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Physical-spatial planning of a smart city using AHP hierarchical analysis method (Study area: Torbete Heydarieh)

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Abstract

Background and objective: Today, technology is not limited to watches and smart phones; rather, things like achieving smart cities and governments are among the most challenging research topics, in such a way that some researchers believe that in the not-so-distant future, the richest and most powerful countries will be the countries that have taken this path before others.

Materials and methods: Considering the importance of smart cities in our country, in this research, we investigated and expressed the physical-spatial indicators of the smart city for the city of Torbat-e Heydarieh using the hierarchical decision-making method of AHP. After examining the questionnaire by experts and experts, it was determined that the criteria were the most important criteria for conducting the research.

Results and conclusion: Finally, after the processing done using the AHP model, the layers were weighted and after fuzzing and overlaying the layers, the final map was determined to reach the city of Torbat-e Heydarieh as a smart city. The results showed Torbat-e Heydarieh's ability to become a smart city. According to the map obtained in Figure (11), it was found that parts of the central areas, parts of the south and parts of the north of the city have a higher talent than other parts to achieve this goal, i.e. a smart city.

***Keywords**:* smart city, spatial physical indicators, AHP, Torbat-e Heydarieh

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1. Introduction

The increasing growth of the urban population and the settlement of more than 60% of the world's population in cities and the continuation of this trend will make the future of the planet face more urban prospects. The increasing urban growth in recent decades has brought many challenges in the economic, social and environmental fields to the cities and their residents (Pourmohammadi and Paydar, 2022). Parallel to the increase of the urban population, new issues and problems are always raised in such societies (Hakimi et al., 2022). This huge process of urbanization centered on the machine, along with the physical development of cities, has caused the destruction of agricultural lands and the imposition of irreparable costs on the environment of cities (Rene Short, 2009). Paying attention to the physical development of the city is considered a basic necessity in urban development plans (Qalichi Moulai, 2012). Urbanization, despite the great achievements for mankind, has brought with it problems and problems that, despite huge scientific and technical advances, solving many of these problems has been associated with failure. Rapid urbanization has caused that cities do not have the dynamism, efficiency, and capability necessary to meet the needs and demands of citizens and establish prosperity, comfort, security, etc. Currently, cities consume 75% of the world's energy and produce a large amount of waste (Ziari et al., 2017: 2, quoted by Ferraro, 2013). Sprawling urban expansion has increased due to the liberation of boundaries, preparation and also the transfer of government and cooperative lands, etc. This type of expansion has resulted in effects such as isolation of rural communities, threat to urban centers and cores, destruction of open spaces and natural resources in Iran (Noorani, 2013). From the point of view of urban planners, one of the strategies for achieving sustainable development and improving the quality of the urban environment is to balance the spatial distribution of uses through the sustainable form of the city. At the end of the 20th century, inspired by the scientific foundations of sustainable development, a new approach called modern urbanism and smart growth has been considered to make the spatial form of cities sustainable. According to the basic assumption of this point of view, proportional distribution of uses and the compact shape of the city while preserving the environment causes less use of cars for transportation. In fact, the smart growth strategy tries to reshape the cities and guide them towards an empowered community with access to a favorable environment (Qurbani and Pourmohammadi, 2012). Development of a sustainable future requires an integrated approach (Basharti et al., 2022).

The term "smart city" is a concept that has recently entered the field of urban management and planning, and in the management and system literature, the city is known as a "smart macro system". This system intelligently manages and administers different parts of the city. Smartness in this concept means reducing urban problems and better management of the city by using new tools and turning the city into a living being that has the ability to solve its problems by relying on itself in new conditions and even

critical conditions. However, due to the comprehensiveness and novelty of this concept, it is not possible to express a precise definition that includes all aspects of the smartness of the urban environment. But despite the similarities between the experts, it can be said that the smart city is a privileged space for sustainable economic, industrial, structural and social development, in which urban issues and problems such as: traffic, energy consumption, pollution, land destruction , updating and optimizing urban infrastructure, improving the quality of life and health through an innovative and systematic approach, based on communication and exchange of information with the aim of optimizing urban management processes, introduced (Mitchell, 2007, quoted by Kamali, 2016). Among the features of this concept that distinguishes it from other concepts in urban management is the fact that a smart city is a city that invests in human and social capital and communication infrastructure, including transportation, as well as modern infrastructure such as ICT, which causes sustainable economic growth and high quality of life, reduces waste of time and energy, along with the proper management of natural resources, through the management of people's participation in it (Portney, 2014, quoted by Kamali, 2016). Smart cities have been proposed as an operational solution for sustainability problems caused by unbridled and accelerated urbanization. These cities have been assessed as essential for a sustainable future (Murtagh & AM, 2020). Today's agendas of smart cities are the latest iteration of urban techno-social innovation. Their goal is to use information and communication technologies (ICT) to improve the economic and environmental performance of cities with the hope of providing a better quality of life for residents (Karvoneh et.al, 2020). In this research, for the purpose of practical investigation and feasibility in reality, the city of Torbat-e Heydarieh has been used as a study sample. Torbat-e Heydarieh has a population of over 140,000 people. (General population and housing census, 2015)

Table 1. different definitions of smart city are presented

Momeneh and Rostam Porzlani, 2016	A smart city is a city based on the application of technology in a strategic approach for better living and economic development A smart city is a digital city that allows citizens to use smart infrastructure technologies.
Poursharifi and Jafari, 2016	A smart city is a city that uses smart technology to improve the green economy and standard of living A smart city is a city that provides better economic development and high quality of life with investment and human and social capital and ict technology infrastructure.
Ghanbari, 2010	Smart city means opening new concepts in urban planning. What moves a city towards smartness is not only the use of electronic tools and the communication system of that city, but the way of planning and using these tools to improve the quality of life of the citizens of a city. The smart city has six areas with features under the headings of "Smart Society", "Smart Economy", "Smart Surveillance", "Smart Mobility", "Smart Environment" and "Smart Life", which need to create technological, human and institutional infrastructures for their development.
Noufel and Parish, 2013	A smart city, like a traditional city, consists of people, organizations, processes, and services, and in this context, the steps of developing a smart city are presented using metamodels. The most important part affected in the development of the organization towards an intelligent organization is the technological information of people and processes

Harrison et al., 2010	A city connected to physical infrastructure, information technology infrastructure, social infrastructure and business infrastructure, in line with the use of the collective intelligence of the city.
Chen, 2010	Smart cities take advantage of the connectivity and capabilities of sensors in urban infrastructure to optimize electrical, transportation and other logistical operations that support daily life, in order to improve the quality of life for all.
Lazario and Russia 2012	A society that has moderate technology, united and stable, comfortable, attractive and safe.
Mohanty, 2016	A smart city is a place where traditional networks and services are made flexible, efficient and sustainable by using information, digital and long-range communication technologies to improve activities and functions for the benefit of the residents of that place. Smart cities are greener, safer, faster and friendlier.

