

Research Paper

Evaluation of the sustainability of rural areas and application of the Delphi fuzzy technique and the artificial neural network: A case study of rural areas of northern Savadkouh County

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ABSTRACT

Nowadays, paying attention to the issue of sustainability, especially in rural areas, has become a pivot in the policies and plans of countries in the world. Identifying the status of rural areas in terms of sustainability can be of great help in this regard. The purpose of this study is to assess the sustainability of rural areas in northern *Savadkouh*. The study used a descriptive method to analyze and collect data through a questionnaire. The statistical population of the study consisted of the villagers living in the villages of northern *Savadkouh*. A combination of the Delphi fuzzy technique and the artificial neural network was used to analyze the data. At the first, using the Delphi fuzzy method, the stability indices were localized. Then, using the artificial neural network method, the rural areas were divided into two clusters. The results showed that there was proper and balanced stability in the rural areas of the study area (CV = 0.062). In addition, the results of the One-Sample T-test showed a significant difference among the indexes except for the empathy index and the gender ratio. Also, in all the three dimensions of sustainability, the human and natural supports of the rural areas of the northern *Savadkouh* region had a good balance and equality. Finally, the findings showed that the villages of Burkhill and Ikew ranked first and second, and the villages of Hajikla and Baikorka ranked 14th and 15th in this regard.

Key words:

Sustainable, Delfi fuzzy, Self-organization map, *Savadkouh*

Extended Abstract**1. Introduction**

One of the most important areas of sustainable development is the sustainable development of rural areas. In Iran, in order to achieve sustainable development, various strategies and measures have been used since the 1330s. However, due to the lack

of continuous evaluation and measurement regarding the stability of rural areas, planning policies and appropriate policies, especially in the rural areas of Iran, have encountered many problems. Therefore, the existence of an assessment mechanism in the field of sustainable rural development that can somehow measure the sustainability of these areas is undeniably essential for government programs. The present study aims to overcome this problem by assessing and analyzing the quality of rural areas. The northern city of Savadkou is located in Mazandaran

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province. It has four rural areas including 40 villages, and 57% of its population in these areas. It is located on the road of Tehran-north and adjacent to the national railway that connects three major cities of the province, namely Sari, Babol and Ghaemshahr. *Savadkouh* has formidable industrial units and high agricultural potentials. Therefore, recognition, evaluation, and development of the quality of the rural areas around this city are of great importance. The purpose of this research is to assess the sustainability of the rural areas in northern *Savadkouh* in terms of sustainable development indicators.

2. Methodology

The aim of the research was to assess the sustainability of rural areas in northern *Savadkouh*. It was conducted by a descriptive method, and data collection was done through a questionnaire. The statistical population of the study consisted of the people living in the villages of *Savadkouh*. A combination of the Delphi fuzzy technique and the artificial neural network was used to analyze the data. At the first, using the Delphi Fuzzy method, the stability indices were localized. Then, using the artificial neural network, the rural areas were divided into two clusters.

3. Results

In the first stage, sustainable development indicators were identified. Out of 37 identified indicators, 28 were finally screened, and the rest were ignored. Then, a one-sample t-test was used to examine the status of the screened indicators. The results indicated that all the indices were in a good condition except for the sympathetic indices and the gender ratio; they were in a moderate situation. In the next stage of the research, the villages were classified into two clusters. The average of cluster 1 in terms of sustainability (0.886) was higher than the overall average stability of the villages (0.820). The village of Burkhil is an example for this cluster. In cluster 2, the average stability of the villages was 0.334, which was very small as compared to the overall average of the villages. Therefore, the villages in this cluster were designated to the second level. Among the villages of this cluster, one can refer to Mangal. On the other hand, cluster 2 had a better balance in terms of supportive, human and natural systems. Generally, cluster 1, with a lower coefficient of variation, had higher equilibrium and stability in terms of sustainability. According to the sustainability scores obtained from the calculations (Table 12), among the villages of *Savadkouh*, Burkhil gained 0.901 as the highest score, but the village of Bazirkola gained 0.167 as the lowest. This suggests a severe variation among the villages. The results indicated a relatively stable situation

(with an average of 0.820 within the range of 0 to 1) in northern *Savadkouh*. Indeed, 46.66% of the villages had a sustainability level above the average.

4. Discussion

According to the results, the inequality is very low among the studied villages. It is suggested that the planning of rural areas in *Savadkouh* County be made according to the needs and the resources available to the people of that region. To fulfill this purpose, in-depth studies should be conducted to detect further potentials of the region in the fields of agriculture and husbandry. Also, attention should be paid to the relationship between these sectors and the industry in order to increase the sustainability level and maintain the upward trend of sustainability in the region.

5. Conclusion

Based on the results, since human systems are generally of the lowest sustainability among the systems ever assessed, it is suggested that strategic plans be developed to increase the literacy rate, access to schools, social assets, sense of belonging, and so on. The use of natural power in the rural areas of the city of *Savadkouh* to attract tourists, in a way that does not harm the sustainability of natural resources, can be effective in increasing the sustainability of human systems as well as supporting the region.

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Conflict of Interest

The authors have no conflict of interest to declare.