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Sustainability Evaluation of Rural Settlements in South Donbaleh Roud Dehestan of Izeh County Using V-Promethee Technique and Fuzzy Inference

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Abstract

Purpose- Due to the dewatering of Karun Dam, the village of Southern Donbaleh Roud of Izeh County has been surrounded by water since 2004 until now and has been deprived of services and amenities and communication. Moreover, their access to the cities of Dehdez and Izeh has been limited. Given the importance of the issue, the aim of this study is to assess and evaluate the sustainability of development in rural areas of Southern Donbaleh Roud District.

Design/methodology/approach- This research is based on the applied purpose and has an analytical- descriptive nature. Required data were collected using library and field (questionnaire) method. The area under study includes 18 villages and 1460 households. The sample size was estimated based on Cochran formula of 300 family guardians and the questionnaires were distributed among them. To analyze the data from the questionnaire, the Prometheus model (in the visual Prometheus software environment) and the fuzzy inference system (in MATLAB software) were used.

Finding- Based on the Prometheus model, the villages are ranked according to three positive (Phi+), negative (Phi-) and pure flows. The villages with the highest positive minimum negative flows are in the first place, and the villages with the least positive and the most negative flows are at the last place of development sustainability. The results obtained from the Fuzzy inference system also indicate that the sustainability of the studied rural area is between the medium and low levels.

Originality/value- There have been a lot of changes in spatial organization of the studied villages due to water logging of the villages. These changes have created disruptions in the system and functioning of the settlements and have affected the quality of life and wellbeing of the inhabitants. Because the construction of dams has destroyed the communicative routes between villages and the city, agricultural lands and gardens, schools, rural healthcare centers, residential houses, provincial villages and… and the villages have been left behind the dam so far. Therefore, considering the special circumstances of these settlements, the problems of these villages have been scientifically examined and addressed to planners and officials. Because, through this, the authorities and development experts gain knowledge about the opportunities and capabilities, limitations and impasse of the villages.

Key words- Sustainability evaluation, PROMETHEE Technique, Fuzzy System, Southern Donbaleh Roud Dehestan.
Paper type- Scientific & Research.

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1. Introduction

In recent years, sustainability has been considered as a fundamental approach to any type of development, including rural development. Each rural settlement consists of a variety of economic, social, cultural and political arenas, each of which represents one aspect of social life. Accordingly, rural space has a certain structure with regard to its environmental and ecological characteristics and its socioeconomic features which indicate the fundamental capabilities and potentials. Whenever there is an interruption in the development and improvement of the spatial organization of settlements, there will be a disruption that leads to unsustainability of rural settlements (Khosrobeigi, Shayan, Sajasi Qeidari, & Sadeghlou, 2011). Today, rural issues such as population decline, rural poverty, the lack of employment grounds in villages and lack of facilities and services and abundant and wasteful migration of the villagers to cities in order to find a better job and life, food insecurity, major population living on the margins and… have attracted the attention of authorities and planners. Therefore, rural planning as a mechanism to eliminate such problems and modify the population displacement is essential for the sustainability of the rural population and the prevention of the destruction of renewable and nonrenewable natural resources (Ameri Siahouii, Rostam Gourani, & Beiranvandzadeh, 2011).

The rural areas of Iran are under the influence of a wide variety of heterogeneous factors sometimes arising from natural conditions like geographical coordinates, geographical isolation, geographical conditions and weather differences and sometimes arising from human condition like the prevalence of patterns and practices of urban life which, in turn, has affected the diversity and economic and social differences of the villages of the country (Rezvani, 2008). Hence, the starting point to pay attention to sustainable rural development is the recognition of the extent of rural settlements' development based on various economic, social and environmental indicators. The reason is that through this the officials and development experts are provided with a deep recognition about opportunities and capabilities, on one hand, and the challenges, limitations and impasse of the villages, on the other hand, and provide the grounds for adopting macro and micro policies and opelogical and executive plans and projects (Heshmat Kaboudvand, Mirdamadi, Farajollah Hoseini & Pasban, 2014). The area under this study is the Southern Donbaleh Roud of Dehdez district of Izeh city. The Izeh city has two parts which are central and Dehdez districts. The central district includes 7 rural districts and Dehdez includes 3 rural districts, each of which has a total of 20 to 35 villages.

Following the construction of the Karun 3 Dam in 2004, about 64 villages (a population of over 16000) were evacuated from three rural districts of Dehdez. Due to the damping of the dam, the villagers lost their agricultural lands and pastures and they turned to marginalization in the cities of Khouzestan and Isfahan. Also, in the second phase, about 6 villages with a population of 2000 people were forced to be evacuated due to the transfer of high-voltage electric power carriers of the Karun 3 dam power plant. In addition to mentioned 70 villages, 18 villages belonging to Southern Donbaleh Roud rural district were also surrounded by water and their communications were cut off. The inhabitants of these 24 villages, are more than 8 thousand people by the census of 2011. They have been surrounded by the dam lake water since 2004 until now and are forced to use launches (boats) of "Iran Water and Power Resources Development Company" for crossing. These launches operate from 8 a.m. to 8 p.m. at half-hour intervals. Thus, people are deprived of the possibility of transportation for half a day, and in the remaining half, their access to the launches is limited to once in every half an hour. So far, a significant number of people in these villages have lost their lives due to the lack of rural roads and late arrivals to the hospital. Apart from access problems in these villages, there are some problems like shortages and lack of infrastructure services-welfare, low productivity, lack of employment opportunities, immigration, management weaknesses, and so on. Therefore, despite the potential of these villages in various fields, including many natural tourist attractions, handicrafts, fertile soil prone to agricultural production, medical plants, abundant water resources, etc, they have not yet succeeded to achieve the position they deserve. Accordingly, the current research seeks to study the

sustainability of villages based on the three dimensions of sustainability (economic, social, and environmental) using a Prometheus decision model and a Fuzzy inference system. Three questions are raised in this regard:

- What is the status of the indicators of sustainability of development in each of the studied villages?
- In terms of sustainable development, which villages are in the first place of sustainability and which villages are in last place?
- According to the rule if-then of the Fuzzy inferential base, what is the level of sustainability in the studied villages?

2. Research Theoretical Literature

The concept of sustainable development and sustainability has been defined by various scientific approaches, each of which has been for a special purpose and was applicable to different fields (Winograd, 2010).

The presented definitions can be considered as various concepts such as expressing the perspectives, exchange of values, moral development, social reorganization, the process of transformation towards a better future, not endangering the environmental quality, empowering people, creating new capacities, increasing knowledge and information, making people feel happy about their lives, and freedom of choice and equality in access to opportunities (Lee & Greed, 1993), all of which somehow explain the main idea of sustainable development, meeting the needs of the present generation with consideration of the needs of future generations (Tanguay, 2010).

The expressed concepts are indicated in an overlapping framework of economic, social and environmental context.

Meanwhile, each of the mentioned triple structures has its own particular aspects and different goals (Khosrobeigi, Shayan, Sajasi Qeidari, & Sadeghlou, 2011).

The concept of sustainability in the theme framework of rural sustainability expresses the balance and dynamism of rural settlements in relation to natural-ecological, socio-cultural and physical-spatial structures, so that it guarantees the sustainability of the settlement during the spatial-temporal trends (Boosle, 1999). Sustainable rural development can be considered as a process of change and transformation aimed at improving the quantitative and qualitative levels of rural community life, a process which ends in creating ecological balance and harmony between the two urban and rural spheres and mainly seeks to create empowerment and efficiency necessary for the poor and low income rural population who are not able to sustain themselves and stand on their own feet.