2. Research background

Kazem Khah et al. (2022) studied and investigated the identification of factors affecting the development of urban space in the framework of the smart growth model with a future research approach in Rasht city. The obtained results showed that 55 influential factors in the future development process of Rasht city are based on smart growth, which are divided into three dimensions of use, transportation and density. Factors have influenced each other in more than 62%. What the scatter plot of the effective variables in the future of the spatial development of Rasht based on smart growth shows is the instability in the system. The results of the analysis of the evaluation matrix of the impact plan and the influence of the factors with direct and indirect methods determined 14 factors with the greatest role in the future spatial development of Rasht city within the framework of the smart growth model.

Shafaati et al.(2022), in a research, investigated the role of smart urban development in the intermediate development of worn-out areas of Tabriz in District 8 of Tabriz city. The results of the research showed the closeness of the obtained coefficients in relation to the key influential factors (in the numerical range between 104 and 106) and influential (in the numerical range between 105 and 107). By studying, examining and analyzing the obtained results, it was determined that seven key influencing factors of smart development include creativity with a factor of 106, innovative spirit with a factor of 106, sustainable management of resources with a factor of 106, local access with a factor of 106, sustainable and creative and safe transportation with a factor of 16.105, environmental protection with a factor of 16.105 and flexibility with a coefficient of 16.105 and three key influencing factors of the interfaith development, including urban per capita with a coefficient of 106, work and activity space with a coefficient of 16.105 and population density with a coefficient of 83.105, which play the greatest role in the future regeneration of the inefficient tissues of Tabriz metropolis with emphasis on smart urban development were selected. Also, the graph obtained showed the direct influence of the factors indicating the instability of the system and the high probability of drastic changes in the near future.

Zhu et al. (2022), in a research to investigate how a smart city can shape a happier life? They studied and researched the mechanism of happiness-oriented smart city development. They used the HDSC

mechanism to review Manchester's smart city initiatives. This mechanism was effective in helping decision makers to understand the current situation of smart city development in their urban context, it was also shown that it can identify the strengths and weaknesses in the HDSC development process. In the end, the results showed that the smart city plan can be moved to a better happiness-oriented path through dynamic evaluation and adjustment.

Tully and Murtagh (2020) in an article entitled the concept of sustainability in smart city definitions, referring to the lack of explicit literature and the vagueness of the concept of sustainability regarding the smart city, due to the multitude of existing definitions, 43 definitions of the smart city were evaluated with a focus on the dimensions of sustainability. He claimed that the findings of this research contribute to knowledge and practice by providing conceptual clarity and especially by focusing on the basic assumptions about the role of sustainability in the development of a smart city.

Karan and his colleagues (2020) in a research titled urban planning and smart city: Projects, procedures and policies, with the aim of discovering different effective and effective methods of urban planning in smart cities, provided empirical evidence of how urban planners interact with smart urbanization processes through projects, actions and policies. They proved the deep and lasting impact of digitization in urban planning and provided several recommendations to urban planners as pioneers and drivers of the smart city.

Moradi (2018) in a research with the aim of studying the trend of research activities in the field of smart cities in the world, in order to identify the busy and under-worked areas of this area, and with emphasis on not doing repetitive work and focusing on less worked topics to prepare and Compile a scientific atlas in order to show active countries in this field. As the findings of this research showed, more than half of the articles in the field of smart city were placed on the topic of information technology infrastructure. It was also found that a number of countries have focused on certain aspects of the smart city change. He concluded that the most cited topics in the field of smart city included information technology, smart governance, environment and smart urban development, smart transportation, smart energy and smart economy. The geographic atlas showed that the three active countries in the field of smart city were China focusing on smart information technology infrastructure, Spain in smart citizen and smart energy, Italy in smart governance, smart transportation and smart environment. In general, from the data of 10 busy countries, it can be concluded that in all the continents of the world, the issue of smart city is very important and among the components of the smart stream, more attention has been paid to the infrastructure of smart information technology.

Qomian (2016) in a research on the evaluation of Tabriz city in terms of smart city factors (case study of Tabriz citizens and municipality) stated that smart city theory, based on information and communication technology in different dimensions, tries to make different layers of the city and human life smarter, to act as a suitable measure to improve the living standard and increase the quality of life of the city dwellers. In this thesis, the evaluation of smart city criteria and the evaluation of Tabriz citizens and Tabriz municipality in terms of smart factors have been investigated.

Abdullahzadeh (2015) in a research entitled "Analysis and evaluation of challenges faced by people in the smart city, a case study of Mashhad region and municipality" with the aim of evaluating the readiness of Mashhad municipality region 1 in the dimension of smart people and determining the most important factors influencing the improvement of the dimension of smart people in Mashhad, the influential factors and challenges for improving the popular aspect of the smart city have been investigated and the main effective factors have been extracted.

Pirani (2014) in a research entitled "Compilation of the criteria and indicators of the studied smart city: District 3 of Isfahan city" concluded that the smart city as a new concept in urban planning and a unique solution to solving urban problems, is of interest to city planners and city managers are located. In this regard, for the greater success of the goal, it is necessary to identify criteria and indicators to achieve a smart city; because indicators and criteria are measuring tools for the state of a society and with their help you can get a picture of the whole society and determine the direction of the society. Therefore, the importance of criteria and indicators becomes necessary in the stage of recognition, evaluation and planning.

Golgoun (2012) in his research on the sources and limitations of the realization of the electronic city in the metropolis of Tehran, with the aim of investigating and analyzing the concepts and principles related to the electronic city, and investigating the resources and limitations of realizing the electronic city in Tehran metropolis, it was by examining the indicators and criteria of the electronic city and also explained the necessity of paying attention to the electronic cities.

