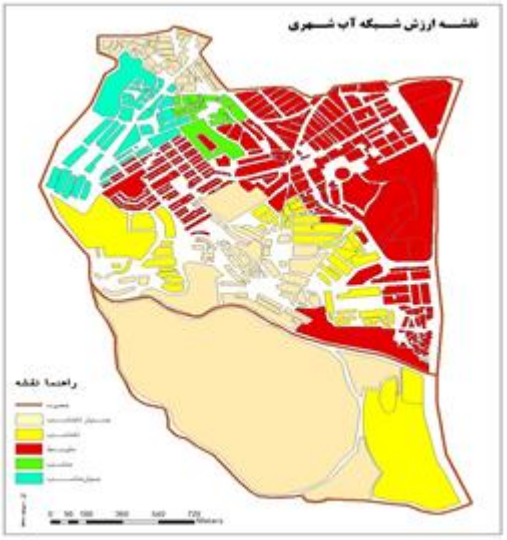
Price of lands: land expenses which is one of the most important constituents of appraisal in all urban places including sport venues. In location finding studies, always it is tried to find the location with more effectiveness and less expenses for sport venues (map NO.2).

Water and sewage network:

In the past, the water requirements of Bojnourd was provided by shafts and aqueducts but now the city water is provided by Shirin Dare sluice. The rate of water in Atrak River in input is 125 million m2 and in the output is 95 million m2. Surface water volumes adjustable from Shirin Dare sluice is annually 105 million m2 which 60 million m2 is for urban usage and 45 million m2 is for agricultural usage. All in all, the rate of annually products of underground water is 58/54 million m2. All the Bojnourd texture, even suburbs have the pipelines. In study of optimization and correction plan of water distribution network, urban water usage, water transmission status from refinery to pump stations, volumes and number and capacity of water storage necessary for city's future is studied. The extreme capacity of refinery number 1 is 1075 liter per second and the capacity of refinery number 2 is 1150 liter per second.

Sewage network in the new and technical form has not a long history in this city and just new structures and preparation plans have new and technical Sewage network. The Sewage of old parts of the city is directed to Gheshlagh River through 8 channels. Although some parts of middle texture of the city have more regular network but its sewage system is the same as central part of the city. In the new texture of the city also, sewage is evacuated into the Gheshlagh River. Sewage refinery is structuring in the south western of the airport. The capacity of this Sewage refinery is about 1.15 m3 per second and in the rain it is 2.5 m3 per second (map NO.3.4).

Map NO.3- Water network



Map NO.4-Sewage network

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Residential structure quality:

In the study of Bojnourd's development and civil plan, structures are divided into 5 categories in respect to quality:

- Structures which have acceptable quality (new structures which do not need to be repaired)
- Structures which have repairable quality (they have not any problem structurally but need to be repaired or replaced)
- Structures which have destruction quality (they are structured by weak materials and are not repairable)
- Structures which have desolate quality (they are obsolete and it is not possible to inhibit there)
- Structures which have valuable quality (they have architectural and cultural heritage)

Availability according to pathways width: formation and life of the city and doing various activities and the relationship between various spaces is dependent largely on relation network. In order to make coordination between street's traffic capacity and traffic loads caused by sport venues, it is essential that types of the streets be scaled according to standards. Wide pathways with high capacity have more values (map NO.6).

Map NO. 5- Structure's quality

Map NO.6- availability and pathways network

Urban land usage:

Land usage plan is the way of using, distribution and conservation of urban lands (Mahdizade, 1379). In other words, it means determining types of the land usage in cities, development and leading of the city space organization, determination of structures and way of land coincidence (Ziari, 1379).

According to this framework, it is necessary to prevent from improper usage of lands in urban usage distribution and pay attention to social, economical, skeletal- physical and environmental objectives (Ziari, 1379). Nowadays, extension of urbanism and its problems, land usage along with appropriate and correct use of land is of importance among them are sport venues and specially sport pools in different levels.

