Research Article

ASSESSING SUSTAINABLE RURAL DEVELOPMENT USING THE ROUGH SET APPROACH CASE STUDY: VILLAGES OF MAHAN-KERMAN DISTRICT

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Abstract: Rural development is one of the essential pillars of the five-year development plan of the Islamic Republic of Iran. Sustainability is one of the keywords in the structure of programs, plans, and all human beings. Due to their special geographical features, measuring the sustainability of rural areas is not an easy task. The most important tool for awareness of sustainable knowledge in rural areas is strategies and policies for the land. This study aims to develop a multivariate decision support system based on the Rough set approach to evaluate the potential of sustainable rural development in the Mahan region. Based on the subject under study and the purpose of the research, the hypothesis of the article is expressed with the following application: It seems that there is a relationship between rural empowerment and sustainable rural development. The methodology of this descriptive-analytical article based on Rough set theory has been studied in 11 villages of Mahan district. The general results of the research show that according to the decision table and straightforward rules, there is a relationship between the capability of the village - farmers, rural tourism, etc.

Keywords: Rural Development, Sustainable Development, Multivariate Index Analysis, Rough set Theory, Mahan.

Introduction

After the Second World War, a part of the world community faced many socio-economic problems, and the issue of economic growth and development was raised to solve their problems. Firstly, growth and development were considered equivalent, so that the United Nations (UN) considered six percent growth necessary to improve the social and economic conditions of underdeveloped countries (Bell and Morse, 2007, 23). Regarding the inefficiency of this theory, different views and theories were presented to pay attention to economic growth and development from each aspect (Pourasghar, 2006, 3). This ideological conception of development came to a standstill in the light of the many and varied critiques of the 1970s, particularly the 1980s. The concept of sustainable development, which was introduced in 1980, was a response to the destructive effects of the environment and society and, in general, to economic growth (Motiei and Shamsaii, 2009, 42). Perhaps the best definition of sustainable development is presented in the 1987 Brount Land Report, entitled "Our Common Future." At its 1987 meeting, the UN Commission defined it as:

"A development that considers meeting current needs without neglecting future production capacity to meet the needs of future generations" (Taylor, 2002, 2). Consequently, rural capability assessment is more necessary than ever (Eftekhari et al., 1999, 12). Generally, it can be supposed that the discussion of sustainability in sustainable development is engrained in biologists' studies and has since gradually entered the social, economic, and physical categories. In line with Rough set theory, much research has been done on its application in various fields - although it has not been used in Iran in the field of geographical sciences - some of which are mentioned below:

Piotor et al. (2014), in an article entitled “The Application of Dominance-based Rough Sets Theory for the Evaluation of Transportation Systems,” have concluded: 1. Identification of the essential features of the transportation system evaluation (in this analysis, 12 out of 24 major selected indicators were investigated, the most important of which was the road index), 2. Definitions of project development and evaluation (in this analysis), a set of dynamic decisions, 12 of the most important features were selected for further consideration. 3. Assigning the real-world transportation system is defined as classes, selecting legal decisions and relative intensity, and finding the final indicators are ranked based on the value of the proposed indicators. Boggia et al. (2014), in an article entitled “Assessing Rural Sustainable Development potentialities using a Dominance-based Rough Set Approach,” concluded that there is an integration between the development and sustainability of each village. Likewise, the rough set theory analysis showed a high capability in management and planning and indicators of sustainable rural development. This research pursues an expert answer to the following question: Is there a significant relationship between rural empowerment and sustainable rural development?

Study area

Mahan is one of the districts of Kerman city. Mahan is the most pleasant climate near Kerman, which has two famous tourist attractions: Shahzadeh Garden, which is one of the famous Iranian gardens and was built during the Qajar period, and the tomb of Shah Nematullah Vali, the famous Iranian mystic, is located in this area. In this section, there are beautiful summer villages that are one of the target centers and examples of tourism in Kerman province. The population of the villages studied in this section is 5723 according to the 2020 population and housing census (Statistics Center of Iran, 2020).