In general, rural sustainability can be considered as a process during which the well-being of rural residents and the ecosystem is preserved and improved simultaneously.

Economic development comes with social justice and environmental protection and the durability and persistence of the settlements is increased, economic diversification and income resources are increased and social cohesion and participation are internalized. Rural inhabitants utilize the available resources in an efficient way so that all the society members, now and in the future, achieve a higher level of prosperity, economic and physical-spatial security and at the same time, maintain the integrity of ecological systems (Badri, Yari Hesar, Pourtaheri, & Faraji Sabokbar, 2013). In order to assess sustainability, appropriate indicators and frameworks to achieve accurate and logical conclusions is necessary.

The serious challenge about the indicators and criteria is that, sustainable development is a relative concept depending upon the location and variety of the communities (Tavakoli, 2014).

The limitations are more evident during the assessment of sustainability of rural settlements since a lot of indicators and standard methods are not desirable for local levels. A lot of needed data do not exist in villages or gathering data through field operations has problems.

In this regard, the defined assessment indicators of sustainability based on global scales must be adapted to national and local circumstances based on two main criteria of appropriateness and access (United Nations, 2007).

Also, the indicators must be sensitive to temporal and spatial changes, must not have a value bias and must be able to predict future conditions (Liverman, Hanson, & Brown, 1988).

Therefore, it is important to select the indicators carefully so that, they can show the desired knowledge of sustainable development. In the present study, systematic and organized analysis has been used to identify and categorize the

indicators. Accordingly, the basic and effective indicators have been identified in the form of triple dimensions and systems of sustainability. (Table1).

Table 1. Dimensions, indicators and criteria of rural sustainable development

Dimension	indicator	criterion
Social	Health	Benefit from health facilities, Dietary Diversity, level of health , healthy entertainment and leisure
	Individual and social security	The amount of crime, Hope for the future, Benefit from rural insurance, Happiness, Ethnic integration in the village
	Social relations	Co-operation and Partnership, social connection, social relations,
	Participation	Individual Participation, Social Participation
	Education	Access to educational Infrastructures, Benefit from educational facilities, Knowledge Level
	Access	Satisfaction with the Amount of Access to the Service, Satisfaction with City Access
	Communication	Access to Communication Infrastructures, the Level of Application of Communication Technology
Economic	Employment and Efficiency	Job Satisfaction, diversity of job opportunities
	welfare	Income Satisfaction, Income and Wealth of Family, Rural Households' Saving
Environmental	The Quality of Environment	Weather Condition, Pollution of Soil and Water Resources of Villages, The use of Fertilizers and Pesticides, Quality of Garbage and waste Collection
	Housing	Quality of Housing, Housing Satisfaction, Benefit from Housing Services
	Vulnerability	Vulnerability to Hazards, Vulnerability to Incidents
Source:: Roknoddin Eftekhari & Aghayari Hir, 2007, Faraji Sabokbar, Badri, Motiee Langroudi & Sharafi 2010, Roknoddin Eftekhari, Sajasi Qeidari & Sadeghlou, 2011, Badri, Faraji Sabokbar, Javdan & Sharafi, 2012, Badri, Yari Hesar, PourTaheri & Fariji Sabokbar, 2013, Anabestani, Shayan,Shamsodini, Taghilou & Zareei, 2013, Akbarian Ronizi & Sheikh Beiglou 2015, Imani, Bakhtar & Khosh Raftar 2016.		

Studies have been conducted on the development and understanding of the sustainability level of the villages, including the research by Luo, Li, and Fu (2011).

In a research titled "Factors influencing social sustainability in China rural areas" it has been concluded that the studied area is in a favorable situation in terms of social sustainability and economic factors, security measures, religious differences between villagers, and justice, which are factors influencing social sustainability. Knight (2014) in China, showed that no income increase, economic inequality, lack of economic security, and mismanagement are among the key threats of social sustainability among Chinese citizens.

Roknodin Eftekhari & Aghayari Hir (2007), in a research on the sustainability rural development level in Hir district in Ardabil, concluded that the development of rural areas in Hir district is in the medium level.

Faraji et al. (2010) have investigated the sustainability of rural areas in Fasa. Their findings showed that due to the linkage between indicators and criteria in different dimensions, for accurate measurement of sustainability, attention to different groups and dimensions of sustainability, independently of each other, as well as the use of surveys and consideration of expert opinions is necessary.

Roknoddin Eftekhari, Sajasi Qeidari, & Sadeghlou (2010) have evaluated the rural sustainability using a strategic model in Khodabandeh City. The results from the implementation of the model showed that the villages of Khodabandeh City are in a poor level in terms of sustainability.

Ebrahim Zadeh & Raeis Pour (2011) in a research, investigated the trend of changes in the degree of development in rural areas of Sistan and Balouchestan.

The results indicated an imbalance between the villages, and the change in the status and development level of the villages, mainly consisting of the central parts of the counties.

Khosrobeigi, Shayan, Sajasi Qeidari, and Sadeghloo (2011) in a study titled "Sustainability assessment and evaluation in rural areas in the City of Komijan" concluded that, Fazl Abad and Ali Abad villages had high levels of sustainability and the villages of KasrAsef and Chalmyan had a lower level of sustainability compared to other settlements.

Badri, Faraji Sabokbar, Javdan & Sharafi (2012) have ranked the level of sustainability of rural areas in the villages of Fasa. Their findings revealed that there is a difference between the amount of sustainability of the economic, social and environmental dimensions of rural areas.

Badri, Yari Hesar, Pourtaheri, & Faraji Sabokbar (2013) have explored and explained the process of selection of indicators for investigation and assessment of the sustainability of the rural settlements in the metropolitan areas with an emphasis on Tehran Metropolis.

The results of their study indicated that in relation to the average analysis of the value of the selected indicators, socio-cultural indicators with a score of 7.92 compared with other indicators have more credibility in sustainability analysis. The economic, natural, and physical infrastructural indicators are at the next level.

Anabestani, Shayan, Shamsoddini, Taghilou, and Zareii (2013), in a study on economic sustainability assessment in rural areas of Jafar Abad district of Qom, concluded that there is a difference in economic sustainability between villages. Tavakoli (2014) conducted a research to measure the socioeconomic sustainability of rural settlements in the northern and Southern Khaveh District of Lorestan Province.

The results showed that with the TOPSIS method 92% and with the Maurice method 96% of studied villages are in semi stable conditions. Shamsoldini, Jamini & Jamshidi (2016), in a study titled "Assessment and analysis of social sustainability in rural areas of Javanroud City", concluded that social sustainability among villagers in the city of Javanroud is in a good condition. A review of the research records shows that the economic, social and environmental sustainability dimensions include several indicators, and these three dimensions are interrelated. In order to measure the sustainability of the villages in the Southern Donbaleh Roud District of Izeh City, these three dimensions each containing different indicators and indices were used.

Among the differences between the present research and previous studies, it can be cited that the villages are studied at the level of the indicators and the Prometheus method and the Fuzzy inference system are used for data analysis.

3. Research Methodology

3.1 Geographical Scope of the Research

The city of Izeh with an area of about 182329 square kilometers, is located in an elliptical plain in the northeast of Khouzestan Province.

The city is located between Chahar mahal Bakhtiari and Kohgiloyeh and Boyer Ahmad Provinces and the cities of Masjed Soleiman and Baghmalek. Due to its mountainous and semi mountainous position and its proximity to the Zagros Mountains, this city has a more independent and cool climate than other cities of the province.

