

Agricultural Land Consolidation in Iran: Advantages and Limitations (The Case of Villages in Dehgolan Township, Iran)

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ABSTRACT

The purpose of this descriptive-analytical research was to analyze the advantages and limitations of agricultural land consolidation in the villages of Dehgolan Township, Iran. The statistical population of this study included 190 farmers in the villages of Dehrashid (where the adaptive consolidation plan was implemented between beneficiaries) and Telvar (in which the plan has not yet been implemented among farmers). The samples were selected from 140 people by using the Krejcie and Morgan sample size table and stratified random sampling method. The data gathering instrument was a researcher-made questionnaire, which was presented to the faculty members of the Department of Rural Geography at Kharazmi University to confirm the face and content validity. Further, the reliability of the tested items was confirmed by using the Cronbach's alpha ($\alpha = 0.81$). To analyze the data obtained from the farmers' opinions, multi-criteria decision making FTOPSIS (Fuzzy TOPSIS) analysis methods and linear regression in SPSS₂₄ were used. The results of regression analysis indicated that the main obstacles of implementing consolidation in the studied area were "economic" ($\beta = 0.416$) and "technical" ($\beta = 0.304$). Also, there was a significant difference between the two periods before and after consolidation of agricultural lands in terms of crop production and reduction of operating costs. In general, the effects of consolidation indicated a higher level of crops production per unit area, yield per unit area, income from agriculture and its sustainability, job diversification, and a decrease in immigration in the studied villages.

Keywords: Agriculture, Fragmented land, Fuzzy TOPSIS, Researcher-made questionnaire.

INTRODUCTION

Lack of optimal utilization of the production factors, especially land and water, is regarded as one of the most important challenges faced by rural communities, which is related to the problem of small farm size and dispersion of lands belonging to each of beneficiaries. Fragmentation of agricultural land is considered as one of the most important structural challenges in agricultural development, especially in traditional exploitation, which is related to the type of land management structure at the national

level. This issue is faced by two deep-rooted problems of the small-scale equipment of exploitation and the dispersion and small-size of land for cultivation, which are largely rooted in Iran's feudal system in the era of land reform and before (Abdullahzadeh and Kalantari, 2006; Ahmadi and Amini, 2007; Einali *et al.*, 2013).

Land dispersion has led to a slowdown in agriculture transfer from traditional to advanced system. The high costs of production, poor income, non-optimum utilization of machinery and new technical and scientific achievements in production

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activities, as well as rural poverty as an indicator of underdevelopment, are related to land dispersion. In order to achieve self-sufficiency and food security and agricultural development, it is necessary to implement agricultural land consolidation programs by using governmental support, participation of farmers, and the private sector (Rostami *et al.*, 2008).

The policy of land consolidation is a kind of renewal of optimal allocation in production factors based on soil and water resources through re-grouping or aggregating plots along with the process of land ownership transfer, in order to improve the land ownership structure and strives to provide the ground for the efficiency of new structures that make possible the use of modern technologies (De los Rios and Diaz, 2011). Therefore, increasing the size of plots and reducing their number is the most justifiable reason for the usefulness of land consolidation programs (Vitikainen, 2004). In order to improve the agricultural productivity, numerous efforts have been made. These include adopting appropriate policies for land management through the improvement of water and drainage management (Thomas, 2006), management of natural production resources, especially water resources (Rembold, 2003), soil and water conservation and industries development (Falkgrad and Sky, 2002), improvement of lands and rural buildings (Pašakarnis and Maliene, 2010, Xiang and He, 2012), creating the necessary infrastructure for agricultural and rural development and environmental protection (Lisec and Pintar, 2005), and providing suitable grounds for mechanization, improving the quality of land, using modern irrigation techniques, and commercial production (Huang *et al.*, 2010).

Land consolidation provides the ground for achieving goals of rural and national development. Although distribution of agricultural land in traditional societies with traditional structures can be effective, it delays the achievement of development goals and other developmental processes in both developing and developed societies. Land dispersion not only adds to the plights of

people, but also reduces their cooperation, as well as their motivation for further efforts (Roknoddin Eftekhari, 1988).

Regarding the problems and issues of dispersion of agricultural lands, to address the problems and complications of this issue, agricultural planners and policymakers recommend the logical and practical solution of the land consolidation. This approach is a policy associated with changing the land size and increasing agricultural production, rationalizing exploitation, using machinery and new crop technology and, ultimately, achieving agricultural development. In other words, this process and organization of the land are essential for the sustainable development of agriculture (Ibid).