Theoretical Foundations

Sustainability is described as the ability of the ecosystem to support human life and social welfare, which is supported by a vibrant economy and is stable with the health of the ecosystem (Motiei Langroudi and Shamsaii, 2009, 7). Generally, sustainability is recognized as an essential part of the ideology of the new world order, and all trends and tendencies are related to it (Rezvani, 2008, 107). Regarding the importance of the issue, sustainable rural development is a long-term process that provides needs and welfare for the villagers, improves the quality of life, and reduces poverty, which this development needs to maintain human and social assets that we have inherited from the past. If sustainability is the goal, sustainable development is the path to it. In other words, sustainability is not a limited and established concept (Ghadiri and Azmi, 2009, 25). In sustainable development, the principle is that essential natural resources are protected, so that future generations produce and consume at least as much as the current generation (Pourtaheri et al., 2010, 4).

Sustainable development pursues several goals that are not limited to time and place. Key features of these goals are intergenerational and intragenerational justice, socially, geographically and community management, protection of natural environments and living within caring capacity, minimal use of non-renewable resources, economic vitality, diversity, community self-reliance, individual well-being, and meeting basic human needs have been expressed (Maclaren, 1996, 184). Rural empowerment raises rural issues in economic, social, and environmental dimensions at the village level. This level of development refers to all individual and social activities in the rural environment to live and ensure the material well-being of the villagers (Ghanbari et al., 2014, 8). Due to this fact, sustainable development is the realization of economic, social, and environmental ideals in rural areas. In this approach, the basis of development is the people. Though, agricultural-rural policies concerning the country's villages have increased in the last three decades after the revolution.

Regarding the primary purpose of the current study, based on using an appropriate model for ranking the levels of sustainability in rural areas, this article emphasizes the sustainable development approach. Rough set theory is used to assess the sustainability of villages in Mahan-Kerman. For this purpose, first, the framework for organizing sustainability indicators is proposed. Then with a brief introduction of methods and models of measurement and measurement, the features and characteristics of some of them are presented in accordance with the objectives of the research. In rural areas, development must lead to improved socio-economic conditions. Based on the European Union, the following are used as guidelines for the modernization of the Sustainable Development Strategy for the years 2006-2009 (Coups & Crabtree, 1996). Rural development must lead to sustainable rural development. The goals of sustainable rural development are as follows:

1. Diversification of agricultural products;
2. Multipurpose agriculture (increasing social, environmental, cultural, agricultural, and productive functions).
3. Improving food security;
4. Employment and public income in rural areas;
5. Natural resource management and environmental protection;
6. Protection of social and cultural traditions in rural areas;

The results of sustainable rural development should lead to the achievement of rural communities with the following goals:

- Position stability and stable economy.
- Being able to attract people and skills, build capacity and participate in growth and development.
- Ensure protection and management of the environment (Baldock et al., 2001).

Sustainable rural development is a multidimensional concept (Kitchen & Marsden, 2009, 2). In this regard, multiple criteria decision aiding (MCDA) is one of the appropriate tools to evaluate its process (Figueira et al., 2005). This factor is for better evaluation of programs and plans related to rural development and better analysis of local opportunities and capabilities. In this way, the possibility of managing rural development will be realized. Measuring the level of sustainable rural development in rural areas, finding differences in the villages' level, providing the best decisions, and allocating resources are necessities. The decision support system helps us maintain and improve the level of development and sustainability in rural areas. The rough set approach has been used to observe these villages, develop a decision support system, and assess the potential of sustainable rural development. For this evaluation, a set of selected indicators of rural development and sustainable development has been used.

Organizational frameworks for sustainability indicators

"Framework of Sustainability Indicators" is a structural concept that organizes the essential elements or components and the link between sustainable development in the form of a general and unified image. On the other hand, because the issues related to sustainable development are many, complex and interdependent, a framework is needed to be able to integrate issues related to sustainability based on a multidisciplinary approach and the main changes to meet the fundamental changes to achieve sustainable development goals (LEPAE, 1998, 2).

