Locating optimal areas for physical development of the city using the Fuzzy ANP model (Case study Maragheh city)

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Introduction

One of the physical factors in the development of Maragheh is the change of utilities and their conversion into residential use, which in turn have a direct impact on the process of physical development. The city of Maragheh is one of the most important cities in East Azerbaijan province, which has no exception to the rule of physical development. In this research, the characteristics of the city development process are examined physically. Statistics show the growing population in the city of Maragheh during the years 1966 to 2011. Understanding the factors affecting the physical expansion and development of cities helps understand urban growth and development trends. The study clarifies the factors that cause horizontal and physical growth of cities and, conversely, the repulsive factor of other parts of the city that are left behind by physical growth for any reason, and this explains the need for this research. The causes of urban growth are exactly the same as the origins of urban sprawl. In many cases, no distinction can be made between urban growth and urban sprawl however, it is important to have a clear understanding of the difference between urban sprawl and urban growth. The most imperative problems that have arisen from the uncontrolled growth of city due to physical development are the excessive use of land, the lack of sufficient urban facilities and equipment, the disconnection of the suburbs and thus adding to the urban problems. The purpose of this study is to study environmental and physical factors and their impact on the physical growth and development of Maragheh city and provide the best place for future development of the city.

Data and Method

In the present study, the criteria and sub-criteria and the relationships between them were first defined by the ANP method using Super Design software, and after obtaining the weight for each criterion and sub-criterion, the sub-criteria were first fuzzy and according to the weight of each of them the main criterion was obtained from the sum of these sub-criteria. Finally, the three main criteria of human, environmental and topographic parameters, considering their weight, have provided the main layer of the possibility of physical development of the city. Choosing a suitable method and approach for modeling a system depends entirely on the complexity of that system and complexity is inversely related to the amount of knowledge and understanding of our system. Fuzzy systems can be well used to model two main types of uncertainty in the phenomena. The first type is uncertainty due to the lack of knowledge and human tools in recognizing the complexities of a phenomenon.

Results and Discussion

Using the three main layers obtained for topographic, environmental and human criteria and according to the weight of each, the final location map of physical development of Maragheh city was obtained. The development map of Maragheh shows that the south-eastern parts are very unsuitable for physical development, while the north-eastern, north-western and south-western parts are suitable for development in terms of three environmental, human and topographic features. Environmental factors seem to have the greatest impact on the development and expansion of cities. According to our findings, and depicting the map of the city development over different years, the final map was obtained for the development of this city which is almost in line with the expansion of the city during the years 1996 to 2006 and 1976 to 1986.

Conclusion

With the arrival of the third wave of industrialization in Third World countries since the beginning of the twentieth century, production and income in cities, followed by increased demand for urban services and consequently urbanization has expanded. One of the effects of physical growth is related to the expansion of the outskirts of cities beyond the administrative boundaries of any city. Such urban development goes to areas outside the administrative boundaries and changes in land uses. The city of Maragheh has many limitations in terms of physical expansion due to the gardens around the city. In order to prevent the destruction of gardens and agricultural lands as well as physical expansion in line with natural and human criteria, extensive studies should be conducted. Information and data were applied in this study for the analysis of these parameters.

The city of Maragheh needs to expand physically following the increase in population naturally and its increasing expansion goes on due to uncontrolled urban migration. In the present study, three main criteria of human, environmental and topography have been used. From the topographic criteria, the south-western parts are the most suitable places and the north-eastern parts of the city are the most unsuitable parts. In terms of environmental criteria, the western and south-western parts and to some extent parts of the north are suitable for development. Due to being a garden city, it is limited to gardens from the surroundings, which makes it difficult to expand from a human and environmental standards point of view. By combining three layers of environment, human and topography, the best place for the development of this city according to the final map was prepared for the optimal location of the future development the city based on ANP Fuzzy method by which it is more suitable in the west and north-west than in the south and south-west. Paying attention to horizontal expansion preserves the traditional texture of the city and single-storey buildings and prevents its vertical expansion. Although vertical expansion has advantages over horizontal spreading out, the current conditions of Maragheh city and its size, as well as its traditional texture and culture, make the need for horizontal expansion more tangible than vertical expansion.

By using the right development model, both the traditional construction of the city can be preserved and the problems caused by sporadic development can be reduced, provided that the horizontal development goes in the direction that environmental and human conditions demand.

Key Words: Maragheh, Physical Development, GIS, Locations, Fuzzy ANP

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