Agricultural activities and severe land fragmentation, as one of the most important challenges of rural economies, have led to a reduction in production and, consequently, lower income of farmers, and the instability in economic growth and social development in developing countries and can reduce food security, employment, income, and rise in immigration and poverty levels in rural areas (Shirzad, 1998). On the other hand, agricultural growth (as the main source of income and rural employment) has a close relationship with the enhancement of the productivity of production factors, such that the production inputs is implemented through infrastructure development, appropriate technology, new farming methods, and farm management improvement. Therefore, land consolidation is a tool for better management of land use and the improvement of the productivity of production factors in agricultural production units and is considered as a "secret weapon" for generating economic growth and shared wealth. Thus, removing small and scattered farms as one of the important obstacles to increase production and improve the productivity of agricultural production factors and increasing the scale of exploitation units can facilitate the process of rural development and, as a result, the national development (Ghaffari *et al.*, 2016; Abbasian *et al.*, 2017).

In Iran, there are three conceptual approaches to land consolidation, of which the first and second approaches do not differ greatly in terms of implementation; however, the third one has different approaches including all farmers of one or several villages. The three approaches are as follows:

1. The general consolidation of the plots (landowners switching or transferring lands to one or more points)
2. Consolidation of all cultivated lands (Consolidations of lands are that under cultivation of a specific crop and belongs to several farmers)
3. Land consolidation (reallocation of all agricultural lands and the formation of larger farms) (Einali *et al.*, 2013).

There are not many differences between the three types of land consolidation. However, their executive approach is different in Iran. This difference stems from the variability in the pattern of crop cultivation [according to the geographical pattern of rain reduction (in Iran, with movement of north to the south due to locate on the warm and dry belt of the earth decreases the amount of rainfall decreases)]. For example, in the western parts of Iran, especially in Kurdistan, some of the plain areas have high fertile land, but most of the western borders of the province are mostly mountainous and there is no opportunity for agricultural activity and more gardening is done in this area. In the northern regions, as there are many fertile lands and a rainy area, the second method is often implemented. The third method is also not implemented in the current situation due to the division of land and the diversity of minorities as well as the existence of the law of inheritance. However, during implementation of the third phase of land reform (1960-1970s), land consolidation was used.

Although many efforts have been made in this regard in Iran, a technological gap is still tangible in global analogy and competition. The dispersion and small size of agricultural lands are regarded as a deep-rooted challenge. Working on a land that is divided into large and small pieces has many problems for the

farmer. The most important problems mentioned by the farmers are water conveyance losses (Yazdanpanah *et al.*, 2014; Bijani *et al.*, 2017; Mirzaei *et al.*, 2017, Valizadeh *et al.*, 2018) and irrigation problems, non-use of agricultural machinery because of the land dispersion, the high percentage of fragmented lands, low yield of agricultural products, the problem of traffic, absence of roadways between farms, low area under cultivation, lack of access to inputs (pesticides and fertilizer), conflict and struggle over water and land, waste of time, and the need for more due to the increase in the number of plots (Yasuri *et al.*, 2012). These issues increase costs and, consequently, reduce profits, despite the great difficulty (Derakhshanfar, 2011). It should be noted that many actions [such as agricultural activities (planting, harvesting, harvesting) as collectively, forming community groups] have been taken in the last few years in Iran; however, most farm lands are still fragmented despite the problems due to fragmentation. Although this issue has a long history in Iran, the desired goals have not been reached due to the lack of social, economic, and technical constraints. The dispersion of land plots is one of the elements of the traditional agricultural structure of the country, which has gradually lost its positive role to the extent that it has become a major hindrance to the advancement and promotion of agriculture and, consequently, a serious problem for the rural society and agricultural development in the present circumstances (Ibid).

In this regard, the present study aimed to investigate the limitations and advantages of land consolidation in some villages in Dehgolan Township. Obviously, the results of this study can be used to understand the problems and challenges of rural economy used by managers, planners and policy makers of rural development in Iran.