The minimum annual temperature in this city is about 2 degrees below zero in winter and 42 degrees centigrade in summer, and the amount of rainfall is estimated at 600 to 800 mm per year. The city of Izeh has two parts, the central district and Dehdez district. The central part includes 7 rural districts and Dehdez includes 3 rural districts (Southern Donbaleh Roud, Northern Donbaleh Roud and Dehdez), each of which has a total of 20 to 35 villages. According to the latest data from the general population and housing census in 2011 the city has a population of over 203594 people, with an urban population of 122013 and a rural population of 8151 (www. Amar. org.ir, 2011). The area under study in this research is Southern Donbaleh Roud rural district.

This area has 18 villages and a population of more than 8 thousand people. In Figure1, the distribution of the studied villages and in Figure 2, a view of these villages are shown.

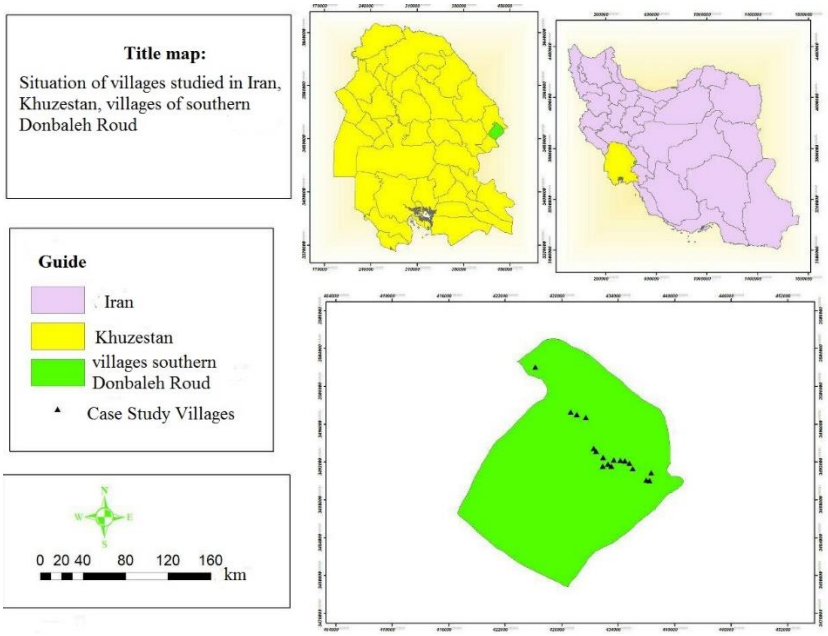

Figure1. The geographical location of the City of Izeh, Dehdez District, and the villages of Southern Donbaleh Roud Rural District

Source: Political divisions of Iran (https://www.amar.org.ir, 2017)

Figure2. A view of location, natural attractions and routes of the villages of Southern Donbaleh Roud Rural District

(Source: research findings, 2017)

3.2. Methodology

The present study is based on the purpose of the applied type and in terms of the nature and data collection is descriptive-analytic. Two types of methods, i.e. library (taking notes) and field (questionnaire) were used to collect the required data and information. The statistical population of the research is 1460 households in 18 inhabited villages of Southern Donbaleh Roud Rural District of Izeh City. The sample size was calculated based on Cochran formula of 300 household heads that the number of samples has been distributed in villages based on their population ratio.

In the following, in order to evaluate the validity of the questionnaire experts' views on geography

and rural planning were used. Then the obtained data from the questionnaires were entered into the SPSS software and mean indicators were obtained. Finally, to analyze the data and information to study the sustainability of villages based on triple dimensions of sustainability (economic, social, environmental) the Prometheus decision model and Fuzzy inference system have been used in MATLAB software.

PROMETHEE method

This technique which is used to enrich evaluations, was put forward by Jean-Pierre Bronze and Bertrand Marskal for the first time in 1986. The PROMETHEE method is one of the MADM methods and as an efficient method using two terms, preference and indifference, is to seek the best option (Faraji Sabokbar, Badri, Sajasi Qeidari, Sadeghlou, & Shahdadi Khajeh Asgar, 2011). This method is used to evaluate and prioritize the discrete options and to select the best option based on several criteria (with different measurement scales) (Chou, Lin, Cho, & Haung, 2004). Also, the PROMETHEE methods have good performance in cases where the decision criteria conflict with each other and decision makers regard the basic information as undesirable (Arab Halvaee, 2009).

The first step: is to get the deference between each of the options based on (a,b)=fj(a)_fj(b) in each of the indicators relative to each other.

Step two: the amount of priority of each option to the other options. After calculating the amount of difference between options, the value of Pj(a,b) will be obtained.

Step three: the sum of the values indicates the priority of the options.

Step four: gaining Positive (Outlet) and Negative (Input) ranking stream: options can be ranked by positive or negative flow.

Output flow: states that how much an option such as a is prior to the other options. The higher the value, the better this option.

Input flow: states how much other options are prior to option a. the less this value, the better.

Step five: gaining a net stream of ranking, this stream is the balance between positive and negative ranking stream. The higher net stream indicates the prior option (Firouzi, Ne'mati, & Dari Pour, 2014).

The Fuzzy inference system model (FIS):

The Fuzzy inference system is one of the most powerful tools in the field of expert systems and artificial intelligence which is applicable in numerous studies (Faraji Sabokbar, 2016; Ratnayake, 2014). Theories of Fuzzy sets provide tools by which human reasoning and decision making can be mathematically formulated and use the obtained mathematical pattern in various fields of science and technology. The Fuzzy inference system in general includes a Fuzzy input, a knowledge base (including base low and data base) which provides the necessary logical base and field for reasoning and as the main stage of analysis is responsible for approximate reasoning and Fuzzy inference in the form of Fuzzy rules (If=Then) in its different stages. (Adriaenssens, 2004). In the next step, the output of each stage is used as the input of the next stage until the last Fuzzy output is extracted and in the next step the final fixed values are obtained through the non Fuzzy making operation for primary and basic components (research indices and components) (Amini Faskhoudi, 2006; Kiani, Pasban Isalou, Badly, & Kanouni, 2015).

4. Research Findings

In order to have access to research goals, after the primary steps of related data collection, 13 criterion of rural sustainable development have been given weight. Then, using the obtained weights and the PROMETHEE model in (V0PROMETHEE), first GAIA has been conducted and finally the villages have been prioritized based on their rank.

In the complete prioritization method, equilibrium is made between positive and negative classification flows. The net flow represents the better option. In Figure 3, whenever, a criterion has the least positive values and the most negative values, that option will be lower than the other options and indicates less priority. As this figure shows, based on the values of net ranking flow (phi), the villages of Abolkheir and Dehno have the best options or the most priority and BarAftab Fazeli and Chaman have the least priority.