Winters (2011) investigated the complexity of the implementation of the electronic city and its dissemination with the help of operational strategies with an emphasis on developing countries that lacked infrastructure. It provided complete details and indicators in understanding, explaining and implementing e-government (electronic and smart city) and the complexity of spreading its benefits to similar countries. The results of this research, which was conducted on the sample study (Qatar), showed that regardless of strong financial support, governments should be equipped to deal with some of the challenges of e-government implementation.

3. Research Methodology

3.1. Study area

The history of the construction of the city of Torbat-e Heydarieh dates back to the pre-Islam era and the Sassanid era. The original name of the city was Zaveh, which means watery plain. This city was rebuilt in 541 AH and because Maulana Qutboddin Haider's burial place is located in this city, it is known as Torbat-e Heydarieh. Regarding the stages and process of the growth and expansion of the city, based on the documents, it can be said that the central core of the city includes: the market (as the most powerful and evolved organ and tool of the city's life), caravanserai, bathhouse, mosque at the intersection of the old road of Mashhad- Gonabad was created with the location of the bazaar and developed around the bazaar from the south-west and east, and the bazaar was one of the important factors in the physical and economic development of the self-proclaimed city, and at the end of the Qajar period, the main shape of the city was established in its current form. The city of Torbat-e Heydarieh is located at 53 degrees and 12 minutes east longitude and 35 degrees and 17 minutes north latitude, at an altitude of 1333 meters above sea level. This city is one of the cities of Razavi Khorasan province, which is located 141 km south of Mashhad and 1115 km from Tehran. It is also located in the north of the city along the Mashhad road. The natural bed of the city is settled on the alluvial plains at the foot of the surrounding heights and is limited from the west and southwest to a series of heights that have a northwest-southeast trend.

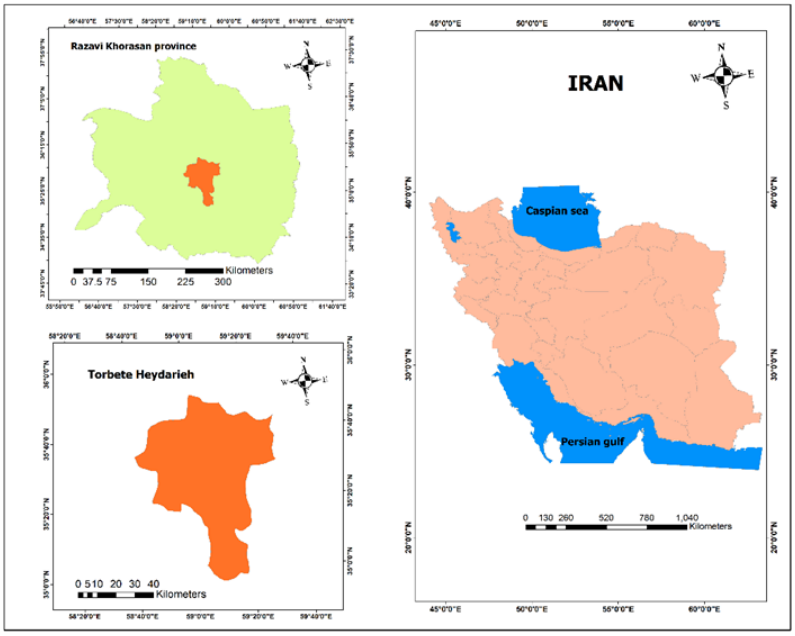

Figure 1. Geographical map of the study area

In this research, the AHP method was used to investigate the smart city in the study area. First, by preparing a questionnaire according to the opinion of experts and specialists, the criteria and sub-criteria are specified and processed for review.

Table 1. Valuation of indicators relative to each other

explain	Comparison status of i compared to j	Preferred value
Option or index i has equal importance compared to j or they do not have priority over each other.	equal importance	1
Option or index i is slightly more important than j.	Relatively more important	3
Option or index i is more important than j.	more important	5
Option or index i has much more priority than j.	Much more important	7
Option or index is absolutely not more important than j and comparable to j.	absolutely important	9
Intermediate values show the priority values, for example, 8 indicates a higher importance than 7 and lower than 9 for I.		2,4,6,8

Table 2 shows the main zoning criteria:

Table 2. The main criteria of zoning

privacy	Economic characteristics	privacy	Surface water movement system	Thermal properties	privacy	Geology	privacy	Limiting factors
	land use	1000meters	Route	Climate		Soil type		slope
	agriculture		Flood hazard areas		5000meters	Active fault	1000meters	iron rail
1000meters	Downtown	1000meters	The main river		3000meters	Semi-active fault	500meters	main road
1000meters	village	500meters	Sub-river		3000meters	landslide	3000meters	dam
500meters	seedling work							Height

Finally, the weighted maps were prepared and after this step, the layers were entered into fuzzy, for this purpose, the Fuzzy membership tool was used and the membership type was defined based on the type of project, and the linear function was used in this project. Using this function, due to the fact that it has already been defined on the privacy layer, both normalization is done and the values are already defined in it. It means that the minimum is zero and the maximum is more than zero by default, so that the further we are from the privacy, the higher the value of our location. In other layers that have been weighted, the classification is done manually based on the layer information, and the next step is the raster layer, then the weight of each layer is added in a separate field called weight in the Arc map environment. Finally, the weighted layer is re-converted into a raster to enter fuzzification. Raster calculator was used to apply the final weight to each of the main criteria, and each layer was called separately and multiplied by the initial weight that we had for all the main criteria in this project. All the layers are fuzzified and output to us in the form of zero and one values. A value of one for a layer means a suitable range for locating and a value of zero is considered an inappropriate range. The final stage is the overlapping of all the fuzzified layers. For this, we use the fuzzy overlay command. The best parameter for zoning is to use the and parameter, which we use after calling all the layers.