In principle, a conceptual framework is interrelated, principles and ideas that help organize and direct thinking about specific outcomes or topics in sustainability. Frameworks organize specific indicators or sets of indicators logically to be used for a variety of purposes. Frameworks also guide the two processes of data set and information, and summarizing essential information taken from different sections, is considered a helpful communication tool for decision-makers. On the other hand, frameworks deal with the logical classification of related information sets and, while combining and interpreting indicators, help to identify critical issues about which there is little information and, consequently, identify the data to be collected (Badri et al., 2012, 25). Consequently, the chief objectives of selecting and organizing the appropriate framework for sustainability indicators are:

A. *Providing a logical structure*: One of the goals of the package of sustainability indicators is to help determine the essential dimensions of sustainability, classify phenomena, and determine the extent and direction of change. Hence, paving the way for achieving a logical and understandable structure for managing the index design process (and collecting and measuring the index) is necessary.

B. I*dentify Relationships Between Components:* Sustainability frameworks should be symbolic of the basic components of sustainability and how they are related and linked on the one hand and with sustainability goals on the other. This conceptual image will help understand the nature of sustainability and build a consensus on a set of indicators (LEPAE, 1998; Ewert et al., 2005).

Organizational frameworks for sustainable development indicators are designed and used in accordance with the goals and realities of the international environment and national-local conditions to achieve the mission and goals of sustainable development. Hence, each framework has its characteristics; consequently, each framework has its characteristics, but in general, the criteria characteristics of a suitable framework for organizing sustainability indicators can be being understandable, comprehensiveness, scalability, compatibility, stability and internal coordination, dynamism, realism, and purposefulness (LEPAE, 1998: 3-4).

Various frameworks have been suggested for organizing the index regarding the approach, scientific origin, different goals, and dimensions assumed for sustainable development. These include the framework of driving forces, status, response, thematic framework, the proposed framework of FAO sustainable development indicators, the framework of pressure state response (PSR), the framework of driving forces-pressures-state-impacts-responses, the proposed framework of the world conservation union natural, European commission framework for agricultural and rural development, tree domain framework, (Triad), goal-based frameworks, criteria sustainability framework, hierarchy framework, global capital-based framework, frameworks proposed by regional and national institutions and experts (Ministry of Agriculture-Jihad, 2007, 130). According to the current literature, there are three fundamental aspects in measuring indicators: first, indicators are necessary due to their nature and unit of measurement, and secondly, if necessary, they should be weighed[1]. Third, a suitable method should combine the indicators and determine the unit score to compare the results.

In the case of simple data standardization methods, based on experiences in various scientific and primarily statistical fields, they have been used extensively in many measurements focusing on the stability of some methods due to their simplicity. The primary assumption of these methods is that due to the different data and indicators in terms of nature (for example, average annual household income and agricultural land density) and unit of measurement (Rials per hectare or square kilometer), for any comparison and combination, they should be released from the scale or make them so-called unscaled. Some of the essential methods used in stability measurements are the unscaling fuzzy method, linear unscaling method (Prescott-Allen, 1999), percentage or relative unscaling method, standard score method (Nardo & et al., 2005), method of division by means, and Euclidean method (Kalantari, 2002). Nonetheless, the most important and, at the same time, the most controversial process of developing sustainability indicators is how the data are combined as a result of measurement. The complexity and importance of the issue are such that there is still no clear basis or a unified method accepted by experts and even relevant international institutions.