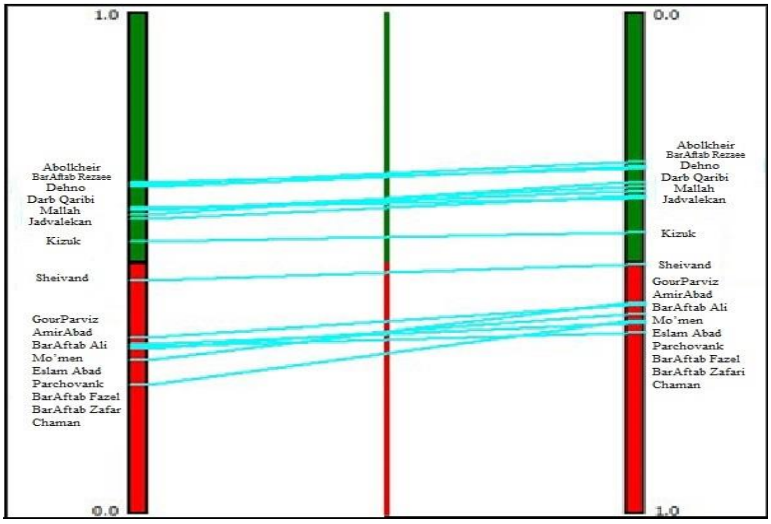

Figure 3. Complete prioritization of options
(Source: Research Findings, 2017)

In Table 2, the villages of Southern Donbaleh Roud Rural District have been ranked based on three output analysis (positive ranking, negative ranking and net output). Based on the intended table, the villages of Abolkheir, Dehno, BarAftab Rezaee, Darb Qharibi, Mallah, Jadvalekan, MirAhmad, Faleh and Kizuk have the most positive flow and the least negative value. The villages of Sheivand, Gour Parviz, AmirAbad, BarAftab Ali Mo'men, Eslam Abad, Parchovank, BarAftab Fazel, BarAftab Zafari and Chaman are in the next ranks. It should be noted that the average social, economic and environmental sustainability in the intended villages are 2/61, 2/04 and 2/92, respectively.

Table 2. Ranking of the villages based on output flow from the PROMETHEE model
(Source: Research Findings, 2017)

Villages	Positive Ranking (phi+)	Negative Ranking (phi-)	Net Ranking (phi)
Abolkheir	./654	./298	./357
Dehno	./660	./312	./348
BarAftab Rezaee	./651	./307	./343
Darb Qharibi	./606	./348	./257
Mallah	./597	./339	./257
Jadvalekan	./606	./357	./248
MirAhmad	./610	./371	./239
Faleh	./588	./366	./221
Kizuk	./543	./438	./104
Sheivand	./466	./502	-./036
GourParviz	./352	./583	-./230
AmirAbad	./307	./579	-./271
BarAftab Ali Mo'men	./307	./579	-./271
Eslam Abad	./330	./601	-./271
Parchovank	./339	./619	-./280
BarAftab Fazel	./334	./638	-./303
BarAftab Zafari	./257	./615	-./357
Chaman	./257	./615	-./357

Table 3, shows the status of 13 development indicators for each of the villages separately, based on the scores of -1 and +1. The indicators with +1 score are at an appropriate level and the

indicators with -1 score are at an undesirable level. For instance, in the village of Abolkheir the status of indicators of ecological diversity, health, education, social relations, welfare, security, participation, quality of environment, and employment are appropriate and the indicators of vulnerability, communication, access and housing are in an undesirable status. Or in the village of Chaman the status of indicators such as quality of environment, housing and welfare are appropriate and the criteria of education, communication, health, participation, ecological diversity, social relations, employment, access, vulnerability and social-individual security are in an undesirable status.

Table 3. The status of indicators of rural sustainable development of studied villages seperately
(Source: Research Findings, 2017)

Indicators / Villages	Health	Security	Social relations	Participation	Education	Access	Communication	Employment	Welfare	Quality of environment	Ecological diversity	Housing	Vulnerability
Abolkheir	+1	+1	+1	+1	+1	-1	-1	+1	+1	+1	+1	-1	-1
Dehno	+1	-1	+1	-1	+1	-1	-1	-1	+1	-1	+1	-1	+1
BarAftab Rezaee	+1	+1	+1	-1	-1	-1	-1	+1	+1	+1	+1	-1	+1
Darb Qharibi	+1	+1	-1	+1	+1	-1	-1	+1	-1	-1	+1	-1	+1
Mallah	+1	+1	+1	+1	+1	-1	-1	+1	+1	-1	+1	-1	+1
Jadvalekan	+1	+1	+1	-1	-1	-1	-1	-1	+1	+1	+1	+1	+1
MirAhmad	-1	+1	+1	-1	+1	-1	-1	+1	+1	-1	-1	+1	+1
Faleh	+1	+1	+1	+1	+1	-1	-1	-1	-1	-1	+1	-1	+1
Kizuk	+1	+1	+1	+1	+1	-1	-1	+1	-1	-1	+1	-1	+1
Sheivand	+1	+1	-1	+1	-1	-1	-1	+1	-1	-1	+1	-1	+1
GourParviz	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	+1	-1
AmirAbad	-1	-1	-1	-1	-1	-1	-1	+1	+1	+1	-1	+1	-1
BarAftab Ali Mo'men	-1	-1	-1	-1	-1	-1	-1	+1	+1	+1	-1	+1	-1
Eslam Abad	-1	-1	-1	+1	+1	-1	-1	+1	-1	+1	-1	+1	-1
Parchovank	-1	-1	+1	+1	+1	-1	-1	-1	-1	+1	-1	+1	-1
BarAftab Fazel	-1	-1	-1	+1	+1	-1	-1	-1	+1	-1	-1	-1	-1
BarAftab Zafari	-1	-1	-1	-1	-1	-1	-1	-1	+1	+1	-1	+1	-1
Chaman	-1	-1	-1	-1	-1	-1	-1	-1	+1	+1	-1	+1	-1

In the following, in order to complete the results obtained from the PROMETHEE model in (V-Promethee) environment, the Fuzzy inference system has been used in MATLAB environment. Fuzzy inference steps to obtain the rural sustainability level include knowledge base,

creating a data base (Fuzzy sets and membership functions) and creating a rule base (Fuzzy Logic Rules).

To form the knowledge base (Figure 4), the real data exists only at the first level of the model, that is, the basic development variables. Therefore, each of the indicators are the linguistic variables which are inferred using Fuzzy Logic and approximate reasoning from basic data. Therefore, the main necessity for designing an expert Fuzzy system is first, to select membership functions with high efficiency for linguistic variables and define input Fuzzy sets and output of each stage (form the database), and then, to gather knowledge about the studied problem and encoding knowledge collected in the form of Fuzzy logical rules if-then (form rule base) (Kiani, Pasban Isalou, Badly, & Kanouni, 2015).