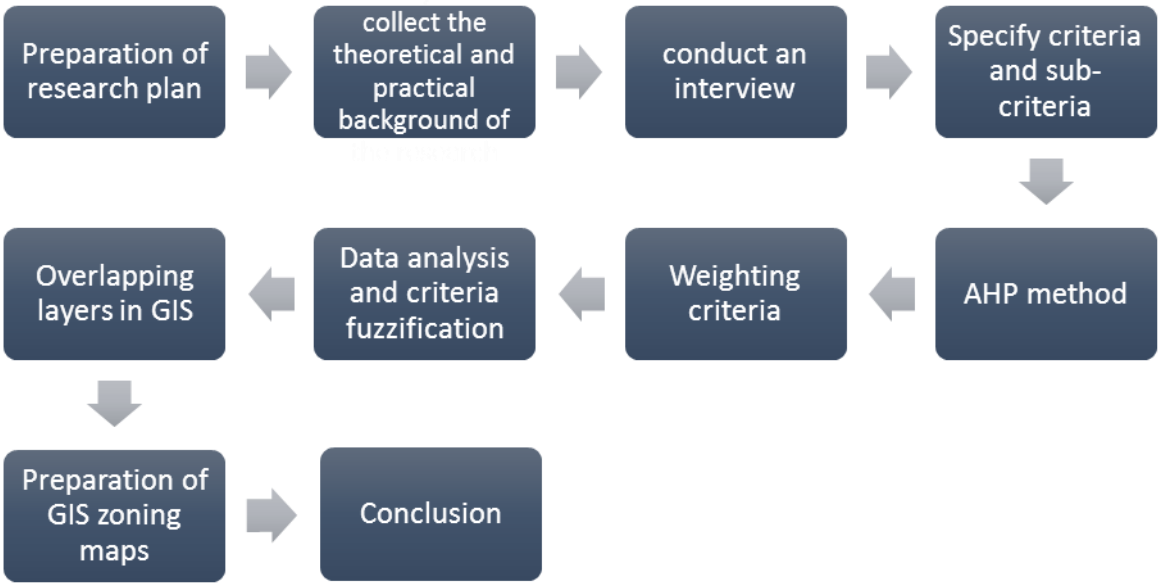

Figure 2: Workflow diagram

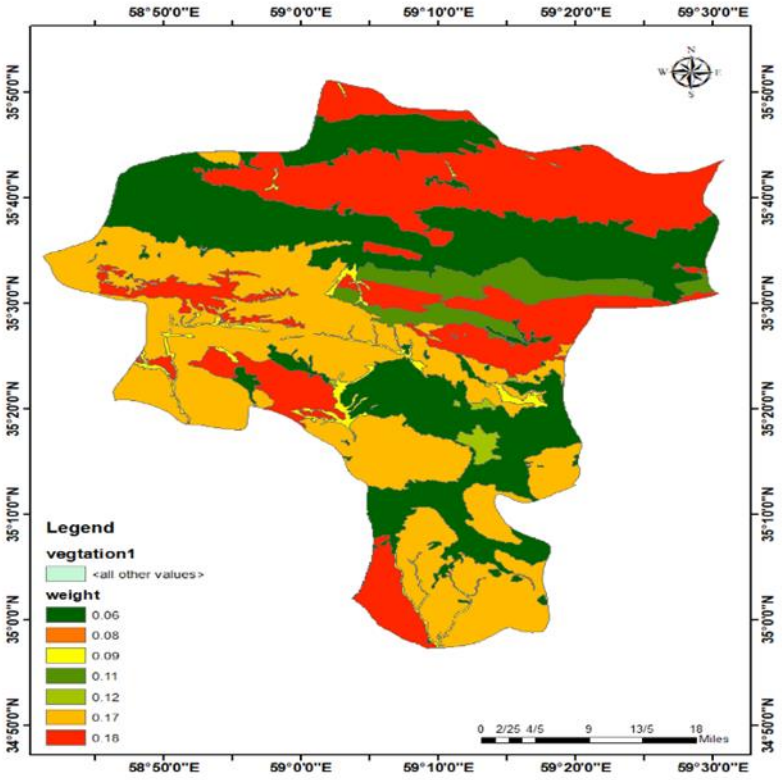

Figure 3. Fuzzy map of vegetation

4.Results and discussion

The most important and main stage of any research is to get the answer that the researcher was looking for. After the responses from the questionnaire or behavioral data have been collected, it is necessary to organize them in a suitable way; therefore, data analysis estimates the final goal of conducting a research. Data analysis is one of the main and most important parts of research. In this part, the analysis of the criteria and the preparation of weighted maps using the Ahp method were discussed, and the maps are shown in figures 2 to 9.

