

THE SOCIO-ECONOMIC DETERMINANTS OF SUSTAINABILITY OF AGRICULTURAL PRODUCTION IN SOME RURAL AREAS IN CHAHARMAHAL AND BAKHTIARI PROVINCE, IRAN.

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Abstract. Sustainability of agricultural and farm production systems is an important issue, particularly in countries which heavily rely on this economic sector. Actually, so many methods have been proposed to assess sustainability of such agricultural systems from various viewpoints. Nonetheless, limited attention has been paid to find the important key factors in agricultural sustainability in Iran. Although researchers often recognize ecological factors as the main element affecting sustainability, but also the other factors play an important role in the sustainability of an agricultural and farming system, instead. This study proposes a method to analyze the determinants of sustainable crop production, and applies it to wheat cultivation in Chaharmahal and Bakhtiari province, Iran.

INTRODUCTION

Sustainability is a conflicting concept, with no univocal definition (De Luca et al., 2017). Some of agricultural researchers are in agreement with on defining sustainability science as a multidisciplinary, inter disciplinary, problem-driven field that addresses essential questions on the interactions between nature and society (Carpenter et al., 2009). Hansen and Jones (1996) defined sustainable agriculture as the ability of cropping systems to continue into the future. Sustainability keeps the ability to farm and produce food into the future, without reducing the options for future generations. We agree with three main perceptions of sustainability identified by (Yunlong and Smit, 1994) that they are ecological definition of sustainability, which focuses on biophysical processes and continued productivity of performance ecosystems, the economic definition of sustainability, which is

principally concerned with the long-term preservation of the benefits of farming to agricultural producers and the social definition, which addresses the continued satisfaction of vital human needs for food and shelter, as well as equity, education, security, freedom, employment and recreation. Sustainable development in agriculture and farming is one of the most important issues that can be considered from different aspects and in different contexts including sustainable agriculture. Additionally, agricultural sustainability is not only significantly affected by the ecological factors, but is also impacted directly by changes in socioeconomic factors at both farm and nonfarm scale and the social and economic determinants of farming system sustainability are also significant in many developing countries, because agriculture is the major source of livelihood support in these countries (Rao and Rogers, 2006). A growing consensus believes that long term sustainability of agriculture and production systems can be enhanced through locally based planning and management at the farm scale. Therefore, within farming systems analysis, many argue that some forms of agricultural management are more sustainable than others (Dalsgaard, Lightfoot and Christensen, 1995). Identifying causative factors of farming system sustainability provides a framework for integrating knowledge and perspectives of the social and natural sciences into planning, policy and decision-making at farm scale. Such an interdisciplinary framework simultaneously addresses the socioeconomic and environmental guidelines of natural resource policy and agricultural management (Clark and Dickson, 2003). Many factors are supposed to intermediate the effects of socioeconomic determinants on sustainability of crop-ping system. However, few studies have tried to examine this mediating effect (Amani and Chizari, 2006). The current paper intends to analysis the socioeconomic determinants of sustainability in terms of ecological variables such as tillage practices, crop/land rotation, erosion, weed, disease, and pollution control methods to create composite index of sustainability as dependent variables without investigating how these variables affect the sustainability.

MATERIAL AND METHODS

The heads of the selected households in the study area were interviewed, using a structured and semi structured questionnaire in 2017. To prepare the study questionnaire, an informal survey was conducted by holding interviews with key informants, including 10 farmers, university faculty members, government officials, nongovernment organizations, and other research agencies. A random two stage sampling technique was used to select the sample of farmers. In the first stage, 5 counties were randomly selected. Then 10 villages were selected among these counties and finally a complete list of 20 villages was available. In the second stage, farmers in the 20 sampled villages were listed. The survey covered 200

farmers randomly selected in proportion to the number of farmers in each village. Two farmers were eliminated from the analysis because of missing information in their questionnaires. The type of data collected was concerned variables associated with conceptual framework such as using sustainable farming practice methods such as crop and or land rotation, organic, green and animal fertilizers, crop remain and straw, conservation plough, farmer and village factors such as age, education, income, access and contact with service, research and extension agencies, and farmers' attitude toward sustainability, farm characteristics such as land fragmentation, land cultivated; and social and institutional factors such as satisfaction farming job, preferences with regard to sustainability and social participation. Many studies propose to assess sustainability by the means of collecting a set of indicators (Sydorovych and Wossink, 2008). In this study, sustainability level of wheat cropping system as the dependent variable was assessed by the construct of sustainability composite index. The sustainability composite index comprises 13 indicators that measures sustainability level in a wheat cropping system (Table 1). In the present study, principal components method was used to derive composite index. In order to develop the composite index, dividing by mean method was used to re-move the scale biases.