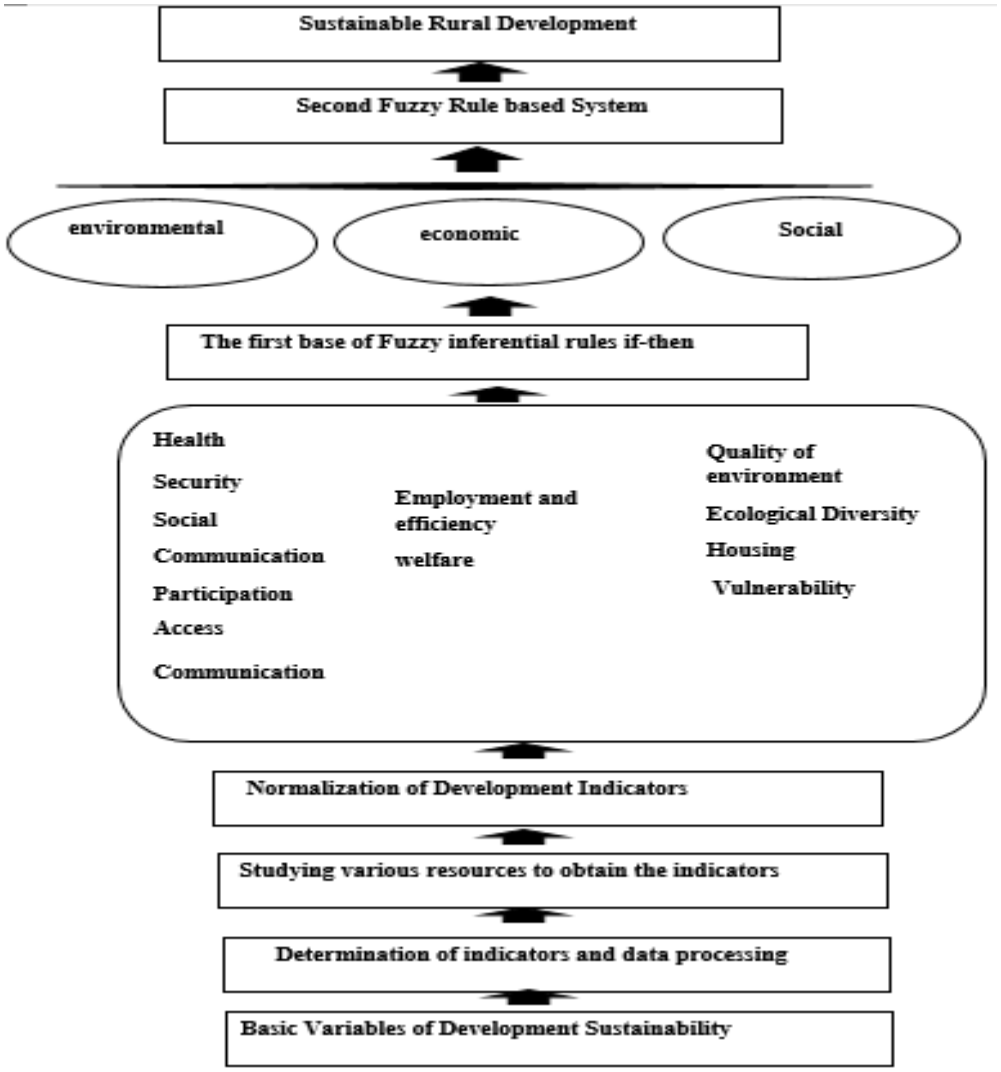

Figure 4. The main stages of inference and figure of the used Fussy model
(Source: Research Findings, 2017.)

In the next step for each dimension of economic, social and environmental sustainability, the input of Fuzzy sets with five values or linguistic amounts were defined as very low, low, medium, high and very high, and for sustainability of development, the output of Fuzzy sets with membership functions were defined as good, moderate and weak. In the third stage, which is the most important part of Fuzzy inference method (building rule base) the rules from the level of basic indicators to highest level are obtained. These rules represent the

interdependence between indicators, components and their interaction and impact on each other (Amini Faskhoudi, 2005). An example of the if-then rules used in the model is:

If the social development is low and the economic development is very low, then the degree of sustainability of development is undesirable.

If the economic factor is moderate and social development is good and environmental development is weak, then economic development is low.

As can be observed, each rule contains two parts of top (if) and tale (then). The tale part is always a nominal phrase but the top part usually includes several phrases (or so-called several conditions) which are connected to each other with a relation (and) logic.

The number of these rules depend on the number of inputs and the number of classes between inputs (different levels of components) and also, the type pf defined Fuzzy sets in the database (the number of linguistic values of each primary and secondary components and indicators).

In the first base of the rule of inference of development components, the main components (economic, social and environmental development) require to set 27 rules (5 linguistic values). These 27 rules are set forth in table 4. In three linguistic variables, three linguistic values, i.e. weak, moderate and good are involved .

Table 4. (Fuzzy) Linguistic rules related to the components of rural development sustainability

(Source: Research Findings, 2017)

27 base rules to infer the components of development sustainability				
	Input			Output
Rule	**If social development**	**And economic development**	**And environmental development are;**	**Then the level of Rural sustainability**
1	Good	Good	Good	Very high
2	Good	Good	Moderate	High
3	Good	Good	Weak	Medium
4	Good	Moderate	Good	High
5	Good	Moderate	Moderate	Medium
6	Good	Moderate	Weak	Medium
7	Good	Weak	Good	High
8	Good	Weak	Moderate	Low
9	Good	Weak	Weak	Very low
10	moderate	Good	Good	High
11	moderate	Good	Moderate	High
12	Moderate	Good	Weak	Low
13	Moderate	Moderate	Good	High
14	Moderate	Moderate	Moderate	Medium
15	Moderate	Moderate	Weak	Low
16	Moderate	Weak	Good	Medium
17	moderate	Weak	Moderate	Low
18	Moderate	Weak	Weak	Very low
19	Weak	Good	Good	High
20	Weak	Good	Moderate	Medium
21	Weak	Good	Weak	Very low
22	Weak	Moderate	Good	Medium
23	Weak	Moderate	Moderate	Low
24	Weak	Moderate	Weak	Very low
25	Weak	Weak	Good	Low
26	Weak	Weak	Moderate	Very low
27	Weak	Weak	Weak	Very low

In this stage, the three selected indicators (economic, social and environmental factors) are transformed to Fuzzy values according to linear equations of membership functions. The first input is the economic factors, the second input is the social factors, and the third input is the environmental factors. Referring to the rules in Table 4, only four rules 5,8,14 and 17 have the

membership value. Accordingly, the results of these four rules on the intended rural district will be:

Rule 5: If the social development is good at 0/261 and economic development is moderate at 0/201 and environmental development is moderate at 0/291, then the sustainability level of development is moderate at 0/57 (0/261 and 0/201 and 0/291).

Rule 8: If social development is good at 0/201 and economic development is weak at 0/261 and environmental development is moderate at 0/291, then sustainability level of development is weak at 0/38 (0/261 and 0/201 and 0/291).

Rule 14: If social development is moderate at 0/261 and economic development is moderate at 0/201 and environmental development is moderate at 0/291, then the sustainability level of development is moderate at 0/48 (0/261 and 0/201 and 0/291).

Rule 17: If social development is moderate at 0/261 and economic development is weak at 0/291 and environmental development is moderate at 0/201, then sustainability level of development is low at 0/38 (0/261 and 0/201 and 0/291).

The membership value or the result of the other 23 rules to infer the sustainable development in southern Donbaleh Roud rural district is zero. Figure 5, shows the above implication in graphical form.