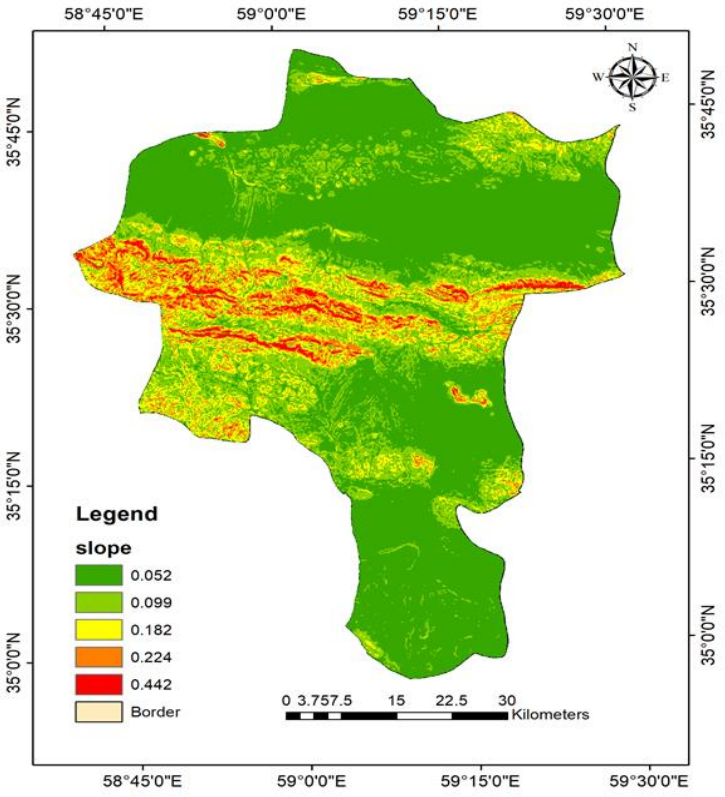

Figure 4. Fuzzy slope map

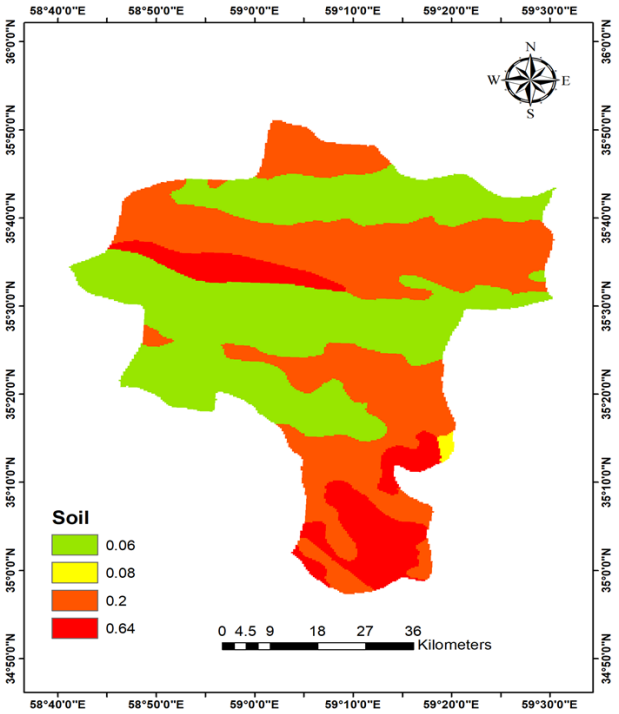

Figure 5. **Fuzzy soil map**

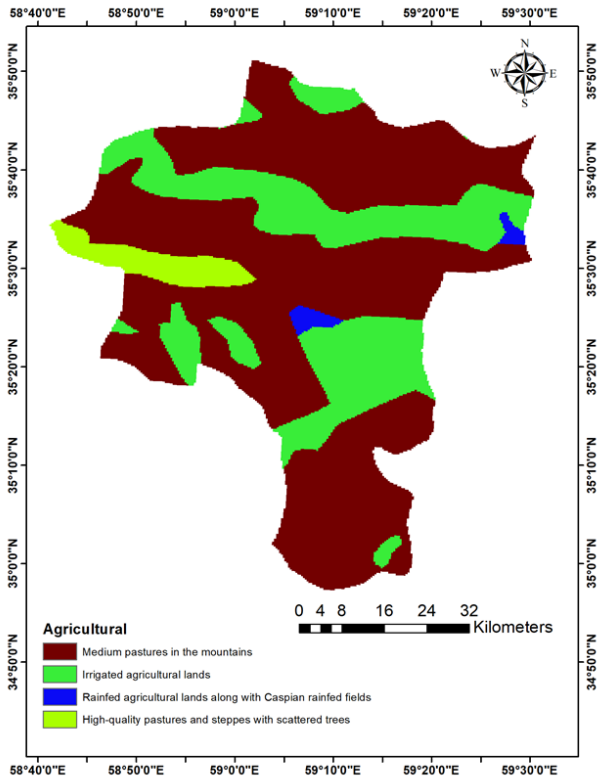

Figure 6. Fuzzy land use map

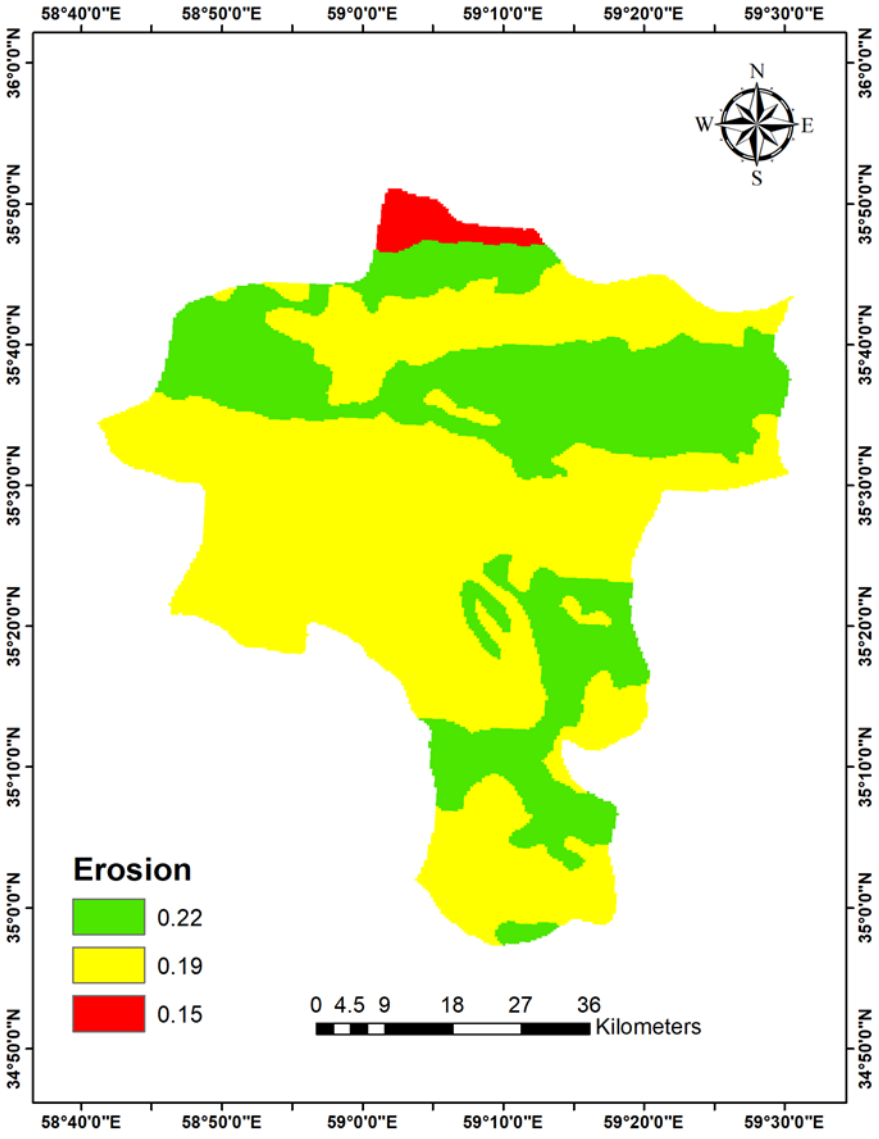

Figure7. Fuzzy erosion map

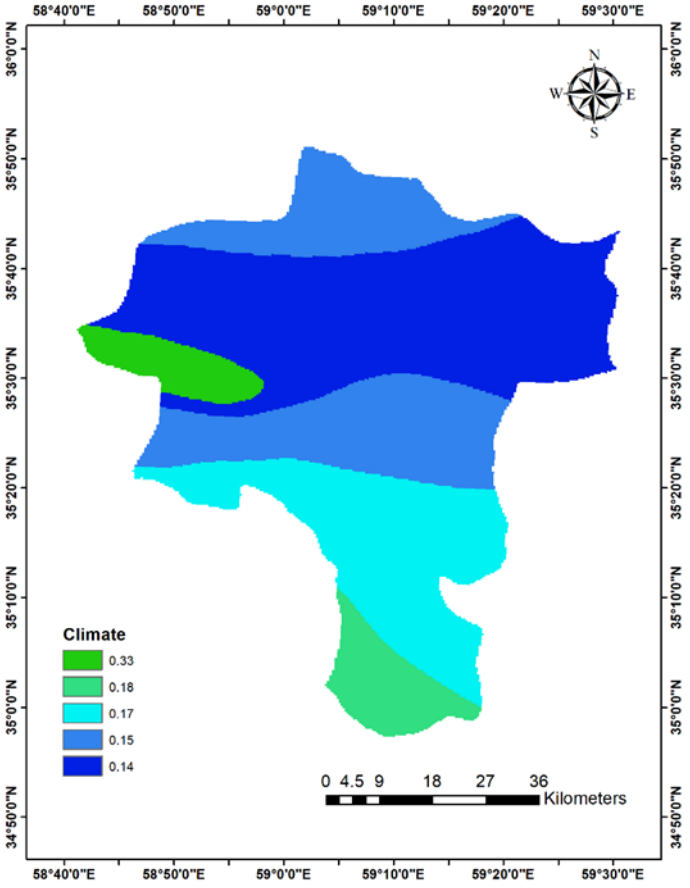

Figure 8. Fuzzy climate map

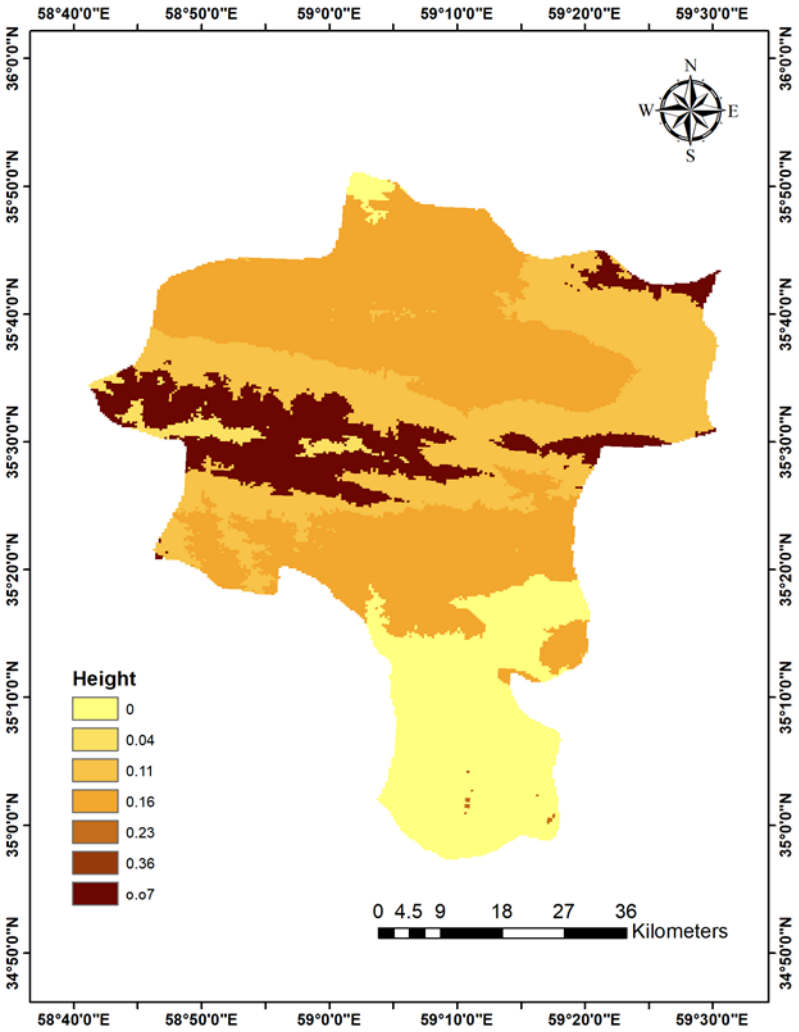

Figure 9. Fuzzy height map

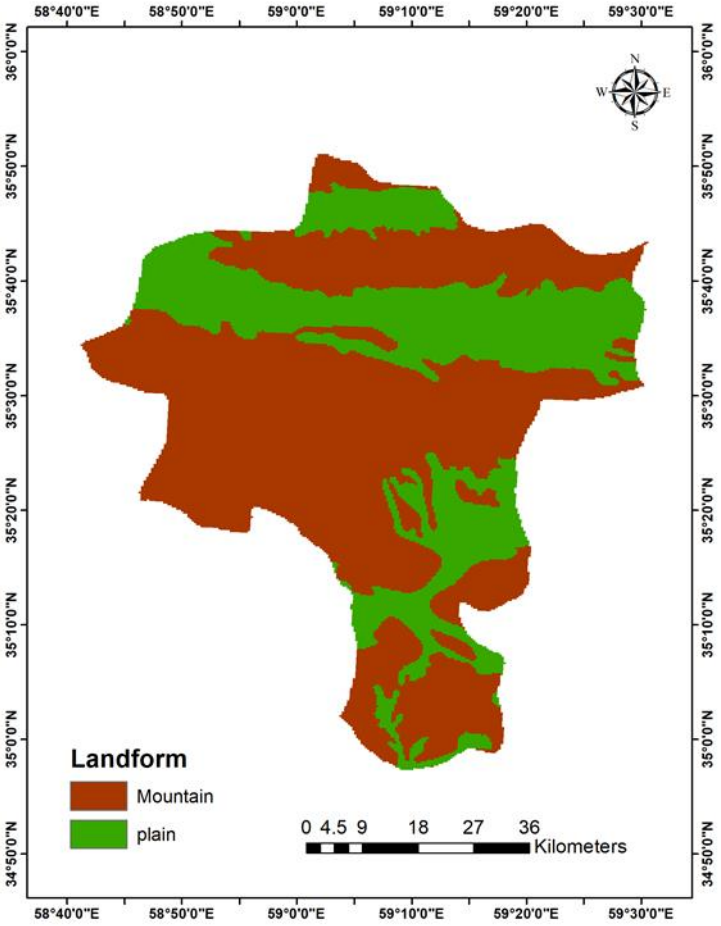

Figure 10. Fuzzy map of mountains and plains

The final result is shown in Figure 11, the location map of the smart city in the study area, Torbat-e Heydarieh. The areas that have the highest value are defined as suitable ranges and the lower the pixel value, the less suitable ranges.

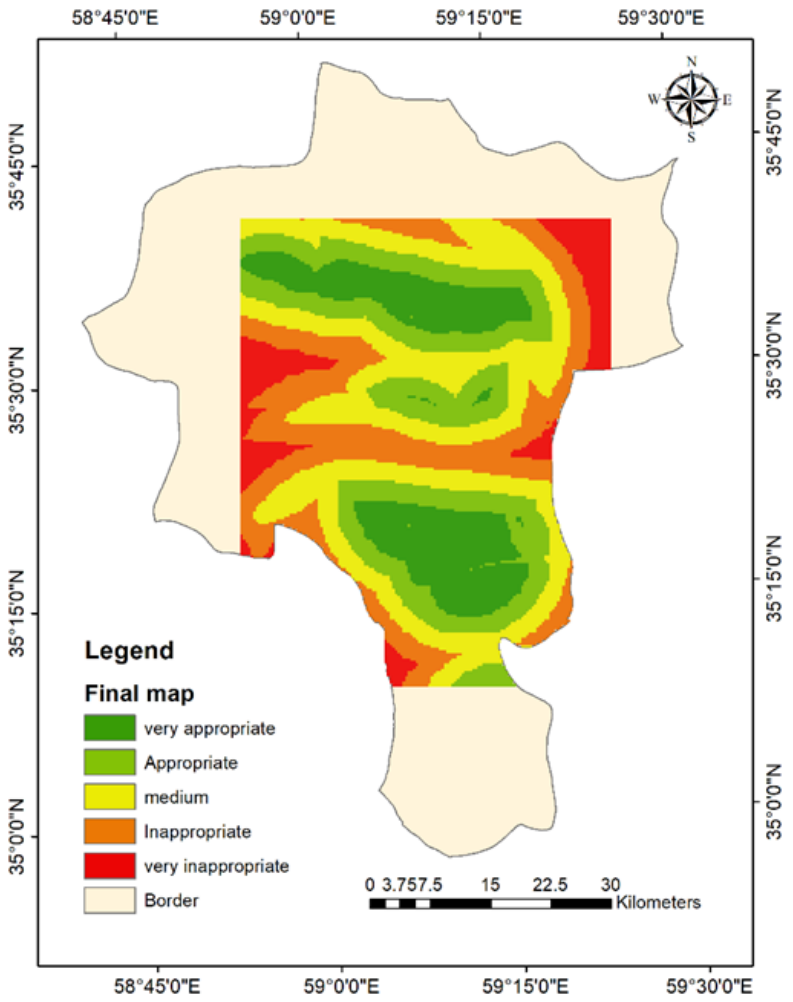

Figure 11. Final smart city zoning map

The present research, like the similar works in the direction of the smart city that Kazem Khah et al. (2021), Shafaati et al. (2001), Moradi (2018), Qomian (2016), Abdullahzadeh (2015), Pirani (2014), Golgoun (2012), Zhou et al. (2022), Tuli and Murtagh (2020), Karune et al. (2020) and Winters (2011) conducted in different researches and in different regions of Iran and the world, showed acceptable results for reaching the smart city in the studied area of Torbat-e Heydarieh city.