Table 1. Indicators used to construct composite index of sustainability

No	Indicators
1	Amount of organic manures used kg/ha (+)*
2	Amount of macro manures used kg/ha (+)
3	Amount of animal manures used kg/ha (+)
4	Amount of nitrate fertilizers used kg/ha (-)**
5	Amount of phosphor fertilizers used kg/ha (-)
6	Amount of chemical herbicides L/ha (-)
7	Amount of chemical pesticides L/ha (-)
8	Amount of chemical fungicides L/ha (-)
9	% of land cultivated under crop rotation system (+)
10	% of land cultivated under land rotation system (+)
11	Burning of crop residues per ha (-)
12	Number of crop planted annually (+)
13	% of converting arable lands (-)

* and ** are as a : (+) and (-) are indicators with positive and negative effect on sustainability

A preliminary set of questions about items and scales related to independent variables was developed and pre-tested on 50 farmers. Scales were then developed for the issues of primary concern, technical knowledge, access to agricultural extension and education services, access to agricultural supportive services,

satisfaction of farming job, and social participation in rural affairs and technology usage. The scales included 5point items Likert type scale. The final developed scales reliability during this stage is shown in Table 2. Sustainability of wheat cropping system as dependent on some variable. It acknowledges testing a causal pathway of variables by allowing variables to act as both independent and dependent (Kline, 1998). The path analysis estimates the magnitude of the relationship between variables, and tests the proposed model, too. Path coefficients were obtained using stepwise multiple regression analysis by including the focal variable as the criterion variable, and those which are expected to directly influence it as predictors. After the initial analysis, the model is trimmed to eliminate variables with little impact, retaining only significant variables. In this initial analysis, SPSS was used to conduct a series of 9 regression analyses.

Table 2. Items and scale reliability

Scale	Reliability (Cronbach's α)
Technical knowledge	0.914
Accessibility on agricultural extension and education services	0.938
Accessibility on agricultural supportive services	0.840
Satisfaction of farming job	0.816
Social participation in rural affairs	0.758
Technology usage	0.868

Some key characteristics of farmers' households are presented in Table 3. The number of plots cultivated by a household as land fragmentation measures ranges differentially.

Table 3. Descriptive statistics of key variables

Variables	Mean	SD	Minimum	Maximum
Number of plots under wheat cultivated	9.78	7.25	1	45
Average plot size	1.10	12.20	0.16	75
number of people in a family	6.42	2.76	1	12
Labor force of household	7.80	26.78	8.38	94.16
Share of off-farm income	9.02	5.26	1.58	23.54
Average annual income from agriculture (1 million Rials)	1212	1325	2600	38000
Farming experience	24	14.50	1	58
Age of farmers	45	14	24	70
Wheat cultivated land	6.1	6.4	2	32
Total land area under ownership	11.12	7.5	2	96
Average wheat yield	4.25	1.1	1.2	7.2

Sustainability composite index was considered as a final variable and entered in cluster analysis. The results of cluster analysis were classified in 5 categories (Table 4). According to the findings dominant form of wheat cropping system was unsustainable as 9 percentages of the farmers were deified in very low sustainability category and 51 percentages belonged to low sustain ability category based on total composite index, while 9.20 percentages of farmers were in the high sustainability category and 1 in the very high sustainability category.