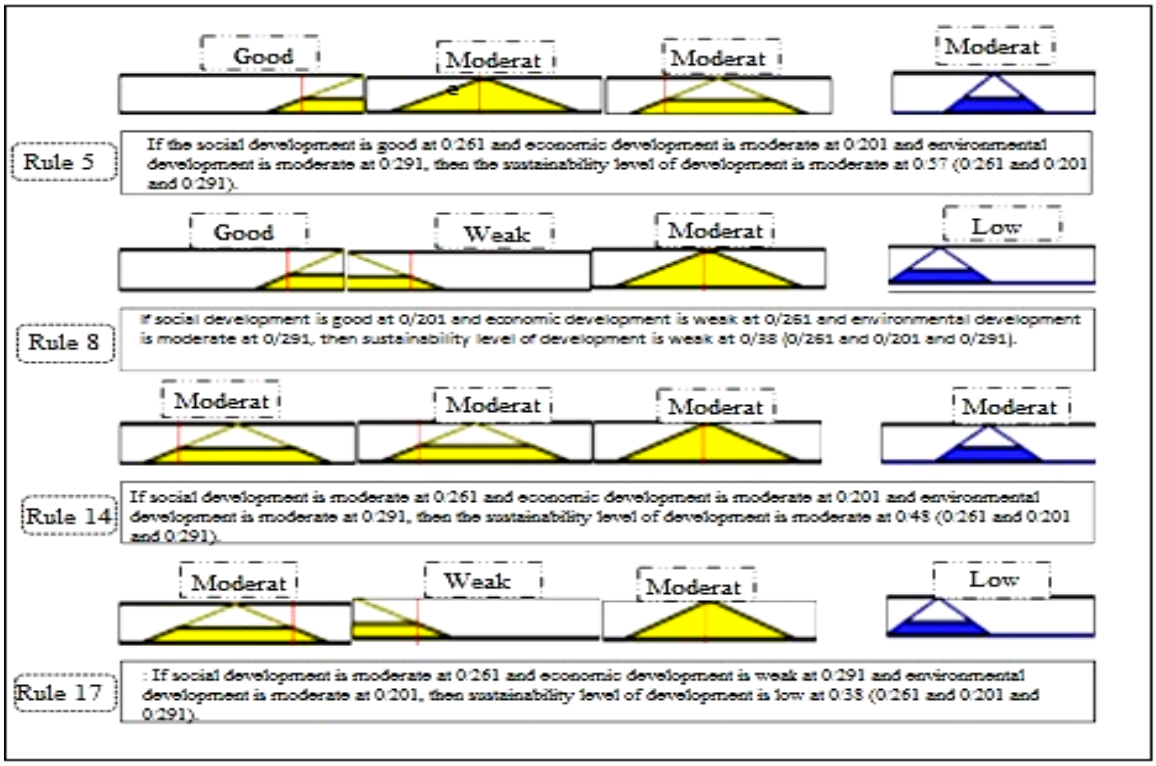

Figure5. Outputs (economic, social, environmental) and output (sustainability level) of Southern Donbaleh Roud Rural District

(Source: Research Findings, 2017)

Discussion and conclusion

It can be concluded from the theoretical discussions that, sustainable development is the process of achieving a coherent and future-oriented approach to development through understanding of human-environmental relationships with an emphasis on the rights of all human beings. Achieving this desired perspective is possible through continuous evaluation in different levels of planning and management of rural settlements; because, rural areas are currently facing many problems, they also face different choices for their future. In order to achieve sustainable rural development, explaining the status quo and the current status of our rural areas is considered to be a starting point. Accordingly, planning sustainable rural development is in fact, a future-oriented program

and investigates the rural communities and their issues in different environmental, social and economic aspects. In this regard, the use of appropriate evaluation techniques and models is of key importance to determine the sustainability status. One of the methods and techniques of new sustainability assessment, which is also emphasized in the global literature, is the multivariate evaluation method. Beyond the conventional decision models, in this study, models were used that allowed the simultaneous entry of several decision makers with various criteria and goals and options. Hence, in the current study, first dimensions, indicators and criteria of sustainable rural development were determined then the required data were collected. Finally, for data analysis, the PROMETHEE technique and the Fuzzy inference system were used in MATLAB software environment. It can be inferred from the results obtained from PROMETHEE technique that, the villages of Southern Donbaleh Roud Rural District of Izeh City are in a different situation in terms of sustainability, especially the socioeconomic sustainability. In social dimension, health, security, social relations, participation, education, access and communication are not equally and consistently presented and the status of health , security and social relations indicators are fairly appropriate and indicators such as participation, education, and especially access and communication, are not desirable. Also, in the economic dimension, villages are facing a lot of problems. Job satisfaction, variety of job opportunities, satisfaction with family income and savings among villagers are low. It can be said that, despite the tourism and agricultural capacities, the economic condition of southern Donbaleh Roud rural district is unorganized. In the environmental dimension, villages also have good climatic condition, and appropriate water and soil resources and biodiversity. However, there is a difference in terms of housing quality, housing satisfaction and availability of services for vulnerability among the villages studied and the housing situation and their vulnerability to hazards and accidents are not in good condition. This issue is considered a serious threat to inhabitants. Generally, in terms of sustainability of economic, social and environmental dimensions, the villages of Abolkheir, Dehno, BarAftab Rezaee, Darb GHaribi, Mallah, Jadvalekan, MirAhmad, Faleh and Kizuk have the most positive flow (Phi+) and the least negative flow (Phi_). The villages of Sheivand, Gour Parviz, Amir Abad, Bar Aftab Ali Mo'men, Eslam Abad, Parchovank, Bar Aftab Zafari and Chaman with the least positive values and the most negative values are in the last place of ranking. The achieved ranking indicates the difference in sustainability and the unbalanced growth of development among the villages of Southern Donbaleh Roud.

In the following, tn order to complete the results obtained from the PROMETHEE technique, the Fuzzy inference system was used to obtain the level of rural sustainability. The obtained results of the 27 base rules, indicate that only four rules, 5,8,14 and 17 have membership values and the membership value for the other 23 rules to infer the sustainable development in Southern Donbaleh Roud Rural District is zero.

Considering the Fuzzy logical rules if-then the sustainability membership value in rule 5, is moderate at 0/57, the sustainability membership value in rule 8 is low at 0/38, the sustainability membership value in rule 14 is moderate at 0/48, and the sustainability membership value in rule 17 is low at 0/38. In general, the sustainability condition of the studied rural district is between two moderate and low levels. That is, a number of villages in Southern Donbaleh Roud are moderate in terms of development and some of the other villages are at the lowest level of development.

Many studies have been conducted on the sustainability of rural settlements, where the development or lack of development of settlements has had the same or different conditions. But in the studied villages, the reason for the lack of sustainability and deprivation of rural settlements may be different from other settlements. The reason is that there have been a lot of changes in spatial organization of the studied villages due to water logging of the villages. These changes in the system and the functioning of the settlements have created disruptions and have affected the quality of life and well-being of inhabitants. The construction of the dams has destroyed the communicative routes of the villages with the cities, agricultural lands and gardens, schools, offices of rural health, residential houses, community service villages and… and the villages have been left behind the dam by this time. The total of the above factors

led to the forced immigration of many households and the hope and motivation of other residents to be ambiguous about the future of the villages. Therefore, in such circumstances, the intervention in the settlement system is necessary in order to stabilize and optimize it. Hence, today, considering the important role of quantitative and qualitative sustainability and development of employment, income condition, welfare, access, housing quality, participation, increasing the quality of residential environment, creating and, of course, fair distribution of facilities and services in various sectors of development in rural areas is necessary. In general, considering the pivotal role of economic, social and environmental sustainability, for achieving sustainable development, on the other hand, the significant difference in the studied villages in terms of sustainability, it is required to strengthen the indicators and criteria of sustainability in all villages, especially the villages that are placed in lower levels.

According to the results of this study, suggestions were made to eliminate the deprivation of rural settlements of Southern Donbaleh Roud Rural District and to move towards development:

- In order to prevent the evacuation of the intended villages, the authorities must establish communicative routes from villages to city by building bridge over Karun River. This may give more residents access to welfare services and facilitate the transportation of people and vehicles.
- Improving facilities and infrastructure services in villages, especially in less developed villages.
- Considering the desirable capacities and capabilities of the region, the boom of tourism, agriculture and the transformation industries can make the region's employment and income sustainable and reduce poverty and unemployment.
- Considering the old housing texture in some villages, the Housing Foundation should provide low-interest loans to improve residential buildings and passages.
- It is necessary to establish more empathy among villagers, governors of rural districts and authorities in order to solve the problems of these villages.

