*J. Agr. Sci. Tech. (2020) Vol. 22(2): 389-400*

# Sustainability Analysis of Family Farming System in Kermanshah Province: Using DPSIR Framework

A. Papzan[1], and Sh. Geravandi[1*]

## ABSTRACT

**This study aimed to address analysis and zoning of sustainability of family farming system in Kermanshah province. To achieve this objective, two steps were taken: (1) Identification of a comprehensive framework to measure the sustainability of family farming system, and (2) Evaluation criteria and sub-criterion weight for the proposed framework by conducting Fuzzy Analytical Hierarchy Process (FAHP). In this regard, firstly, 12 agrarian experts who had theoretical and practical experiences were selected by purposed sampling for FAHP. Secondly, descriptive cross-sectional survey was carried out on family farming system. Results of FAHP revealed that management, capitals, vulnerabilities, and stresses were of utmost importance in a context of sustainability of family farming system, respectively. According to the findings, Eslamabad-e Gharb and Harsin with scores of 72.91 and 58.76 have high sustainability. In contrast, Qasr-e Shirin (20.92) showed high unsustainability. Furthermore, Sarpol-e Zahab, Kermanshah, and Javanroud with values of, respectively, 57.95, 57.37, and 52.92 lie in the middle of the spectrum.**

**Keywords**: Agrarian System, DPSIR, Fuzzy Analytical Hierarchy Process.

## INTRODUCTION

Currently, there are 500 million family farms in the world, accounting for 98% of farms. Moreover, family farming is the main form of agriculture in the countries of the world. Particularly in developing countries, 70% of the population live in rural areas and depend on agriculture for subsistence and income obtained from agricultural activities. [21]. There is also evidence that tends to confirm the high potential (poverty alleviation, food security, and economic growth etc.) of family farming [6, 50, 21, 31, 24]. In other words, this type of agrarian system can promote the farmer environment relationship, as it ensures not only family subsistence but also an interaction with the community, establishing relationships with other farmers, and with the rural environment [6].

Different definitions are introduced for family farming systems, each focusing on a particular aspect [34, 13]. Overall, Family farms are defined by two criteria: the importance of family labor and the transfer of ownership, land tenure or management to the next generation [51].Farming systems in large parts of Iran are intensifying, thus family farming system is common and there is heavy reliance on land. This is an issue of concern, because, on the one hand, it can endanger food security. On the other hand, it may impose heavy political, economic, and social burden on nations. Briefly, the term "unsustainability" is a more suitable word to describe this situation.

Despite the importance of sustainability in agrarian systems, we are witnessing an old, superficial, and repetitive and one-dimensional research in this field. Hence, there is lack of applied research in the area

[1] Department of Agricultural Extension and Education, Faculty of Agriculture, Razi University, Kermanshah, Islamic Republic of Iran.

[*] Corresponding author; e-mail: sh.geravandi1@razi.ac.ir





[ DOR: 20.1001.1.16807073.2020.22.2.9.7 ]

of sustainability, especially a comprehensive framework and basic indices to measure sustainability of agrarian systems. It seems that this is due to low awareness and little research conducted from this angle. Accordingly, the continuation of this trend in the country would lead to stagnation and, even in some cases, backwardness and intensifying unsustainability in the agrarian systems.

Nowadays, we are witnessing a variety of unsustainability in agrarian systems. In order to prove this claim, consider the following points: reduction in the annual agricultural GDP from 3.9% in 2009 to -5.8% in 2013, increase in urbanization from 31% in 1956 to 72% in 2011, further reducing in food production from 2.25% during 1996-2001 to 1.41% during 2006-2011, reduction of average grain yield from 2,415 kg $ha^{-1}$ in 2004 to 2,227 kg $ha^{-1}$ in 2012.

All these cases only show a small fraction of the declining status of the agrarian system; however, if the sustainability of agrarian systems was scientifically and practically addressed, not only such problems would not realize but also the country's agrarian systems would thrive and grow. Sustainability is a social concern and a new strategic factor for productive and economic viability. Nevertheless, research on sustainability as a holistic approach is limited in general and family farms in particular. [18]. Previous literature has shown that peasant farming systems have less use of machines and fertilizer and, in terms of environmental considerations; they have the greatest potential compared to the commercial and production cooperatives [33]. In this regard, Abbasizaded Qanavati *et al.* (2012) [1] showed that this system is economically and environmentally unsustainable and socially semi-sustainable. In addition, Motiei Langroudi *et al*. (2010: 323) [23]. Result showed that sustainability of family farms is somewhat greater than rural cooperative system. In addition, there is limited literature on theoretical framework to assess sustainability of agrarian system.

Studies carried out in this field have shown that different frameworks are used as follows: Tree farm sustainability [27], Indicateur de Durabilité des Exploitacions Agricoles (IDEA) [37], Indicator of sustainable agricultural practice (ISAP) [32], Multiscale Methodological Framework (MMF) [19], Sustainability Solution space (SSP) [6], PSR [35, 5], and Response-Inducing Sustainability Evaluation (RISE) approach. However, none of these frameworks is comprehensive to measure sustainability in agrarian systems.