On the other hand, dispersion in the use methods does not provide the possibility of the proper set. Generally, what is most common, consists of two categories of simple computational methods and relatively complex methods of inferential statistics. As the name implies, simple computational methods are one of the most common methods for combining indices due to their simplicity. In this format, different methods are used, some of the most important: arithmetic mean method, geometric mean method, set theory-based method (Ibid, 45), and method of calculating the sum of points. On the other hand, methods designed based on index of the unit of measurement of sustainability such as "ecological footprint" (Hardi et al., 1997: 49), "sustainability barometer" (Sors, 2001: 12, "The Dashboard of Sustainability" (Hardi & Atkisson, 1999), Cobweb of Sustainability (Bossel 1999, 1999) and Method of Multi-Criteria (Saaty, 2007) do not allow for proper summarization. Some of these models, which have emerged since the development of sustainable development indicators, are organized in a way that is not just a measurement model but a single package with defined indicators, which is the process of designing and measuring sustainability indicators. At the same time and simultaneously, and in other words, there is no possibility of entering, occupying, and replacing them. In the meantime, some are considered a way to combine indicators that can be used at any level. However, the interest in multi-criteria analysis and evaluation methods in management sciences, especially strategic planning, has a relatively long history, and its techniques are evolving in various ways. In recent years, especially since the 1980s, some of its techniques have also been considered in regional planning and development sciences. Techniques of "Decision Analysis" (DA), "Multi-Attribute Utility Theory" (MAUT), "Multi-Criterion Decision Making" (MCDM), "Social Judgment Theory" (SJT), "Multi-Criteria Decision Making" (MADM), and Multivariate Criteria Analysis (Tawfiq, 1993; Asgharpour, 1998; Kazemi, 2005).

In the current paper, in evaluating the potential of sustainable development among the mentioned techniques related to measuring sustainable development indicators, "rough set theory" has been paid the most attention. Regarding the importance of the subject under study, the rough set theory was founded in the early 1980s by Professor Zdzisław Pawlak. Finding an equivalent word for "ROUGH SETS" is problematic. In the dictionary, the word "ROUGH" has equations such as coarse, approximate, rude, turbulent, and uneven (Honby, 1974). Among

[1] Of course, giving weight to indicators is just as important as not giving them weight.

these words, the word approximation is more similar to the concept intended by the founder of this theory. However, none of these words have the meaning of the Latin word itself, so in this article, the term “rough sets” will be used as its equivalent. In MCDM problem-solving decision theory or multi-criteria decision-making, problem indicators are generally assumed to be fixed, depicting unrealistic conditions for problem-solving.

Consequently, to solve problems in which decision-makers violate their preferences concerning the criteria of the problem of action and independence between the indicators of the problem, we practically need a rough set theory (Javadi et al., 2012, 1). The purpose of using rough sets is to deal with the uncertainty and ambiguity that we face in some issues. This theory generalizes classical set theories based on three-valued logic to work with incomplete and inconsistent data and reduce redundant data over database requirements. The primary purpose of Rough set analysis is to obtain approximate concepts from the acquired data. The basis of the theory is formed by the concepts of standard approximation set, upper approximation set, and boundary area (Mirufakhreddini, 2012, 69).

Rough set theory is a new mathematical method for intelligent data analysis and data mining. Almost twenty years after the founding of the rough set theory, its application methods have reached a certain degree of perfection, and in recent years there has been a rapid growth in attention to the rough set theory and its applications around the world. It is seen. This theory deals with the analysis of data tables. The primary purpose of RST analysis is to obtain approximate concepts from the acquired data. This theory is a powerful mathematical tool for reasoning in ambiguity and uncertainty cases that provide methods for removing and reducing irrelevant or redundant information and knowledge from databases. A set of meaningful summarized rules is obtained by reducing information that dramatically simplifies the decision-makers' work. So, due to the rapid growth of data volume, RST can play a very influential role in decision support systems (Ziarko, 1993, pp. 213-228). A rough set consists of several objects in a data table described by a set of attributes. In this table, the objects are in the row, and the attributes are in its columns (In this article, the attributes of the villages are placed in the rows, and the names of the villages are placed in the columns). Therefore, each village is declared by the mentioned attributes (population, rural technology, rural tourism). A decision table called S formation is represented as S = <P, Rt, I, N>, S. U is a finite set of villages, U is called the reference set, {U = D1, D2,…, D11}, and set A is a finite and infinite set of properties.

A = {P, RT, I, N}

V ∪⊂ V

In this table, a function called information function is defined as f: U × A□V; So that for each x∈U and P∈A, the vector is expressed as follows:

(DesA (x) = [f (x, p1), f (x, p2), f (x, P)

If in a data table, attributes A are divided into two groups of conditional attributes, denoted by C, and the decision attributes, denoted by D, so that C∪D, such a table is sometimes called a decision table. This particular type of information table represents information about the decision-making process and has many practical applications (Table 1).