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References

1. Adriaenssens, V., De Baets, B., Goethals, P. L., & De Pauw, N. (2004). Fuzzy rule-based models for decision support in ecosystem management. *Science of the Total Environment*, *319*(1-3), 1-12.
2. Akbarian Ronizi, S.R., & Sheikh Beiglou, R. (1394/2015). Analysis and prioritization of social sustainability in rural areas (Case study: Darab County). *Journal of Geography and Environmental Sustainability*, *17*, 35-47. [In Persian].
3. Ameri Siahouii, H.R., Rostam Gourani, A., & Beiranvandzadeh, M. (1390/2011). Measuring rural sustainability and rural development in Shahab Qeshm County. *Quarterly Journal of Human Geography*, *3(4)*, 159-177. [In Persian].
4. Amini Faskhoudi, A. (1384/2005). Application of Fuzzy Logic Inference in regional planning and development studies. *Journal of Science and Development*, *17*, 40-60. [In Persian].
5. Anabestani, A.A., Shayan, H. Shamsoldini, R., Taghilou, A. A., & Zareei, A. (1392/2013). Evaluation of economic sustainability in rural areas using Linear Multi-Criteria Decision Decoding (Case: Jafarabad, Qom Province). *Geography and Environmental Studies*, *1*(4). 140-118. [In Persian].
6. Arab Halvaee, A. (1388/2009). Application of the Promethean technique in police decision making. *Journal of police human development*, *6(23)*, 53-63. [In Persian].
7. Badri, S.A., Faraji Sabokbar,H., Javdan, M., & Sharafi, H.S. (1391/2012) Ranking the sustainability levels of rural areas based on the Vikor Model, Case study: The villages of Fasa County. *Journal of Geography and Development*, 26, 1-20. [In Persian].
8. Badri, S.A., Yari Hesar, A., Pourtaheri, M., & Faraji Sabokbar, H.A. (1392/2013). Studying and defining the process for selecting sustainability evaluation and appraisal indicators for rual habitats of metropolitan areas: The case of Tehran Metropolitan. *Journal of Geography and Development*, *32*, 127-148. [In Persian].

9. Bossel, H. (1999). *Indicators for sustainable development: theory, method, applications* (p. 138). Winnipeg: International Institute for Sustainable Development.
10. Chou, T., Lin, C., Cho, W., & Haung, P.)2004). Application of the PROMETHEE technique to determine outlet location and flow direction in DEM. *Journal of Hydrology, 287*, 49-61.
11. Ebrahim Zadeh, I., & Raeis Pour, K. (1390/2011). Review of the trend of changes for development grade in rural areas of Sistan & Baluchestan by the use of numerical taxonomy during the decades of 1996 & 2006. *Journal Geography and Development, 24*, 56-56. [In Persian].
12. Imani, B., Bakhtar, S., & Khoshraftar, A. (1395/2016). The evaluation of social sustainability indicators in the rural areas: The case of rural suburban city north of Islamabad-West. *Journal of Regional Planning, 6(24)*, 167-178. [In Persian].
13. Faraji Sabokbar, H. A. (1385/2016). Providing a model for assessing the quality of the natural environment in rural areas using knowledge-based systems. *Journal of Research & Rural Planning, 5*(1), 1-18. [In Persian].
14. Faraji Sabokbar, H. A., Badri, S.A., Motiee Langroodi, S.H., & Sharafi, H.A. (1389/2010). Measuring the sustainability of rural areas using Analytical Network Process (ANP): A case studyof the rural areas of Fasa County. *Human Resource Research, 42*(72), 135-156. [In Persian].
15. Faraji Sabokbar, H.A., Badri, S. A. Sojasi Qidari, H.A., Sadeghloo, T., & Shahdadi Khaje Asgar, A. (1390/2011). Entrepreneurship development ranking (gradation) in rural areas by using the PROMETEE Technique (Case study: Suburb districts, Central District of Khodabandeh, Zanjan Province). *Human Resource Research, 43*(75), 56-56. [In Persian].
16. Firouzi, M.A., Nemati, M., & Dari Pour, N. (1393/2014). Measurement and evaluation of quality of life indices in Mehr House Design (Case study: Omidieh City). *Geography and Environmental Studies, 3*(11), 49-62. [In Persian].
17. Heshmat Kaboudvand, B., Mirdamadi, M., Farajollah Hosseini, S.J., & Pasban, F. (1393/2014). Measuring rural development sustainability levels in Karaj County. *Journal Village and Development, 17*(2), 69-86. [In Persian].
18. Khosrobeigi, R., Shayan, H., Sajasi Qeidari, H.A., & Sadeghlou, T. (2011). Assessing sustainability in rural areas using Fuzzy-Topsis Multi-variable Decision-Making Technique. *The Journal of Rural Research, 2*(1), 151-185. [In Persian].
19. Kiani, A., Pasban Isalou, V., Badly, A., & Kanouni, R. (1394/2015). Application of Fuzzy Inference System in the field of human development assessment: Parsabad County. *Quarterly Journal of Geography and Urban Regional Development, 6*(19), 1-16. [In Persian].
20. Knight, J. (2014). Economic causes and cures of social instability in China. *China & World Economy, 22*(2), 5-21. doi: 10.1111/j.1749-124x.2014.12059.
21. Lee, K. N. (1993). Greed, scale mismatch, and learning. *Ecological Applications, 3*(4), 560-564.
22. Liverman, D.M, Hanson, M.E., & Brown, B.J. (1988). From global sustainability toward measurement. *Environmental Management, 12*(2), 133-144.
23. Luo, X., Li, P., & Fu, X. (2011). Factors that affect social stability of rural areas in Ganzi district. *Asian Agricultural Research, 3*(2), 43- 83. doi: 10.5539/jas.v3n2p223.
24. Ratnayake, R. C. (2014). Application of a fuzzy inference system for functional failure risk rank estimation: RBM of rotating equipment and instrumentation. *Journal of Loss Prevention in the Process Industries, 29*, 216-224.
25. Rezvani, M.R. (1387/2008). *Development of rural tourism within the sustainable tourism approach* (1st Ed.) Tehran: Tehran University Press. [In Persian].
26. Roknoddin Eftekhari, A.R., & Aghayari Hir,M. (1386/2007). Level of sustainability of rural development (Case study: Hir Division). *Geographic Research Journal, 39*(61), 44-31. [In Persian].
27. Roknoddin Eftekhari, A.R., Sajasi Qeidari, H.A., & Sadeghlou, T. (1389/2010) Rural Sustainability measurement using a strategic model (Case study: Villages in Khodabandeh). *Planning and Arrangement of Space, 15*(1), 86-104. [In Persian].
28. Shamsoldini, A., Jamini, D., & Jamshidi, A.R. (1385/2016). Measurement and analysis of social stability in rural areas (Case study: Javanrood Township). *Journal of Rural Research, 7*(3), 486-503. [In Persian].

29. Tanguay, G. (2010). Measuring the sustainability of cities: An analysis of the use of local indicators. *Ecological Indicators, 10,* 407–418.
30. Tavakoli, J. (1393/2014). Socio- economic sustainability assessment of rural settlements of north and south Khave rural districts, Lorestan province. *Journal of Applied Research in Geographical Sciences, 14*(32), 71-92. [In Persian].
31. United Nations. (2007). *Indicators of sustainable development: Guidelines and methodologies*. New York: United Nations publication.
32. Winograd, M., & Farrow, A. (2009). Sustainable development indicators for decision making: concepts, methods, definition and use. *Dimensions of Sustainable Development-Volume I, 1*, 41.