Map NO. 7- Urban land usage

Map NO.8- Land size and space

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Table 1: Location finding using AHP model

Double matrix in AHP process								
usage	Structure's quality	density	pathways	sewage	water	Land price	space	weight
usage	1	2	4	1	5	7	0.5	4	0.205789
Structure's quality	0.5	1	4	1	3	5	1	3	0.147752
density	0.25	0.25	1	8	1	2	8	1	0.160748
pathways	1	1	0.125	1	6	9	1	8	0.180835
sewage	0.2	0.333	1	0.167	1	2	6	2	0.077407
water	0.143	0.2	0.5	0.111	0.5	1	9	1	0.06884
Land price	2	1	0.125	1	0.167	0.111	1	8	0.120773
Space	0.25	0.333	1	0.125	0.5	1	0.125	1	0.037855
total	5.343	6.116	11.75	12.403	17.167	27.111	26.625	28	

According to information acquired from this table, maximum value is 8.029 and I=0.0042 and I.R=0.003. In ATP method the scales are reweighted between 1 to 9 to actualize given values and avoid from results being probable. Giving weight should be such that index (I.R) be under 0.1 otherwise, continuing analyze by this model is not possible and some changes must be done in giving weight to usage. Changes in these weights continue until approximation coincidence ratio cadre is presented by software. As it is shown in the cadre, consistency ratio) I.R (of this comparison is 0.003. So as this value should be smaller or equal to 0.1 in consistency judgment, it is acceptable.

To determine final optimized location finding map of sport pools in IDRISI software by A.H.P model, first we obtain the weight of each index then for combining layers in ARC GIS 9.3 software, INDEX OVERLAY method was used. In figure NO.9 optimized location finding's of Bojnourd city is shown.

Map NO.9: final optimized location finding map of sport pools in 3 given sectors

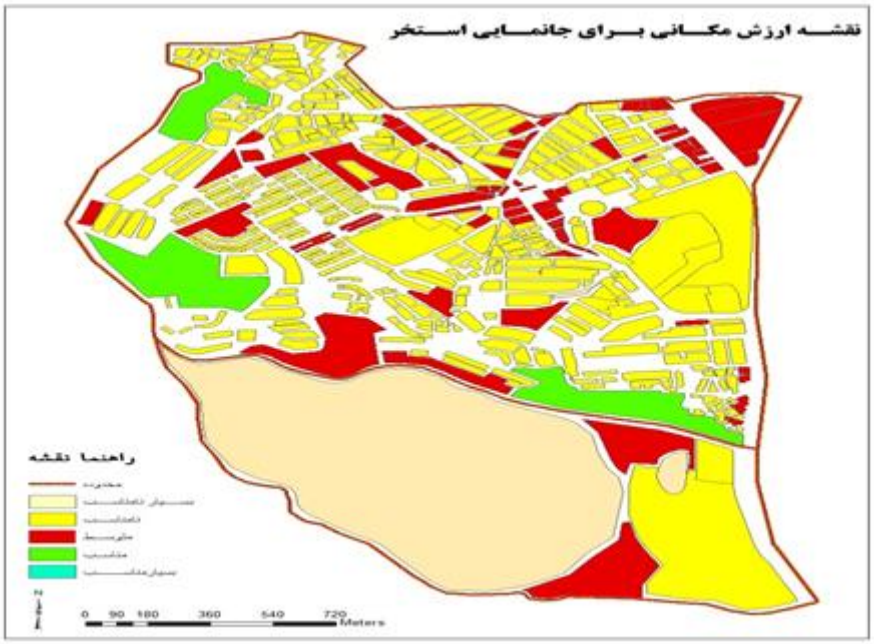

Table. 2: Optimized location findings of sport pools of Bojnourd city

location findings of sport pools	valuation	Space(hectare)	percent
Very inappropriate	1	968856.58	%32.0
inappropriate	3	1320820	%43.6
normal	5	500877.75	%16.6
appropriate	7	236261.5	%7.8
Very appropriate	9	0	%0

According to calculations done by ARC GIS 9.3 software, the following results were found: completely improper lands for Optimized location findings of sport pools were 968856.58 hectare (32%), improper lands were 132.820 hectare (43.6%), normal lands were 500877.75 hectare (16.6%), and proper lands were 236261.5 hectare (7.8%).

Discussion:

One of most important effective factors in building the sport pools is the place position, so optimized location findings makes the efficiency of sport venues maximum and better services is provided for users by the least expenses. Therefore, it is essential to find the optimized location for sport venues all around the city. One of the results obtained from this survey shows that swimming pools' distribution pattern is not proportionate with population volume, therefore some of the swimming pools are faced with high volumes of customers and some of them are faced with low volumes of customers because of incorrect planning improper place and have fewer customers in comparison to other pools. This is along with Fazelnia and *et al*, and D. Fernandes and *et al*. and it is not consistent with Vahidinia and *et al*. Also, the other findings of this survey points to this fact that location findings of Bojnourd's swimming pools is very inappropriate in respect to considered standards in this study and most of them is located on north parts of the city. The main reason for this problem is the lack of flat and proper lands for sport venues in south part of the city which prevents citizens from optimized using of swimming pools. Findings of this parts is in consistence with Taghvaei, Zebadast and Goly and *et al*.