P = population of villages

RT = Rural tourism

ICT = Information Technology

N = number of farmers

Position attribute = {P, RT, I}= Decision attribute = {N}

This theory is based on the concept of upper approximation and lower approximation for a set, based on summarizing data, eliminating additional features, and extracting rules, among the applications of rough theory (Tavakkoli et al., 2013, 3). The set U is classified according to the properties of A, based on the equivalent classes. Then we calculate the upper and lower approximations according to these two relations:

$$\underline{B}X = \{x | [x]B \subseteq X\} (Lower\ approximation) \quad and \quad \overline{B}X = \{X | [X]B \cap X \neq \emptyset\} (Upper\ approximation). \tag{1}$$

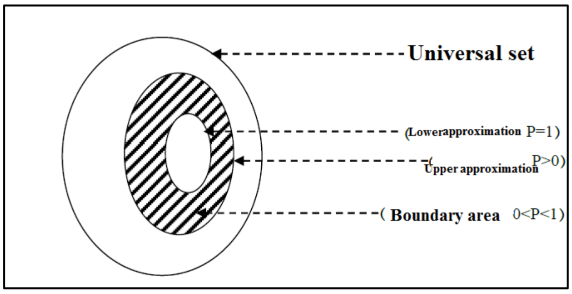

Figure1: The boundary area of a rough set

Method

Rough set's theory was proposed by Zdzisław Pawlak in 1980 (Pawlak, 1982, 1991). Rough set theory philosophy is based on approximating a certain amount of information (data, knowledge, etc.) (Boggia et al., 2014, 161). In this research, first, position and decision features were selected based on selected characteristics, and then, based on Rough set theory, villages were classified regarding the indicators. Equivalent villages (indistinguishable and similar in several characteristics) were identified. Then, by determining the reference set and sub-sets, the upper and lower approximation limits are determined, and according to the reduction of redundant data and finding value reduction, the rules are extracted according to the target villages. We examined the results of the dependence of the decision property on the situation property.

Findings

According to the Rough set approach and indicators of target villages, the following process will be considered. A. Specifying a set of villages based on the stated indicators (specify a decision table called S), which is S (U, D, C) and indicates the set of considered villages, the set of decision features, the set of location features, respectively.

Table 1: Characteristics of selected villages

Row	Name of village	Village population	Rural ICT	Rural tourism	Number of farmers
D1	**Langar**	2153	1	4	630
D2	**Qanatghestan**	1083	1	2	517
D3	**Hojjat Abad**	709	1	1	170
D4	**Ismael Abad**	665	1	1	151
D5	**Sekonj**	543	1	4	140
D6	**Arab Abad**	329	1	3	90
D7	**Karim Abad**	67	0	2	20
D8	**Zeynal Abad**	59	0	1	15
D9	**Zahrud**	51	0	1	11
D10	**Amir Abad**	47	0	1	10
D11	**Rughanuiyeh**	17	0	1	5

In this table, the villages are in the rows, and the indicators are in the columns. So, each village is described by the mentioned indicators. The data table is represented by S = <U, P, T, I>, S. In U, S is a finite set of objects, U is called the reference set. {$P = P_1, P_2, \ldots P_m$}, a finite set of attributes, and VP is also called the domain of attributes. First: The table of functions called the information function is defined as f: U × P□V; so that for every x ∈ U and p ∈ P, the vector is expressed as follows:

$Des_Q(x)=q\ \ [f(x,p_1)\,f(x,p_2),\ldots,f(x,q_m)$

If in a data table, the index p is divided into two groups of attributes provided that it is denoted by C and the decision attributes denoted by D, so that $C \cap D \neq \emptyset$andC ∪ D, then such a table is called the decision table. This particular type of information table represents information about the decision-making process and has many practical applications (Table 1).Indicators

A1, the population of villages

A2, number of farmers

A3, Rural Technology

A4, rural tourism

We introduced rules based on indicators; and then defined the rules based on the excellent, good, moderate, and weak classes. We examined the minimum credit or value for each class or group.