MATERIALS AND METHODS

Theoretical Background

There have been various studies and analyses on the advantages and limitations of land consolidation in villages. Some studies express that there was a significant



difference in the number of land plots of each exploiter, the area under the cultivation before and after the implementation of the plan, as well as the yield of wheat and barley, the area covered by the pressurized irrigation systems, the cost of using machinery for plowing, plotting, fringe, nesting and frescos (Farzoni: in this way the field surface becomes shallow and stacked after planting and softening to plant some crops such as potatoes), the cost of land preparation, planting costs, the rate of using machinery for fertilizing, seeding, harvesting and transporting the product, the use of pesticides and workers, as well as the rate of using water. These created significant changes in the productivity of the production factors (Ghaffari *et al.*, 2016). Another study showed that land consolidation improved the technology, farm management, cropping pattern in terms of size and number and water transfer methods, increased the scope of exploitation and production efficiency, reduced costs, saved water consumption and time, and achieved farmers' satisfaction in the villages where the consolidation plan was implemented (Aslan *et al.*, 2007; Zou *et al.*, 2008; Lisec *et al.*, 2012; Yasuri *et al.*, 2012).

In addition, Tahamipour and Shahmoradi (2007) indicated that the annual average growth rate of productivity of the production factors was 0.8.3 in the agricultural sector during the years from 1967 to 2003, by measuring the general productivity growth of the production factors in the agricultural sector and its contribution to the value added.

Investigations on the impact of land consolidation on agricultural products show that land consolidation has a significant impact on the reduction of plots number, increase in area under cultivation, decrease in water use, increase in using agricultural machinery, increase in the yield of agricultural products and, ultimately, increase in farmers' income in the region. Thus, there is a direct relationship between land consolidation and its mechanization with agricultural production (Alizadeh and Kaykha, 2010) and land consolidation reduced the production costs, especially the transportation and the machinery costs, and increased and diversified

production (Roknoddin Eftekhari, 1998). Gonzalez Garcia (2007) in Spain showed that land consolidation programs are an important step in improving the labor efficiency and the optimal land productivity. In addition, farmers' awareness of the economic and social outcomes of land consolidation, the transfer of useful information from promoters to farmers, and government support programs are effective factors in accepting consolidation (Gonzales Garcia, 2007).

Review of previous studies has led to the identification of a set of variables in the form of obstacles and consolidation effects, which are shown in Figure 1.

Methodology

The method of this research is a descriptive-analytic approach. A survey technique was used to collect descriptive data from reference library sources. The statistical population of this study was 90 farmers from Dehrashid village, where all the villagers had consolidated their agricultural lands, and 100 farmers from the village of Telvar who had not implemented the agricultural land consolidation. These villages are located in the suburb of Dehgolan Township in Kurdistan Province (Figure 2). In this regard, the examined samples included 140 people and were selected using the Krejcie and Morgan's table (Krejcie and Morgan, 1970) and stratified random sampling method with proportional assignment. The data-gathering tool was a researcher-made questionnaire that was presented to the faculty members of the Rural Geography Department of Kharazmi University to confirm visual and content validity. Further, the reliability of the tested items in the advantages and limitations of consolidation was confirmed by using Cronbach's alpha (Cronbach, 1951) ($\alpha = 0.81$). To analyze the data obtained from the farmers' opinions, multi-criteria decision making (Fuzzy-TOPSIS) analysis methods and linear regression in SPSS software was used. The compilation of Fuzzy-TOPSIS

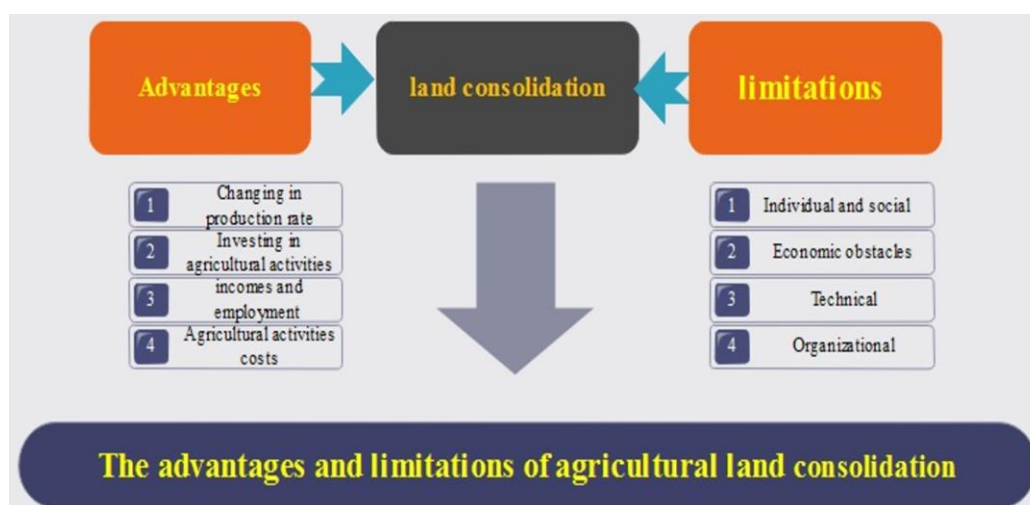


Figure 1. Theoretical framework for analyzing the advantages and limitations of land consolidation.