In-depth exploration revealed that the DPSIR is a comprehensive framework (Figure 1). DPSIR is short for Driving forces, Pressures, State, Impacts and Responses [10]. The DPSIR approach was formerly developed by OECD in the PSR form and was used to highlight relationships between human activity and environment degradation. It is based on a concept of causality: human activities exert pressures on the environment and change its quality and the quantity of natural resources. Society responds to these changes through environmental, general economic, and sector

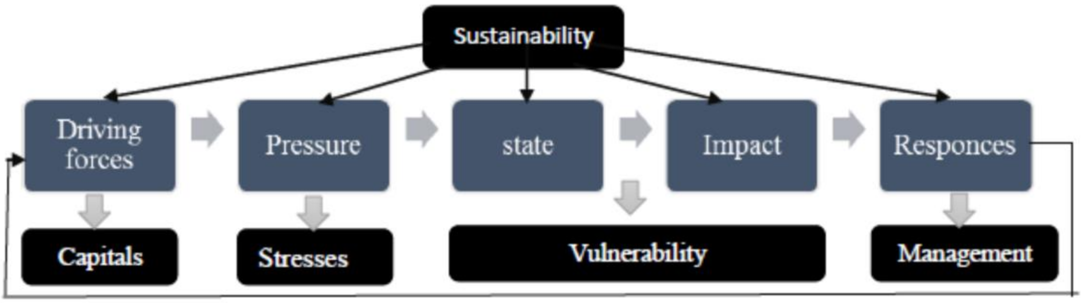


**Figure 1.** Theoretical framework (Asadi and Varmazyari, 2010) [3].





[ DOR: 20.1001.1.16807073.2020.22.2.9.7 ]

policies. The latter form a feedback loop to pressures through human activities [28]. Piedra-Muñoz (2016: 11) [18] state that DPSIR has provided a discourse-selective framework for knowledge production.

Therefore, the present study seeks to fill the research gap on sustainability analysis of family farming system, particularly in Kermanshah province. More specifically, the following questions were systematically investigated:

-Which framework is best suited for measuring the sustainability of family farming system?

-What are the priorities for criteria and sub-criterion in the proposed framework?

-Is there any zonation for the sustainability of family farming system in Kermanshah province?

## MATERIALS AND METHODS

### Study Area

The fieldwork took place in Kermanshah Province in 2016. This province is located in west of Iran. Kermanshah has an agriculture-driven economy. In this province, there are 120,827 agricultural units, of which about 97.2% and the most common crops are wheat and barley. Agro industry, rural cooperatives, share cropping, cash-rent, Farm Corporation, and family farming are operating in this province. In Figure 2, locations in blue have higher agrarian diversity.

### Data and Methodology

This study aimed to address analysis and zoning of the sustainability of family farming system in Kermanshah Province. To achieve this objective, two specific steps were taken: (1) Identification of a comprehensive framework to measure the sustainability of family farming system, and (2) Evaluation criteria and sub-criterion weight for the proposed framework by conducting Fuzzy Analytical Hierarchy. In this regard, firstly, 12 agrarian experts who have theoretical and practical experiences were selected by purposed sampling for FAHP. Secondly, descriptive cross-sectional survey was carried out on family farming system.

The steps are further described below.

### Step One

First, we critically introduced a comprehensive framework to measure sustainability in the agrarian systems (DPSIR Framework). Then, 12 major experts were identified by criterion, snowball and opportunistic sampling

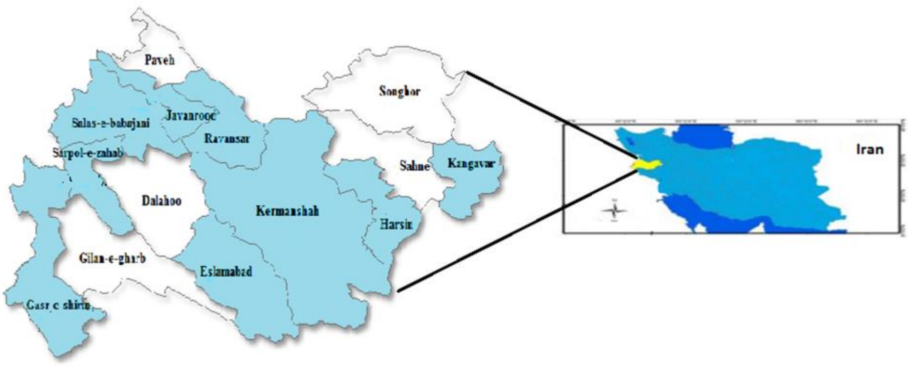


**Figure 2.** Map showing location of Kermanshah Province.

methods [26]. In this regard, two criteria were used to select the experts: First, those who had field experiences about agrarian systems. Second, those who also had published documents such as articles, books, and research project reports. Study participants are shown in Table 1.

Then, the participants were asked to make pairwise comparisons on criteria and sub-criteria levels.

After that, in order to calculate the fuzzy numbers in FAHP, Kong and Liu's (2005: 408) [16] method was used.