Rural population laws:

High = (500 - 1000) population

Good = (200 - 500) population

Average = (100 - 200) population

Weak = (10-100) population

Rules related to the number of farmers:

High = (200 - 500)

Good = (100 - 200)

Average = (50 -100)

Weak = (5-50)

Laws related to rural technology:

High = (3)

Good = (2)

Average = (1)

Weak = (0)

Laws related to rural tourism:

High = (4)

Good = (3)

Average = (1)

Weak = (0)

B, Table 2, specifies a decision table called S. According to Table 1, the rules specified are the characteristics of the situation and the characteristics of the decision. The decision characteristic is in the number of farmers (N), and the position characteristics include (P, I, RT).

Table 2: Decision Table

Villages	U	P	I	RT	N	Result
Langar	D1	High	Average	High	High	High
Qanatghestan	D2	High	Average	Good	High	High
Hojjat Abad	D3	Good	Average	Weak	Good	Good
Ismael Abad	D4	Good	Average	Weak	Good	Good
Sekonj	D5	Good	Average	High	Average	Average
Arab Abad	D6	Average	Weak	Good	Average	Average
Karim Abad	D7	Weak	Weak	Average	Weak	Weak
Zeynal Abad	D8	Weak	Weak	Weak	Weak	Weak
Amir Abad	D9	Weak	Weak	Weak	Weak	Weak
Rughanuiyeh	D10	No	Weak	Weak	No	No
Zahrud	D11	No	Weak	Weak	No	No

Via the decision table based on the result, two villages, D10, D11, which are incompatible with the rule, are removed, and the rest of the villages that comply with the rules are considered (Rughanuiyeh and Zahrud villages were removed).

Table 3: Determining the number of villages based on the rules set for the formation of equivalent classes

Per	**High**	**Good**	**Average**	**Weak**
P	2	3	1	5
I	0	0	5	6
RT	2	1	2	6
N	1	4	1	5

Using the decision table based on the result, two villages, D10, D11, which are incompatible with the rule, are removed, and we consider the rest of the villages that comply with the rules (Rughanuiyeh and Zahrud villages were removed).

C- Via equivalence relations (classification), we classify villages into classes. That is, villages (D1, D9), as follows: based on P = population of villages

{D1, D2}= High

{D3, D4, D5}= {Good}

{D6} = {Average}

{D7, D8, D9} = {Weak}

Based on I = Information Technology Ict

{D1, D2, D3, D4, D5} = {Average}

{D6, D7, D8, D9} = {Weak}

According to Rt, rural tourism

{D1, D5}= {High}

{D2, D6}= {Good}

{D7} = {Average}

{D3, D4, D8, D9} = Weak

Table 4. Formation of matrices based on properties

P	**Rt**	**I**	**N**
{D1, D2}	{D1, D5}	{D1,D2,D3,D4, D5}	{D1, D2}
{D3,D5, D5}	{D2, D6}	{D6, D7, D8,D9}	{D3, D4}
{D6 }	-	-	{D5, D6}
{D7, D8, D9}	-	-	{D7, D8, D9}

Based on I = Information Technology Ict

According to Rt, rural tourism

Finally, this stage generally examines and classifies the characteristics of the situation of villages based on (I, RT, p).

{D1, D2}= {High, High, Average}

{D3, D4, D5}= {Good, Good, and Average}

{D6}= {Average} {Average} {Weak}

{D3, D4, D5}= {Good, Good, and Average}

{D7, D8, D9}= {Weak} {Weak} {Weak}

P, RT, I = {D1, D2} = Result {High}

{D3, D4, D5} = Result {Good}

{D6} = Result {Average}

{D7, D8, D9} = Result {Weak}

Villages D1, D2 are indistinguishable in terms of characteristics (P, Rt, I). That is, they have the same value in these properties. The villages D3, D4, D5, according to their characteristics (P, Rt, I), which are similar, are placed in one class and considered a subset.

