Urban development locating with Fuzzy Logic,
weighted linear combination and FANP Decision-Making Technique
Case study: Kashan City

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Extended Abstract

Introduction

Paying attention to sustainable urban physical development in urban development programs indicates the importance of this issue in strengthening the cultural, social and physical aspects of the city. Developers in developing countries have deeply realized that infrastructure services and facilities have also played a major role in improving the development of urban and rural areas in these countries, and emphasizes this. Finding out that improving the access of urban and rural communities to basic services is an important tool in accelerating regional development, and accepts that location-based services, in addition to impacting costs in Efficiency and utilization and their quality are also effective.

A lot of research has been done in the field of location, including the study of Sin et al. (2002) aimed at evaluating urban land use structures with an eye to sustainable development. Simpleiara et al. (2004) examined the dynamics and modeling of urban expansion with the help of GIS in the city of Manglor, India, and predicted the type of future expansion of the city. Vanakata Subways (2007) completed the article entitled "Analysis of Places for Urban Development using GIS" (Chang, 2008) using GIS and Land Multi-Fuzzy Decision-Making Model Has identified susceptible people for the establishment of an urban forest in Harlingen.

The importance and necessity of this research in the lack of methods are suitable models for locating human settlements. In decision-making for the development of human settlements, all the criteria and parameters required and involved in structured and structured models should be considered in the form of up-to-date models. The purpose of the research is to develop a suitable model for determining the appropriate sites for the development of human settlements. In this research, we have been asked to answer the following question. Is the city of Kashan capable of urban development and, if so, what is its potential and in what districts?

Materials and methods

The city of Kashan with an area of 20,000 square kilometers (2100 hectares) and a population of 500,000, facing the mountains on one side with its back to the desert on the other side, is located in the central region of Iran. The geographical coordinates of Kashan with an altitude of 945 meters above the sea level are 51 degrees and 27 minutes

East longitude and 33 degrees and 59 minutes North latitude.

In this research, at first, data were collected and the criteria were defined and weighted by FANP. Then, using the Arc Gis software, the criterion map was created and standardized. To create the final map, the layers were combined and overlaid by the weighted linear combination method and Gamma function in fuzzy logic. Finally, the attraction map of Kashan City for urban development was created and analyzed.

The GIS-based linear weighting method (WLC) includes the following steps:

1. Defining a set of evaluation criteria and options

2. Standardize the mapping layer of each level

3. Define the weight for each criterion: meaning that a relative weight is assigned directly to each criterion map.

4. Generating the layers of standardized layer with weight: This means that we multiply the standardized layers of the weight in the respective weights.

5. Add the final score to each option using the "Gamma" for the layout of the standard weighted map.

6. Sorting options based on ratings (the best option is the option with the highest score).

Result **an**d **discussion**

To determine the weight and prioritization of the FUZZY ANP software criteria, the purpose of the research which is suitable for urban development, is at the highest level of decision-making, and at the next level, the criteria Includes (environmental, socioeconomic and physical), and at the last level are the following criteria which are mentioned in the article 13 at the beginning of the article, and according to experts, regarding the recognition of the region the weight loss study is carried out for each of the following criteria. After weighting and performing calculations in the software, the final weight is obtained. In urban development, the highest weights are taken to the slope index and the lowest weight is considered as the index of slope (Table 2). After fuzzying and multiplying the weights by the fuzzy layers, the GAMA operator with three suffixes (0.9, 0.5, 0.1), is applied to the fuzzy layers which is shown in Fig. 7. The 0.9 gamma fuzzy operator shows the most compatible among the urban areas of Kashan with appropriate lands for urban development. Therefore, a 0.9 gamma is referred to as the final layer of appropriate land for urban use. The second coexistence method is, using the WLC linear gravity combination. In this section, all cabinet layers were classified instead of fuzzy layers, and their class values were determined. Then, in the RASTER CALCULATOR, the classified layers were multiplied by the weight of the FANP, and finally, the total layers were plotted, as shown in Fig. 8.

Conclusion

Based on the results of this research and the previous studies, the optimal result is the time taken by the 0.5 gamma operator, in which case its function is a combination of two operators Sam and Product. According to the final map obtained from the WLC method, urban development is more possible in the southwestern part of the city of Kashan. In the fuzzy method, the results indicate that the current location of Kashan city and its southern regions have good potential. The results of the linear weight combination method are similar to the fuzzy combination method of the current location of Kashan and its southern and southwestern regions. About 15% of the total area of the city of Kashan is suitable for urban development. Therefore, according to the obtained results, the aforementioned model including two methods and the use of the decision-making techniques, can be used as an appropriate model for studying the power of other similar regions (central regions of Iran). The development of the cities of Kashan and Qasr is more oriented towards the south and southwest.

Key words: Urban development location, Fuzzy Logic, WLC, FANP, Kashan City.