Conclusion:

In this study we investigate the present status of swimming pools and present an Optimized location findings model for Bojnourd's swimming pools in the framework of systematic view and use of GIS capabilities. In other words, our desirable indexes in this survey were studied as elements and constituents of urban open system. Findings obtained shows that distribution pattern is not proportionate with population volume. As a result, some of the swimming pools are faced with high volumes of customers and some of them are faced with low volumes of customers because of incorrect planning; so correct and comprehensive planning in finding the location of Bojnourd swimming pools is essential. Generally, finding the location of sport venues at all urban levels can be analyzed scientifically by proper analyzing method and selection of applicable indexes. Therefore respecting to complication and activation of Iran's cities and also considering the studies of budget and planning organization in technical rules plan of stadiums about establishment of sport venues according to skeletal hierarchy, and Iran native characteristics, following principals should be considered:

Prospected space for availability of complexes or services radius of each of them is first 500 meter for small sport venues, 1000 meter for medium size sport centers and 2000 meter for large sport venues. To access to the desirable capitation in the future, reserve lands should be considered such that by decreasing spaces or development of each unit in the future, desirable capacity be provided.

REFERENCES

Fazelnia, Gh., M. Rastegar, A. Kiani, 1389. Optimized location Findings of Zanjan's Sport Venues by AHP and GIS, Urban Planning & Research Journal, first year, first turn.

Fernández, D.S. and M.A. Lutz, 2010. Urban flood hazard zoning in Tucumán Province, Argentina, using GIS and multicriteria decision analysis, Engineering Geology, 111(1-4): 90-98.

Habibi, M., S. Maseli, 1378. Urban Usage Capitation, Land and Settlement National Organization Press, Tehran.

Hamedinia, M., 1381. Environmental Effects on Sport Activities, Samt Press, Tehran.

Karimi, S., 1385. Urban Design and Sport Venues, City and Sport First National Conference.

Khoshroui, M., 1385. Sport Venues Place in Urban Planning, First National Conference of City and Sport, Tehran.

Kouzechian, H., 1380. Sport Management, Tehran, Afrooz Press, First Edition, pp: 9-13.

Makhdoum, M., 1380. Evaluation of Environment Planning by Geographical Information Regulation, Tehran University Press, Tehran.

Maranjati, H., 1385. Urban Design Sport Venues, City and Sport First National Conference, Tehran.

Mhdizadeh, J., 1379. Usage Land Planning from Constant Development View, Farnahad Consultant Engineers, Urban Design and survey Planning.

Mohammad Taleai and Ali Mansourian; Ali Sharifi, 2009. Surveying general prospects and challenges of GIS implementation in developing countries: a SWOT–AHP approach Journal of Geographical Systems, 11(3): 291-310.

Pourmohammadi, M., 1382. Urban land Usage Planning, Samt Press, Tehran.

Razavian, M., 1381. Urban Land Usage Planning, Monshi Press, Tehran .

Şener, Şehnaz and Şener, Erhan; Nas, Bilgehan ; Karagüzel, Remzi, 2010. Combining AHP with GIS for landfill site selection: A case study in the Lake Beyşehir catchment area (Konya, Turkey), Waste Management, In Press.

Sheikholeslami, D., 1388. Swimming Training and its Skills for Elementary and Professional Swimmers, Agah Press, Tehran.

Journal of Applied Science and Agriculture, 9(5) Special 2014, Pages: 2708-2715

Tims, Willem, 2009. GIS model for the Land Use and Development Master Plan in Rwanda http://urn.kb.se/resolve?urn=urn:nbn:se:hig:diva 4975, January 2009.

Vahidnia, Mohammad H. and Alesheikh, Ali A. and Alimohammadi, Abbas, 2009. Hospital site selection using fuzzy AHP and its derivatives, Journal of Environmental Management, 90(10): 3048-3056.

Zebardast, E., 1380. Application of Hierarchical Analyze in Urban and Territorial Planning, Fine Arts Journal, Volume 10, Tehran.

Ziari, K., 1381. New Urban Planning, Samt Press, Second Edition

Ziari, K., 1381. Urban land Usage Planning, Yazd University Press, Third Edition.