D, knowledge dependence

{D1, D2} {D1, D2}

{D3, D4} {D3, D4, D5}

{D1} {D5, D6}

{D7, D8, D9} {D7, D8, D9}

The above statements show that the equivalence relations of the number of farmers depend on the population of the villages. We will determine the upper approximation, the lower approximation, and the boundary areas in the following.

U = {D1 to D9}

U = {D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11}

Lower approximation = the community of all equivalent classes that are a subset of t, (i.e., properties + position + decision properties + village set) are members that certainly belong to the set.

{D1, D2, D3, D4, D5, D6}

It will probably have the correct number of farmers (upper approximation).

Result (Langar and Qanatghestan) {D1, D2}

Lower approximation of the set {D1, D2, D3, D4, D5, D6}

And set {D1, D2, D3, D4, D5, D6, D7}

Upper approximation of {D1, D2, D3, D4, D5, D6}

Moreover, the set {D3, D4, D5, D6} is considered as the boundary area of the set {D1, D2, D3, D4, D5, D6}.

Given that in the decision table, the characteristic of the number of farmers {W} is the characteristic of the decision. At the same time, the characteristics of the importance of villages, rural tourism, and rural technology centers are the characteristics of the situation. The characteristics of the decision determine what decisions to make to convince the characteristics of the situation.

Inference of rules

Contains contradictory rules. The characteristics of the situation are the same, but the characteristics of the decision are different. Compatible rules have the same characteristics (situation), and the characteristics of the decision are the same.

If all the rules in the decision table are consistent, we set the Ratio of consistent rules in a decision table stability limit to one. As a result, a unique decision is made. Nevertheless, if the stability limit of an information system is less than one, a sufficient decision cannot be considered. So it can be said with certainty that villages D1, D2 are suitable in terms of the number of farmers, but villages D7, D8, D9 are weak in terms of the number of farmers. This means that the number of farmers is low, and in the case of villages D5 and D6, it is not possible to say what their situation is.

N= {High} If {P, RT, I} = {High}

IF P= Good, RT= Good, I= Average → N = (Good)

If p= Average, RT= Good, I= Average → N= {Average}

If p = Weak, RT = Average, I= Weak → N= {Weak}

Data reduction

It is clear that {p, RT, I} are three reductions, and positions on attribute I (Rural Information Technology) can be omitted from the rules given above.

Value reducer

Since rule 1 is derived from the relation (N1) (number of farmers) subset (P1), which is the same as the population of villages. Thus we can show the description of N1 by Result = High alone, which is called the value reducer.

N1 = {U: up = High}

Via these arguments, we can summarize the rules:

1- If p = High Result = High

2- If p = Good Result = Good

If p = Average Result = Average

Conclusion

There is an association and integration between the level of development and sustainability of each village. Consequently, Rough set's approach is used to assess the potential of rural areas. We can use this approach in qualitative evaluation. The decision support system helps us get a lot of information with simple questions and get feedback. In addition, decision-makers can well support this approach. The decision support system can solve an extensive range of issues and give them more information about the decision. The methodology used in this paper is very similar to the ELECTRE, fuzzy rough set model, DRSA. Thus, sustainable rural development is a multidimensional concept. In this regard, the Rough set can improve the number of indicators. Likewise, the Rough set theory analysis revealed a high capability in the concept of management and planning and indicators of sustainable rural development.

Regarding the Rough set theory, the villages of Sekonj and Langar have more potential than other villages. The villages of Qanatghestan, Hojjat Abad, and Ismailabad were virtually indistinguishable due to their similar characteristics. Therefore, due to their equivalence with the Rough set theory, they were recognized. With the set of features and location of the villages and the straightforward approach, the two villages of Sekonj and Langar have a higher capability. The following ranks of sustainable rural development capability in the Mahan section of Kerman were assigned to Karim Abad and Arababad villages. Considering the importance of the subject and the research hypothesis, we concluded that the selected villages have a comparative advantage over other villages in terms of several indicators. Though, essential indicators such as fixed and floating population and seasonal in the studied villages cannot be ignored. In these villages, the sum of natural and human capabilities and existing infrastructure can indicate - the importance of villages in ranking based on the Rough set approach - regarding the indicators of sustainable development selected villages in Mahan district.

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