## Definition of New Fuzzy Comparison Matrix

The difference of fuzzy comparison matrix was presented by Kong and Liu (2005) [16]. They used membership scales instead of using a Saaty's scales 1 - 9, as the values of elements (matrix A').

$$A' = \begin{bmatrix} \frac{w1}{w1+w2} & \frac{w1}{w1+w2} \cdots & \frac{w1}{w1+wn} \\ \frac{w2}{w2+w1} & \frac{w2}{w2+w2} \cdots & \frac{w2}{w2+wn} \\ \frac{wn}{wn+w1} & \frac{wn}{wn+w2} \cdots & \frac{wn}{wn+wn} \end{bmatrix} = \begin{bmatrix} r_{11} & r_{12} \cdots & r_{1n} \\ r_{21} & r_{22} \cdots & r_{2n} \\ r_{n1} & r_{n2} \cdots & r_{nn} \end{bmatrix} \quad (1)$$

If this comparison matrix is consistent, it should satisfy:

$$r_{ii} = 0.5, r_{ij} + r_{ji} = 1, \frac{1}{r_{ij}} - 1 = \left(\frac{1}{r_{ik}} - 1\right) \times \left(\frac{1}{r_{ki}} - 1\right)$$

The meaning of our membership scales can also be expressed in the same way as Saaty's scale, see Table 2.Theoretically, the membership scales put forward in this paper and Saaty's scales should satisfy the following:

$$r_{ij} = \frac{a_{ij}}{a_{ij}+1}, \quad (2)$$

Membership scales were calculated for each of the criteria and sub-criterion. The values membership of scales falls within the range of (0 and 1). In order to calculate the priority of Weights, the following formulas were used.

$$W = (w_1, w_2, \dots, w_n) \quad (3)$$

$$w_i = \frac{b_i}{\sum_{i=1}^{n} b_i}$$

Where, bi is calculated as follows:

$$b_i = \frac{1}{\left[\sum_{j=1}^{n} \frac{1}{r_{ij}}\right] - n} \quad (4)$$

Consistency Test of Comparison Matrix

To calculate the Consistency Index, the following equations were also used.

$$CR = \frac{CI}{RI} < 0.1 \; CI = \frac{\sum_{i=1}^{n} \frac{(AW)i}{nw_i}}{n-1} \quad (5)$$

The various values of RI are shown in Table 3.

## Step Two

At this step, the population study consisted of all wheat farmers in Kermanshah Province, where most wheat farms are dry land (N= 275,528). According to Bartlett *et al*. (2001) [5], 370 samples were selected by using three-stage cluster sampling. Reliability and validity of researcher-made questionnaire was checked by Cronbach's

**Table 1**. Characteristic of research participants.

| Number of key informants | Expertise |
|---|---|
| 2 | Rural Sociology (Tehran University) |
| 4 | Agricultural Extension and Education (University of Shiraz, Ilam University, University of Tarbiat Modares, Razi University) |
| 2 | Economic and Agricultural Development (Tehran University) |
| 2 | Researcher (Members of Iranian Society of Consulting Engineers and Staff of Ministry of Agricultural ) |
| 1 | Geographical Science and Rural Planning (Tehran University) |
| 1 | Agricultural Economic and Development (Members of APERDRI) |





[ DOR: 20.1001.1.16807073.2020.22.2.9.7 ]

**Table 2.** A scale for fuzzy pairwise comparisons. [a]

| The relative importance of two sub-elements | values |
|---|---|
| Equally important | 0.5 |
| Slightly important | 0.55 or (0.6-0.5) |
| Important | 0.65 or (0.6-.7) |
| Strongly important | 0.75 or (0.7-0.8) |
| Very strongly important | 0.85 or (0.8-0.9) |
| Extremely important | 0.95 or (0.9-1) |

[a] Source: Kong and Liu, 2005: 408 [16].

**Table 3**. Values of Random Index.

| Size of matrix | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| RI [a] | 0 | 0 | .58 | .90 | 1.12 | 1.24 | 1.32 | 1.41 | 1.45 | 1.49 |

[a] Random Index

Alpha and educational experts (> 0.7). In order to analyze the data, the SPSS software was used. In the present study, to evaluate some variables, their special equations and components were used (see Table 4).

Furthermore, we used composite index to calculate and integrate the mean scores of the different variables in our research. Thus, each component was divided by the average and summed up with the others.

Finally, in order to sum all analyses and impose weight values obtained from fuzzy AHP, Morris development model was used as follows:

Input variables are transformed into reduced dimensionless variables in the interval (0, 100). Thus, negative values convert to positive value using $1/Yij$ i.e. variables economic, social, and environmental vulnerability and reliability. Then, all composite indices were replaced with the previous numbers by using the Morris formula and replacing the standard numbers.

Morris Unequal Coefficient

$$Yij = \frac{Xij - X\min}{X\max - X\min} \times 100 \qquad (6)$$

Yij= Standardized values؛

Xij= Number of the index؛

Xmin= Minimum number in each column؛

Xmax= Maximum number in each column.

Final sustainability coefficient for all cities was separately calculated by using Equation (7).

$$S.I = \frac{\sum Yij}{n} \qquad (7)$$

Calculating the final coefficient

Yij= Standard zed values؛

n= Number of indices.

The range values are as follows: 0-19.9 very high unsustainability, 20-39.9 high unsustainability, 40 - 59.9 semi-sustainability, 60-79.9 high sustainability, and 80-100 very high sustainability.

## RESULTS

Relative priority weights of each criterion and each sub criteria were calculated. The results of the instance are shown in Table 5. It should be noted that consistency tests showed that the values obtained for all cases were less than 0.1.