5. Conclusion

Smart life does not mean living with wise robots or equipment that do their work by themselves, but smart life is a vital solution for optimal use of modern technologies. The concept of smart life seeks to realize three principles in people's lives: facilitating people's way of life, maintaining their health and at the same time protecting the environment. In the current research, we investigated the situation of Torbat-e Heydarieh city in reaching a smart city. After specifying the important criteria and indicators in the

studied area, analysis was done on the data. The results showed the potential of Torbat-e Heydarieh city to become a smart city, which according to the map obtained in figure (11), it was found that parts of the central areas, parts of the south and parts of the north of the city have a higher talent than other parts to achieve this goal, i.e. the smart city.

References

Abdullahzadeh; B (2015). Analysis and evaluation of the challenges faced by people in the smart city, a case study of Mashhad region and municipality, Master's thesis, Ferdowsi University of Mashhad, Faculty of Literature and Humanities.

Basharti, R; Taimuri, I & Mahmudzadeh, H (2022). analysis on the cross effects of the components explaining resilience and its future research in the old context of cities (case study: Tabriz metropolis), urban planning and regional development journal, year 1, No. 2, pp. 19-34.

Chen, T. M. (2010). Smart grids, smart cities need better networks [Editor's Note]. Ieee Network, 24(2), 2-3.

Fazelian; R, Arefnejad; M & Rusta; Z (2022). Identification and ranking of foreign direct investment obstacles in Iran: application of fuzzy Delphi method. Scientific Quarterly of Applied Economic Theories, 9(3), 147-170.

Ghorbani, R.; Pourmohammadi, M (2003). Compact city strategies, Shahri Fazahi magazine, No. 39.

Gholamreza (2022). Identifying the effective factors on the spatial development of the city in the framework of the smart growth model with a future research approach (case study: Rasht city). Human Settlements Planning Studies, 17(2), 317-305.

Golgoun, Fatemeh Al-Sadat. (2012). Sources and limitations of realizing the electronic city in Tehran metropolis, master's thesis, Allameh Tabatabai University - Faculty of Management and Accounting.