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ارزیابی پایداری سکونتگاه‌های روستایی دهستان دنباله رود جنوبی شهرستان ایذه با استفاده از تکنیک V- PROMETHEE و سیستم استنتاج فازی

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چکیده مبسوط

۱. مقدمه

نواحی روستایی در ایران متأثر از عوامل گوناگون ناهمگونی زیادی دارد که گاه ناشی از شرایط طبیعی مانند مختصات جغرافیایی، انزوای جغرافیایی، شرایط جغرافیایی و تفاوت‌های آب و هوایی و گاه ناشی از شرایط انسانی مانند رواج الگوها و شیوه‌های زندگی شهری است که به نوبهٔ خود، بر تنوع و تفاوت‌های اقتصادی و اجتماعی روستاهای کشور تأثیر گذاشته است. از این رو نقطه آغازین توجه به توسعه پایدار روستایی شناخت میزان توسعه یافتگی سکونتگاه‌های روستایی بر اساس شاخص‌های گوناگون اقتصادی، اجتماعی و زیست محیطی است. در این پژوهش سعی شده به ارزیابی پایداری توسعه در دهستان دنباله رود جنوبی شهرستان ایذه بپردازد. در پی احداث سد کارون ۳ در سال ۱۳۸۳، حدود ۶۴ روستا (جمعیتی بالغ بر ۱۶ هزار نفر) از سه دهستان دهدز تخلیه شدند. به دلیل آبگیری سد، روستائیان زمین‌های کشاورزی و مراتع خود را از دست دادند و به حاشیه نشینی در شهرهای خوزستان و اصفهان روی آوردند. همچنین در فاز دوم، حدود ۶ روستا با جمعیتی بالغ بر ۲ هزار نفر به خاطر عبور دکل‌های برق فشار قوی نیروگاه سد کارون ۳ مجبور به تخلیه شدند. علاوه بر ۷۰ روستای مذکور، تعداد ۱۸ روستا که مربوط به دهستان دنباله رود جنوبی هستند؛ نیز در محاصره آب قرار گرفتند و راه ارتباطی آنان قطع گردید.

بجز مشکلات دسترسی در این روستاها می توان به مشکلاتی چون، کمبود و ضعف خدمات زیر ساختی – رفاهی، بهره‌وری اندک تولید، کمبود فرصت‌های اشتغال، مهاجرت فرستی، ضعف مدیریتی و غیره اشاره کرد. لذا این روستاها علیرغم پتانسیل‌ها در زمینه‌های مختلف از جمله جاذبه‌های طبیعی فراوان برای گردشگری، صنایع دستی، خاک حاصلخیز و مستعد برای تولیدات کشاورزی، گیاهان دارویی، منابع آب فراوان و ... تاکنون نتوانسته به جایگاهی که مستحق آنها است دست یابند.

۲. مبانی نظری تحقیق

مفهوم پایداری در چارچوب مبحث پایداری روستایی، بیانگر تعادل و پویایی سکونتگاه روستایی در ارتباط با ساختارهای طبیعی - اکولوژیکی، اجتماعی- فرهنگی و کالبدی- فضایی است، بطوری که متضمن پایداری سکونتگاه طی روندهای مکانی- زمانی گردد. توسعه پایدار روستایی را می‌توان فرآیندی از تغییر و تحولات، با هدف بهبود و ارتقای کمی و کیفی سطح زندگی جامعه‌ی روستایی دانست، فرآیندی که به ایجاد تعادل و توازن زیستی بین دو فضای شهری و روستایی می‌انجامد و عمدتاً در پی ایجاد توان‌افزایی و کارایی لازم برای جمعیت کم درآمد و فقیر روستایی است که کمتر قادر است بر توان خود بسنده کند و بر روی پای خود بایستد. برای سنجش پایداری به فراخور بعد مورد بررسی، وجود شاخص‌ها و چارچوب مناسب برای نیل به نتیجه‌گیری صحیح و منطقی ضروری است.

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در ارتباط با شاخص‌ها و نماگرها توسعه پایدار بسته به شرایط زمان، مکان و جوامع گوناگون مفهومی نسبی است. بنابراین مهم است که شاخص‌ها با دقت انتخاب شوند تا بتوانند شناخت مورد نظر را از توسعه پایدار نمایان سازند.

۳. روش تحقیق

این پژوهش بر اساس هدف کاربردی و براساس ماهیت توصیفی – تحلیلی است. داده‌های مورد نیاز با استفاده از شیوه کتابخانه‌ای و میدانی (پرسشنامه) گردآوری شده است. محدوده مورد مطالعه شامل ۱۸ روستا دارای سکنه و ۱۴۶۰ خانوار است. حجم نمونه براساس فرمول کوکران ۳۰۰ سرپرست برآورد گردید که بر حسب تعداد خانوار موجود در هر روستا بین سرپرستان خانوار توزیع گردید. تحلیل داده‌های حاصل از پرسشنامه با استفاده از مدل پرومتی (در محیط نرم افزار ویژال پرامتی) و سیستم استنتاج فازی (در محیط نرم افزار MATLAB) انجام گردید.

۴. یافته‌های تحقیق

براساس تکنیک پرامتی روستاها با توجه به سه جریان مثبت (Phi+)، منفی (phi-) و خالص رتبه‌بندی شده‌اند. روستاهایی که دارای بیشترین مقدار مثبت و کمترین جریان منفی باشند در جایگاه نخست و روستاهایی که از کمترین مقدار مثبت و بیشترین مقدار منفی برخوردار باشند، در جایگاه آخر پایداری توسعه قرار گرفته‌اند. نتایج به دست آمده از سیستم استنتاج فازی نیز نشان دهنده آن است که وضعیت پایداری دهستان مورد مطالعه بین دو سطح متوسط و پایین قرار دارد.

۵. بحث و نتیجه‌گیری

پژوهش زیادی در راستای پایداری توسعه سکونتگاه های روستایی صورت گرفته است. که توسعه یا عدم توسعه هر کدام از این سکونتگاه‌ها دارای شرایط مشابه و یا متفاوتی بوده‌اند. اما در روستاهای مورد مطالعه شاید دلیل ناپایداری و محرومیت سکونتگاه-های روستایی نسبت به دیگر سکونتگاه ها متفاوت باشد. چرا که در سازمان فضایی روستاهای مورد مطالعه به دلیل آبگیری روستاها تغییراتی زیادی صورت گرفته است. این تغییرات در نظام و عملکرد سکونتگاه ها نابسامانی‌هایی بوجود آورده است و کیفیت زندگی و رفاه ساکنان را تحت تأثیر قرار داده است. به عبارت دیگر می توان گفت شرایط زندگی قبل از آبگیری سد کارون۳ بهتر از حال بوده است. چرا که احداث سد مسیرهای ارتباطی روستاها با شهر، زمین های کشاورزی و باغات، مدارس، خانه بهداشت روستایی، منازل مسکونی، روستاهای خدمات دهنده و ... را تخریب کرده و روستاها تا این زمان در پشت سد به حال خود رها شده اند. مجموع عوامل فوق سبب شد که خیلی از خانوارها به اجبار مهاجرت کنند و امید و انگیزه، دیگر ساکنان نسبت به آینده روستاها در ابهام باشد. لذا در چنین شرایطی دخالت در نظام سکونتگاهی به منظور پایدار نمودن و بهینه سازی آن ضروری است.

کلید واژه‌ها: سنجش پایداری، تکنیک پرامتی، سیستم فازی، دهستان دنبالهٔ رود جنوبی.

تشکر و قدرانی

پژوهش حاضر حامی مالی نداشته و حاصل فعالیت علمی نویسندگان است.

ارجاع: کریم‌زاده، ح.، حسینی شه‌پریان، ن. و حسینی کهنوج، س. ر. (۱۳۹۸). ارزیابی پایداری سکونتگاه‌های روستایی دهستان دنباله رود جنوبی شهرستان ایذه با استفاده از تکنیک V- PROMETHEE و سیستم استنتاج فازی. *مجله پژوهش و برنامه‌ریزی روستایی*، ۸(۲)، ۵۹-۷۶.
http://dx.doi.org/10.22067/jrrp.v5i4.72236