At the second step, the field survey showed that 48.6% of the family farming system was based on family conditions. To put it another way, there is a balance





[ DOR: 20.1001.1.16807073.2020.22.2.9.7 ]

**Table 4**. Variables of Research based on DPSIR Framework.

| Study variables | Components | Measured variables | Cronbach's Alpha |
|---|---|---|---|
| | Natural | Soil quality (Likert), size (ha), average rainfall (mm $yr^{-1}$), temperature changes during 5 years | .82 |
| | Human | 9 Items (Likert), education, family workforce (person), experience in cultivation (yr) | .86 |
| Capitals | Financial | Farming income (Rial $ha^{-1}$ $yr^{-1}$), non-farming income (thousand Rials $month^{-1}$), type of ownership (%), agricultural costs (Rial $ha^{-1}$ $yr^{-1}$), non-agricultural costs (Rials $month^{-1}$), saving (Rial $yr^{-1}$) | -- |
| | Physical | Infrastructures (9 Items= Y/N), agricultural tools and machines (14 Items= Y/N), facilities (6 Items= Y/N) | -- |
| | Social | 32 Items (Likert) | .87 |
| Stress | Productivity | Revenue of total Farm production ($= FR_i$) divided by the Total Costs spent in production ($= TC_i$) | -- |
| | Reliability | Used nitrogen, phosphorus, potash per hectare (-), use of green fertilizers and animal compost per hectare (+), Used pesticides and herbicides per hectare (-), the density of seeds per hectare, frequency of irrigation and plow per hectare | -- |
| | Stability | Obtained from subtracting the average yield of practice for 4 years ($Y_{average}$) and standard deviation from maximum yield ($Y_{max}$) observed in the study. | -- |
| | Resilience | 9 Items relevant to resilience, off-farm income (thousand Rials a year), access to pasture (Y/N), product variety (Y/N), ownership of livestock, poultry, etc. (Y/N) | .78 |
| | Environmental | 1٧ Items (Likert, the formula was; Vulnerability: Coping-hazard) | .83 |
| Vulnerability | Social | 24 Items (Likert, the formula was; Vulnerability: Coping-hazard) | .88 |
| | Economic | 18 Items (Likert, the formula was; Vulnerability: Coping-hazard) | .87 |
| | Science and Technology Capacity | 22 Items (Likert) | .79 |
| Management | Institutional and Social Capacity | 15 Items (Likert) | .76 |
| | Monitoring | 13 Items (Y/N) | -- |

between land and facilities with the family workforce, so that the family members have no opportunity to be employed by others and have no need to hire other outsiders. Meanwhile, 48.2% was family character. In addition to the family members, these systems also used external forces. Only a small percent (2.3%) included family features. These systems are extensive enough not only to use other workforces but also to provide family members full employment.

Table 6 shows the composite indices and fuzzy AHP weights calculated for each sub-criterion in family farming systems with regard to each township.





[ DOR: 20.1001.1.16807073.2020.22.2.9.7 ]

**Table 5.** Weights and consistency rate of the criteria and sub-criteria.[a]

| Criteria | Priority of criteria | Sub Criteria | Priority of sub criteria | Final Priority of sub criteria | CR of Sub criteria | CR of criteria |
|---|---|---|---|---|---|---|
| C1 | 0.215 | C5 | 0.192 | 0.041 | 0.02 | |
| | | C6 | 0.322 | 0.069 | | |
| | | C7 | 0.150 | 0.032 | | |
| | | C8 | 0.129 | 0.028 | | |
| | | C9 | 0.207 | 0.044 | | |
| C2 | 0.144 | C10 | 0.273 | 0.039 | 0.01 | 0.01 |
| | | C11 | 0.148 | 0.021 | | |
| | | C12 | 0.261 | 0.038 | | |
| | | C13 | 0.319 | 0.046 | | |
| C3 | 0.158 | C14 | 0.235 | 0.037 | 0.00 | |
| | | C15 | 0.250 | 0.039 | | |
| | | C16 | 0.514 | 0.081 | | |
| C4 | 0.482 | C17 | 0.293 | 0.141 | 0.04 | |
| | | C18 | 0.406 | 0.195 | | |
| | | C19 | 0.300 | 0.145 | | |

[a] Source: Research findings, 2014.

**Table 7**. Sustainability composite indices in family farming systems in different townships.

| Harsin | Eslamabad | Sarpol-e Zahab | Qasr-e Shirin | Javanroud | Kermanshah | Weights | Components | Study variables |
|---|---|---|---|---|---|---|---|---|
| 4.44 | 5.21 | 1.30 | 3.81 | 4.56 | 4.68 | 0.041 | Natural | |
| 0.71 | 1.26 | 2.10 | 0.49 | 0.90 | 0.26 | 0.032 | Financial | |
| 4.63 | 4.21 | 3.89 | 3.74 | 3.66 | 3.88 | 0.069 | Human | Capitals |
| 4.35 | 4.41 | 3.76 | 3.15 | 3.87 | 4.49 | 0.028 | Physical | |
| 0.99 | 1.07 | 0.96 | 1.02 | 0.97 | 0.99 | 0.044 | Social | |
| 3.88 | 8.23 | 7.30 | 2.34 | 6.29 | 3.67 | 0.039 | Productivity | |
| 5.62 | 4.78 | 5.83 | 4.43 | 5,00 | 5.09 | 0.046 | Resilience | |
| 0.32 | 0.25 | 0.22 | 0.15 | 0.36 | 0.56 | 0.038 | Stability | Stresses |
| -0.42 | -1.63 | -1.79 | -3.87 | -1.70 | -2.56 | 0.021 | Reliability | |
| -0.53 | -1.20 | -1.02 | -1.30 | -0.88 | -1.08 | 0.037 | Environmental | |
| -0,87 | -0,98 | -0.95 | -1.33 | -0.87 | -1.00 | 0.039 | Social | |
| -1.34 | -0.80 | -1.01 | -0.81 | -1.15 | -0.09 | 0.081 | Economic | Vulnerability |
| 0.98 | 1.18 | 0.92 | 0.76 | 1.14 | 1.01 | 0.145 | Monitoring | |
| 0.91 | 1.05 | 1.08 | 1.03 | 0.94 | 1 | 0.141 | Sci. and Tech. | Management |
| 2.18 | 2.11 | 2.14 | 1.54 | 1.91 | 2.12 | 0.195 | Soci. and Instit. | |