Gharaibeh, A., Salahuddin, M. A., Hussini, S. J., Khreishah, A., Khalil, I., Guizani, M., & Al-Fuqaha, A. (2017). Smart cities: A survey on data management, security, and enabling technologies. IEEE Communications Surveys & Tutorials, 19(4), 2456-2501.

Ghanbari, Hakime. (2011). Smart city theory and urban governance

Haque, A. B., Bhushan, B., & Dhiman, G. (2022). Conceptualizing smart city applications: Requirements, architecture, security issues, and emerging trends. Expert Systems, 39(5), e12753.

Hakimi; Hadi, Heidari Chianeh; Rahim & Bilalkeh; Sudabah (2022). Investigating the role of perceived occupancy security in the physical quality of housing in informal settlements in the north of Tabriz metropolis, a case study: Yusuf Abad neighborhood, Journal of Urban Planning and Regional Development, Year 1, Number 1, pp. 15-26.

Harrison, C., Eckman, B., Hamilton, R., Hartswick, P., Kalagnanam, J., Paraszczak, J., & Williams, P. (2010). Foundations for smarter cities. IBM Journal of research and development, 54(4), 1-16.

Karvonen, A., Cook, M., & Haarstad, H. (2020). Urban planning and the smart city: Projects, practices and politics. Urban Planning, 5(1), 65-68.

Kamali, Hamed (2016). Feasibility of applying smart city principles in district 10 of Tehran municipality, master's thesis, University of Kurdistan.

Kazemkhah Hasan Kiadeh, Sadegh; Azimi Amoli, Jalal; Gadami, Mustafa and Janbaz Ghobadi,

Noorani (2012) neighborhood development solutions (physical-spatial) using the smart city approach (case study: Tarasht city, Tehran) master's thesis under the guidance of Mojtaba Rafiyan, Islamic Azad University, Research Sciences Unit, Borujerd.

Litman, T. (2017). Evaluating criticism of smart growth. Victoria Transport Policy Institute.

Lazaroiu, G. C., & Roscia, M. (2012). Definition methodology for the smart cities model. Energy, 47(1), 326-332.

Moradi, Mehdi; Prizadi, Tahir; Moradi, Morteza (2017). The requirements of city development from the inside, case study: Borujerd city, Armanshahr Architecture and Urbanization, No. 23, pp. 319-332.

Momineh, Mohammad Saeed and Kors Rostam Pourzlani, 2015, Smart city equal to sustainable development, the third scientific research conference of new horizons in the sciences of geography

and architectural planning and urban planning of Iran, Tehran, Association for the Development and Promotion of Basic Sciences and Technologies.

Mohanty, S. P., Choppali, U., & Kougianos, E. (2016). Everything you wanted to know about smart cities: The Internet of things is the backbone. IEEE Consumer Electronics Magazine, 5(3), 60-70.

Nofel Seyed Alireza and Anita Parish, (2012), Survey of Sustainable Development Indicators in Smart City, National Conference on Architecture, Urban Planning and Sustainable Development with a Focus on Native Architecture to Sustainable City, Mashhad, Khavaran Institut.

Pour Ahmad, Ahmad; Zeiari; Keramatolah, Hataminejad, Hossein & Parsa Pashahabadi, Shahram (2017). Smart City: Explaining the needs and requirements of Tehran city for intelligence, new attitudes in human geography, 10th year, number 2, pp. 2-8.

Pirani, Farzaneh (2014). Compilation of criteria and indicators of the studied smart city: District 3 of Isfahan city, Master's thesis, Isfahan University of Arts, Faculty of Arts and Architecture.

Poursharifi, Javad & Masoumeh Jafari, (2015). evaluation and equipping of a smart city with an economic approach, International Conference on Urban Economics, Tehran, Scientific Association of Urban Economics of Iran.

Pourmohammadi, Mohammad Reza & Padayar, Majid (1401), Measuring urban livability with an emphasis on pedestrian approach (Tabriz Metropolis Zone 2), Urban Planning and Regional Development Journal, Year 1, Number 2, pp. 51-67.

Qomian, Alireza (2016). Evaluation of Tabriz city in terms of smart city factors (case study of Tabriz citizens and municipality), master's thesis, Tabriz University, Autoghandran Campus.

Qolichi Moulai; Mohammad (2012). Measuring the scattered trend in the city with an emphasis on density indicators of smart growth (case study: District 1 of Tehran), master's thesis. Tarbiat Modares University.

Qaisvandi, Hamid; Qaisvandi, Arman & Qaisvandi, Kayhan (2010). The smart city, the development of the new urban revolution, the electronic city, the realities of the city of tomorrow, the national conference of the ideals of Iranian cities.

Sadoughi, Farhanaz, Nasiri, Somayeh & Langarizadeh, Mustafa (2013). Minimum perinatal period dataset for Iran: Delphi study, Health Information Management, 11th volume, 6th issue.

Shafaati; Arzoo, Valizadeh; Reza, Rahimi; Akbar & Panahi; Ali(2022). An analysis of the role of smart urban development in the intermediate development of worn-out areas of Tabriz. Research sample: Tabriz Region 8. Geography and Environmental Planning 33(1), 113-132.

Safai, Seyed Majid (2021), Designing a model of structural-behavioral factors affecting the formation and establishment of a smart city (Study case: Isfahan city), Master's thesis, public administration, human resources development, Payam Noor University, Taft. Iran.

Scholl, H. J., & Scholl, M. C. (2014). Smart governance: A roadmap for research and practice. IConference 2014 proceedings.

Short, J. R. (2017). Urban theory: A critical assessment. Bloomsbury Publishing.

Toli, A. M., & Murtagh, N. (2020). The concept of sustainability in smart city definitions. Frontiers in Built Environment, 6, 77.

Verma, A., Khanna, A., Agrawal, A., Darwish, A., & Hassanien, A. E. (2019). Security and privacy in smart city applications and services: Opportunities and challenges. Cybersecurity and Secure Information Systems: Challenges and Solutions in Smart Environments, 1-15.

Winters, J. V. (2011). Why are smart cities growing? Who moves and who stays. Journal of regional science, 51(2), 253-270.

Zhu, H., Shen, L., & Ren, Y. (2022). How can smart city shape a happier life? The mechanism for developing a Happiness Driven Smart City. Sustainable cities and society, 80, 103791.