Table 4. The level of sustainability of wheat cropping system

Level of Sustainability	Number	Percentage	Cumulative %
Very low sustainability	20	9	9.20
Low sustainability	125	51	67.25
Medium sustainability	40	20	88.14
High sustainability	18	9	96.25
Very high sustainability	2	1	99.25

DISCUSSION

Exploitation of production resources based on this type of agriculture faces great challenge occasioned by the high level of depletion, environmental degradation thereby threatening the sustainability of agriculture itself as well as the health of people consuming its products. Some efforts have been made in Iran during the past decade or more to promote farming system in the interests of sustainability and long term conservation of the agricultural production resources. In this regard, socioeconomic factors play key role and a pioneering endeavor aimed at making agriculture environmentally sound, economically viable, and socially acceptable. Hence there is an urgent need to identify and determine the socioeconomic factors associated with sustainability of farming system. This study assessed the impact of socioeconomic factors on the sustainability of wheat cropping system and measuring the level of sustainability committing ecological indicators as assessed through an elevated composite index. This study enriches our showed that farmers and farming system characteristics can enhance or retard sustainability practice in agricultural farming system. According to the study results, a main characteristic of the wheat cropping system was its unsustainable situation. Then a path analysis was conducted to test the path of the variables. The trimmed path analysis model found the direct and significant impact of land fragmentation, technology usage, technical knowledge, and access to extension education services on the sustainability of wheat cropping system. Maghsoudi et al. (2007), however, did not enter this regression analysis, and reported that age, cultivated land, and membership in agricultural cooperative had significant correlation with sustainability. The fact that the majority of the sample consisted of

low income, livelihood farmers with small and fragmented plots in which cultivation is carried on to non geometric small-scale plots may help explain the relatively high impact of land fragmentation and technology usage. These farmers have limited resources to use farm machinery and new cultivation methods such as chemical fertilizers, pesticides, and herbicides to optimize their productions. Therefore, application of suitable and small technology and consolidated farmland aimed at increasing yield, efficiency and reducing production costs, has a direct relationship with sustainability and optimum application of agricultural production resources. Also the low productivity of small farms constrains sustainable crop production at regional and national level. Moreover, agricultural extension-education services will improve sustainability. The technical knowledges, skills and ideas also develop farmers capacity in facing the challenges of sustainable agriculture and in adopting and using new technologies for exploiting agricultural natural resources. Same results were reported by (Sadighi and Roustae, 2003) in study conducted on corn cultivation system by low-income farmers. They found that farmers who had more on farm visit by agricultural extension agents showed significantly more sustainable farming compared to farmers who neglected their on-farm visit. As hypothesized, technical knowledge has a significant influence on sustainability of cropping system.

Rezaei Moghaddam et al (2005) employed two opposing polar conceptual paths, Ecological Modernization (EM) and De-Modernization (DM) theories to explain the sustainability of agricultural development in Iran. They remarked that, based on DM theory, modern technology is the cause of all environmental problems and the only practical and possible strategy for agricultural development is a radical goodbye to modern and scientific technologies by transforming conventional agriculture to traditional farming systems based on indigenous knowledge and technology and social organization. On the other hand, EM based agricultural development policies should be based on the application of eco-modern environmental technologies in different stages of production. Findings of Hayati (1995) in his attitudinal study of wheat producers in Fars Province. On the other hand, age and attitude were related to sustainability orientation. Some studies have found that these factors directly affect sustainability level of farming system in Iran (Hayati, 1995). These results would indicate that sustainability in farm scale is not enough because the out farm compensatory factors influence the farmer's efforts at farm scale. Although supportive, extension, and education services are provided by Ministry of Agriculture Jihad, the main decision is how to provide these services according to needs and conditions at farm scale. Therefore, farmers will ultimately bear the responsibility for implementing the policies and guide-lines necessary for sustainable agriculture. In conclusion, to promote sustainability of farming system in Iran, all subsystems related to sustainable agricultural

activity should be considered. In the context phase, social and institutional constructs should be provided to inform farmers of how to use agro-resources and farm infrastructures, extension and education services, and supportive services as inputs for crop production. At the same time, some subsystems such as development and diversification of agricultural production systems, personal construct in process and output phase interact the whole system and produce socioeconomic outcome. The farmers should be advised about sustainable agricultural practices, quality, quantity and standards of using production inputs, especially chemical fertilizers, herbicides and pesticide, export demand and expectations, as well as the farmer organization and union and its function. At same time, it is very important that farmers are provided with financial, credit and complementary services and support in transition to sustainable agriculture and given guarantees regarding marketing of their products

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