Following the procedure of computation, fuzzy AHP weights were multiplied in composite indices and the obtained values were located in the range of 0 to 100 by using Morris model (Table 7).

In Figure (3), the zoning of family farming system is presented. The data yielded by this study shows that Eslamabad-e Gharb and Harsin with scores of 72.91 and 58.76 have high sustainability. In contrast, Qasr-e Shirin (20.92) is in high unsustainability. Furthermore, Sarpol-e-Zahab, Kermanshah, and Javanroud with values of 57.95, 54.37, and 52.92 lie in the middle of the spectrum.

## DISSCUSION

The data yielded by this study provide convincing evidence that there is different zonation for family farming system in relation to sustainability. A more detailed discussion is given below.





[ DOR: 20.1001.1.16807073.2020.22.2.9.7 ]

**Table 8.** Sustainability index in family farming systems in different townships.

| Harsin | Eslamabad | Sarpol-e Zahab | Qasr-e Shirin | Javanroud | Kermanshah | Components | Study variables |
|---|---|---|---|---|---|---|---|
| 75.43 | 100 | ٠ | 63.67 | 77.99 | 79.37 | Natural | |
| 24.48 | 54.36 | 100 | 12.53 | 34.80 | 0 | Financial | |
| 100 | 56.70 | 23.75 | 8.30 | 0 | 22.72 | Human | Capitals |
| 89.60 | 94.08 | 45.55 | 0 | 53.73 | 100 | Physical | |
| 27.76 | 100 | 0 | 54.69 | 9.80 | 27.76 | Social | |
| 63.45 | 81.02 | 33.86 | 27.84 | 35.26 | 45.97 | Mean | |
| 26.13 | 100 | 84.20 | 0 | 67.05 | 22.56 | Productivity | |
| 48.97 | 24.97 | 100 | 0 | 40.68 | 47.11 | Resilience | |
| 41.41 | 24.36 | 17.05 | 0 | 51.15 | 100 | Stability | Stresses |
| 100 | 16.78 | 14.20 | 0 | 15.59 | 6.29 | Reliability | |
| 54.13 | 41.52 | 53.86 | 0 | 43.62 | 43.99 | Mean | |
| 100 | 67.72 | 75.83 | 0 | 69.91 | 43.94 | Environmental | |
| 100 | 67.72 | 75.82 | 0 | 100 | 62.58 | Social | |
| 0 | 100 | 48.52 | 97,06 | 24.60 | 72.55 | Economic | Vulnerability |
| 66.67 | 78.48 | 66.72 | 32.35 | 64.84 | 59.69 | Mean | |
| 52.38 | 100 | 38.10 | 0 | 90.48 | 59.52 | Monitoring | |
| 0 | 82.29 | 100 | 70.54 | 17.67 | 52.92 | Sci. and Tech. | Management |
| 100 | 89.56 | 94.03 | 0 | 95.72 | 91.05 | Soci. and Instit. | |
| 50.79 | 90.62 | 77.38 | 23.51 | 67.96 | 67.83 | Mean | |

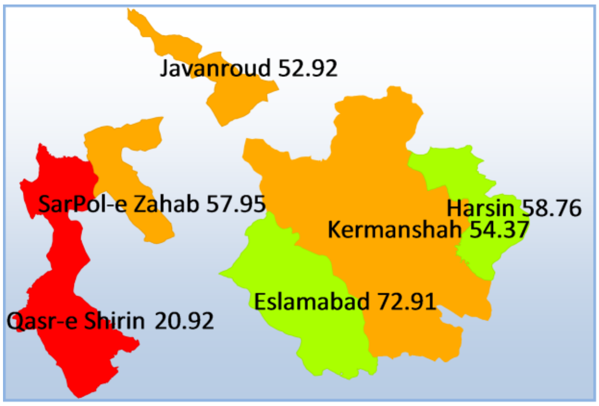


**Figure 3.** Zoning family farming systems

High Sustainability  Moderate sustainability  High unsustainability

### Areas with High Sustainability

Based on findings, Harsin and Eslamabad-e Gharb have the highest score on five capital components and the lowest score on vulnerability. It seems that there is a relation between five capitals and vulnerability. Several authors [15, 12, and 30] confirmed that a high level of each capital component results in low vulnerability. Besides, result revealed that Eslamabad-e Gharb has a good status in management, while in Harsin, only management component is at a high sustainability level i.e. social and institutional capacity, however, the system is at a high unsustainability status in terms of science and technology capacity. Mauerhofer (2013) reported that high level of institutional capital can be derived from high social capital.This is in favor of maximum social capital in Eslamabad-e Gharb. Also, Harvey *et al*. (2014) [14] state that institutional support is needed to improve agricultural production and food security.

According to the investigations, the system is at an unsustainability level in terms of stresses. To justify this, moderate to low financial capital in the family farming system can be pointed out. Similarly, expansion and intensification require capital for mechanization, technologies, and inputs [20]. It seems that formal credit provided by the Agricultural Bank can solve this problem [25].

## Areas with Semi- Sustainability

Findings revealed that Kermanshah, Javanroud and Sarpol-e Zahab have a low capital among studied cases. Sustainability analysis of family farming in Kermanshah showed that it has a high level of physical capital among the studied cases. This may be due to centrality of Kermanshah as the capital and uneven distribution of physical development resources. According to the findings, it seems that fundamental changes in reliability and productivity would influence the relative sustainability improvement of the products mentioned.

Based on the results, Javanroud is in a high unsustainability level in human and social capital. Further analysis of low human capital showed that the participants had the lowest level of experience in cultivation. On the importance of human capital, Pour Mohammadi and Zali (2004: 38) [29] mention that the development solution should be looked for in the human brain. As mentioned before, social capital in the family farming system of Javanroud is unsustainable. Despite low social capital, participants are of high resilience against social damages. Adger (2002: 358) [2] revealed that social resilience enhances coping ability and adaptability against environmental and social damages. Thus, the above findings can be attributed to social resilience not to social capital. Furthermore, family farming system in Javanroud is in high sustainable conditions in terms of monitoring and social and institutional capacity; however, they are in an unsustainable condition with respect to science and technology capacities. An interesting point is that crops productivity, economic growth, [17, 36 and 7], wellbeing and security [12] practically do not exist without science and technology capacities. Concerning the findings, this system is in a semi-sustainable condition in terms of dry farming.

Sustainability components for the family farming systems in Sarpol-e-Zahab showed that natural, human, and social capitals are at high critical point; however, the financial capital with maximum score enjoys high sustainability. Regarding social capital, studies showed that social capital is not only a datum entering the production function, but also a catalyst in the production function and can smoothen social and economic activities and reduce transaction costs and social conflicts [11]. Hence, lack of social capital would have negative social, economic, environmental and political consequences. Examining the other component of sustainability, i.e. stress, showed that participants were enjoying the maximum amount of resilience and were at high sustainability; however, regarding the stability, they were at high unsustainability. This indicates that the participants in Sarpol-e-Zahab have been facing yield fluctuation problems over many years. Yield fluctuation acts like seismic whose vibrations can endanger farmers' family and, consequently, people's food security. As a result, controlling yield fluctuations and stabilizing it is essential. According to the findings, this system has a high sustainability in social and environmental vulnerability. As mentioned earlier, Adger (2002: 358) [2] and Folk (2005: 441) [9] regard this as the result of social resilience not social capital. Moreover, high financial capital is another factor enhancing the members' coping ability and reducing their vulnerability against social and environmental events. The analysis carried out on the dry-farming wheat showed that it was facing stability and reliability problems.

## Areas with High Unsustainability

Results showed that family farming system in Qasr-e Shirin enjoys high level of





[ DOR: 20.1001.1.16807073.2020.22.2.9.7 ]

coping with economic vulnerability; however, they are in high unsustainability in other factors such as physical and human capitals, resilience, environmental and social vulnerability, monitoring, and social and institutional capacities. As it can be inferred, this system in Qasr-e Shirin Township is in serious critical condition concerning all criteria measured since a vast majority of indices are at a low level. The only promising point observed is the low rate of economic vulnerability attributed to financial capital stable level. Investigations in the case of dry-farming wheat showed that productivity and reliability are of high unsustainability.

## CONCLUSIONS

The aim of this paper was to analyze and zone the sustainability of family farming system in Kermanshah Province using DPSIR approach. Findings showed that DPSIR is a useful tool to assess the sustainability of family farming. This adds to the current literature in that DPSIR can be replicated or up-scaled in other agrarian systems. However, a major limitation of this study is that we used quantitative methodology and that we only focused on a particular system such as family farming. We recommend that mix methodologies be utilized and that more than one agrarian system be assessed in future research.

## REFERENCES

1. Abbasizaded Qanavati, M. S., Papzan, A. and Mirak Zadeh, A. A. 2012. Sustainability Analysis of Family Farming Systems in Khanom Abad Village, Kermanshah City. *J. Rur. Dev.*, **15:** 114-95. http://rvt.agri-peri.ir/browse.php?a_code=A--42-10 26&slc_lang=fa&sid=1
2. Adger, W. N. 2000. Social and Ecological Resilience: Are They Related?. *Prog. Hum. Geogr.*, **24:** 327-364. DOI: 10.1191/030913200701540465
3. Asadi, A. and Varmazyari, H. 2010. Assessing the Sustainability of Agricultural Systems. *Rahbord Yas Quarterly*, 288-261.
4. Bartlett, J. E., Kotrlik. J. W. and Higgins, C. C. 2014. Organizational Research: Determining Appropriate Sample Size in Survey Research. *Information Technology, Learning, and Performance Journal*, **19:** 43-50. https://www.opalco.com/wp-content/uploads//10/Reading-Sample-Size1.pdf
5. Binder, C. and Wiek, A. F. The Role of Transdisciplinary Processes in Sustainability Assessment of Agricultural Systems. In: "*From Common Principles to Common Practice".* (Eds.): Häni, F., Pintér, L. and Ferren, L. *Proceedings and Outputs of the First Symposium of the International Forum on Assessing Sustainability in Agriculture (INFASA)*, INFASA and Swiss College of Agriculture, Bern, PP. 33–48.
6. Bogres. A. M. 2016. Family Farming and Human and Environmental Health Conservation. **69(2):** 304-12. http://dx.doi.org/10.1590/0034-7167.2016690216i. RESEARCH. Sci-ELO.
7. Esmaeeli, A. and Sadighi, H. 2017. Effect of Agricultural Research on Productivity and Rural Poverty: Evidence from Iran. *J. Agr. Sci. Tech.*, **19:** 21-32.
8. FAOSTAT. *Share of Food in Total Trade.* Accessed on August 30. 2014, http://faostat.fao.org/site/535/default.aspX#ancor.
9. Folke, C., Hahn, T., Olsson, P. and Norberg. J. 2005. Adaptive Governance of Social-Ecological Systems. *Ann. Rev. Environ. Resour*., **30:** 441-473. DOI:10.1146/annurev.energy.30.050504.144511.
10. Gessesew, W. S. 2018. Application of DPSIR Framework for Assessment of Land Degradation: A Review. *Appro. Poult. Dairy Vet. Sci.*, **1(5):** 1-**7.**
11. Ghaffari Ghajar, Gh. and Palouj, M. 2012. On the Relationship between High-Value Social, Human and Physical Capital of Cops and Livestock Products in the Rural Sector of Isfahan Province. *J. Agric. Econ. Dev*., **19:** 210-187.
12. Ghahremani Ghajar, S., Mohammadi Doustdar, H. and Ranjbar Noei, A. 2012. The Application of Science and Technology





[ DOR: 20.1001.1.16807073.2020.22.2.9.7 ]

Education in Different Countries. *Culture Strategy Quarterly*, **20:**103-128.

13. Graeub, B. E., Chappell, M. Jahi., W, H., Ledermann, S., Kerr, R. B. and Gemill-Herren, B. 2016. The State of Family Farms in the World. *World Dev.*, **87:** 1-15.
14. Harvey, C, A., Rakotobe, Z. L., Rao, N., Dve, R., Razafimahatratra, H., Rabarijohn, R. H., Rajafara, H. and Macinnon. J. 2014. Extreme Vulnerability of Smallholder Farmers to Agricultural Risks and Climate Change in Madagascar. *Phil. Trans. R. Soc. B.*, **369:** 10-12.
15. Huai. J. 2016. Role of Livelihood Capital in Reducing Climatic Vulnerability: Insights of Australian Wheat from 1990–2010. *PLoS ONE*, **11(3):** e0152277. doi:10.1371/journal.pone.0152277.
16. Kong, F. and Liu, H. 2005. Applying Fuzzy Analytic Hierarchy Process to Evaluate Success Factors of E-Commerce. *Int. J. Inf. Syst. Sci.*, **1:** 406-412.
17. Kuramoto, J. and Sagasti, F. 2002. Integrating Local and Global Knowledge, Technology and Production Systems: Challenges for Technical Cooperation. *Sci. Technol. Soc*., **7:** 215-247. DOI: 10.1177/097172180200700202.
18. Piedra-Muñoz, L., Galdeano-Gómez, E. and Pérez-Mesa. J. C. 2016. Is Sustainability Compatible with Profitability? An Empirical Analysis on Family Farming Activity. *Sustainability*, **893**: 2-16.
19. Lopez-Ridaura, S., Van Keulen, H., Van Ittersum, M. K. and Leffelaar, P. A. 2005. Multiscale Methodological Framework to Derive Criteria and Indicators for Sustainability Evaluation of Peasant Natural Resource Management System. *Environ. Dev. Sustain.*, **7:** 51–69.
20. Lowder, S. K., Skoet, J. and Raney, T. 2016. The Number, Size, and Distribution of Farms, Smallholder Farms, and Family Farms Worldwide. *World Dev.*, **87:** 16-29.
21. Toader, M. and Roman, Gh. V. 2015. Family Farming – Examples for Rural Communities Development. *Agric. Agric. Sci. Proc.*, **6:** 89–94.
22. Mauerhofer, V. 2013. Social Capital, Social Capacity and Social Carrying Capacity: Perspectives for the Social Basics within Environmental Sustainability. *Futures*, **53:** 63-73. http://dx.doi.org/10.1016/j.futures.08.006.
23. Motiei Langroodi, S. H., Rezvani, M., Faraji Sabokbar, H. and Khajeh Shahkuhi, A. 2010. Sustainability Analysis of Family Farming Systems and Rural Production Cooperatives (Case Study: Aq Qala City). *I. J. Agric. Econom. . Develop.*, **41**: 323-334.
24. Palinska, M. and Parlinska, A. 2015. Characteristic of Family Farming in the European Union. *Proceedings of the 2015 International Conference on Economic Science for Rural Development*, **38**:23-34 April 2015, LLU ESAF, Jelgava PP. 113-119.
25. Parva1. S. and Moghaddasi, R. 2018. Is Credit a Driver for Agricultural Growth? An Iranian Provincial Analysis. *J. Agr. Sci. Tech.*. **20:** 1333-1340.
26. Patton, M. Q. 1990. *Qualitative Evaluation and Research Methods*. 2rd Edition, SAGE, Newbury Park, California, 536 PP.
27. Pervanchon, F. 2007. When Farmers Integrate Sustainable Development in Their Strategy Thank a Tree: The Sustainable Farm Tree. In: "*From Common Principles to Common Practice*". (Eds.): Häni, F., L. Pintér, L. and Ferren, H. *Proceedings and Outputs of the First Symposium of the International Forum on Assessing Sustainability in Agriculture (INFASA)*, INFASA and Swiss College of Agriculture, Bern, PP. 111–120.
28. Pirrone. N., Trombino, G., Cinnirella. S., Algieri, A., Bendoricchio, G. and Palmeri. L. 2005. DPSIR Approach as a Useful Tool to Shape a Sustainable Development Strategy for the Po Catchment-Adriatic Coastal Zone Continuum. R*eg. Environ. Change*, **5:** 111–137
29. Pour Mohammadi, M. and Zali, N. 2004. Human Development, Challenges and Solutions (With Regard to the Indices of Development in Iran). *J. Human. Social Sci.*, 10.
30. Ribot, J. C., Magahalaes, A. R. and Panagides, S. 2005. *Climate Variability, Climate Change and Social Vulnerability in the Semi-Arid Tropics*. 1rd Edition, Cambridge, USA, 192 PP.
31. Ricciardi, V., Ramankutty, N., Mehrabi, Z. a Jarvis, L. and Chookolingoa, B. 2018. How Much of the World's Food Do Smallholders Produce? *Global Food Sec.*, **17:** 64–72.
32. Rigby, D., Woodhouse, P., Young, T. and Burton, M. 2001. Constructing a Farm Level Indicator of Sustainable Agricultural

Practice. *J. Ecol. Econ*., **39(3)**: 463–478. DOI: 10.1016/S0921-8009(01)00245-2.

33. Toupchi, B. Rostami, F. and Khodabakhshi, A. 2011. Comparing the Indices of Irrigated Wheat Production in Peasant Commercial and Cooperative Farming Systems in Kordestan Province. *Iran Agric. Econ. . Develop. Res.,* **42(2)**: 229-219.
34. Upton, M. 1987. *African Farm Management*. Published by Press Syndicate of the University Cambridge, New York, USA, 190 PP.
35. Vliet, J, A. V., Schut. A. G. T. Reidsma, P., Descheemaeker, K., Maja Slingerland, M., vandeVen, G. W. J. and Giller. K. E. 2015. De-Mystifying Family Farming: Features, Diversity and Trends across the Globe. *Global Food Security,* **5:** 11–18.
36. Wakhungu, J. W. 2001. Science, Technology, and Public Policy in Africa: A Framework for Action. *Bull. Sci. Technol. Soc.*, **21:** 246-252. DOI: 10.1177/027046760102100402.
37. Zahm, F., ViauX, P., Girardin, P., Vilain, L. and Mouchet, C. 2007. Farm Sustainability Assessment Using the IDEA Method. From the Concept of Farm Sustainability to Case Studies on French Farms. In: "*From Common Principles to Common Practice*".,(Eds.): Häni, F., Pintér, L. and Ferren, H. *Proceedings and Outputs of the First Symposium of the International Forum on Assessing Sustainability in Agriculture (INFASA)*, INFASA and Swiss College of Agriculture, Bern, PP. 77–110.

# تحلیل پایداری نظام بهره برداری خانوادگی در استان کرمانشاه: با استفاده از چارچوب DPSIR

ع. پاپزن، و ش. گراوندی

## چکیده

در مطالعه حاضر سعی شد به بررسی و پهنه بندی نظام بهره برداری خانوادگی در استان کرمانشاه از لحاظ پایداری پرداخته شود. به منظور دستیابی به این هدف، دو گام طراحی شد. در مرحله ابتدایی به شناسایی چارچوبی جامع در خصوص سنجش پایداری در نظام های بهره برداری خانوادگی پرداخته شد. سپس با استفاده از روش فازی به ارزیابی معیارها و زیر معیارهای شناسایی شده در چارچوب اقدام شد. در این راستا، ۱۲ نفر از متخصصان نظام های بهره برداری که دارای تجربه عملی و میدانی در حوزه نظام های بهره برداری بودند، شناسایی شدند. در مرحله بعدی با استفاده از روش توصیفی پیمایشی به بررسی پایداری نظام مورد مطالعه پرداخته شد. نتایج نشان داد به ترتیب: مدیریت، سرمایه ها، آسیب پذیری و استرس بیشترین اهمیت را در پایداری نظام های بهره برداری از زمین دارا می باشند. همچنین بر اساس یافته ها، اسلام آباد غرب و هرسین به ترتیب با مقادیر ۷۲.۹۱ و۵۸.۷۶ دارای بالاترین میزان پایداری بودند. این در حالی بود که قصر شیرین بیشترین ناپایداری (۲۰.۹۲) را به خود اختصاص داد. در این میان، سرپل ذهاب(۵۷.۹۵)، کرمانشاه (۵۷.۶۷) جوانرود(۵۲.۹۲) در حد واسط طیف بودند و در وضعیت نیمه پایدار به سر می برند.