Figure 2. The site of the study area.

method is the most recent and accurate analytical method in research on the nature of the assessment of multiple analyses in various societies. Especially in cases where the variance between the data in the samples is very low and the relationships between variables are vague and uncertain, this method is used to measure the accuracy of the analysis and measurement of the relationships and their effect levels is between zero and one. Therefore, the results of this method are highly accurate. This compilation technique can provide quantitatively and mathematically many of the concepts and variables that are inaccurate and ambiguous, providing a ground for reasoning, deduction, control,

and decision making in conditions of uncertainty. In the present study, considering that multi variables with different nature are investigated in two different societies, application of this method has been useful due to its high accuracy.

The variables examined in this study have been identified based on previous studies and field surveys (Tables 1 and 2). Subsequently, for each variable, items and questions were developed in the form of a five-point Likert scale and provided to the sample population, such that its results could be used to achieve the research goal.

The questionnaires designed by FTOPSIS were used to identify the most important component and prioritize the variables to



Table 1. The obstacles to agricultural land consolidation.

Components	Variables	Indicator
Individual and social obstacles	Lack of trust of farmers to each other	O1 ^a
	Lack of interest in group and collective work	O2
	Dependence of farmers on their land	O3
	Low farmer literacy	O4
	The existence of laws such as inheritance and endowment (Waqf) ¹	O5
	Aging of farmers	O6
	Lack of trust of farmers in the government and its programs	O7
	The existence of traditional beliefs in the village	O8
Economic obstacles	Land price difference	O9
	Fear of losing individual land ownership ^b	O10
	Fear of risk due to poverty and bad economic conditions	O11
Technical obstacles	The difference in land quality and access to water and road resources	O12
	The high dispersion of land	O13
	Traditional exploitation	O14
	Lack of access to water resources (Wells and rivers, etc.)	O15
	A large number of people working in agriculture	O16
	The multiplicity of agricultural land plots for each household	O17
	Lack of awareness of farmers about the technical benefits of consolidation	O18
Organizational obstacles	Lack of written and specific rules for land valuation	O19
	Lack of a specific organization to implement the plan and pay compensation for land swap	O20
	Absence of training-promoting classes in the field of consolidation	O21

^a O in column of indicator is abbreviation of the word Obstacle. ^b The fear of losing individual ownership is a factor resulting from the economic thinking of farmers, which means the loss of land and its consequences as poverty. This idea provides the basis for creating social barriers, including farmers' lack of trust in each other and lack of interest in teamwork. Hence, the fear of individual ownership (as an economic barrier) provides the basis for the emergence of social barriers.

achieve the research objectives. This method was a generalization of the TOPSIS method in the management science, in which the predictions of experts were initially expressed in terms of definite numbers. This theory can express many of the inadequate concepts and phrases with mathematical language and provide a ground for reasoning, inference, control, and decision-making in uncertainty conditions. In this theory, a fuzzy number is a special fuzzy set as $\tilde{A} = x \in R / \mu_{\tilde{A}}(x)$ in which x accepts the real values of the set member of R and its membership function is $\mu_{\tilde{A}}(x)$. The most commonly used fuzzy numbers are triangular and trapezoidal fuzzy numbers. Triangular fuzzy numbers are more commonly used due to their simpler computations. Hence, we used fuzzy triangular numbers in this study. A

triangular fuzzy number (A) with the step-linear membership function of μ_A is defined as (1):

$$(x-a^l), a^l \leq x < a^m$$

$$\mu_x(x) = \begin{cases} (1): \\ (a^r - x) / (a^r - a^m), a^m < x \leq a^r \end{cases}$$

This can be represented as triangular fuzzy numbers (a^l, a^m, a^r). Figure 3 illustrates this membership function.

If $A = (a^l, a^m, a^r)$ and $B = (b^l, b^m, b^r)$ are two triangular fuzzy numbers, the function of the distance $d(A, B)$ is defined as (2) (Chang, 2002):

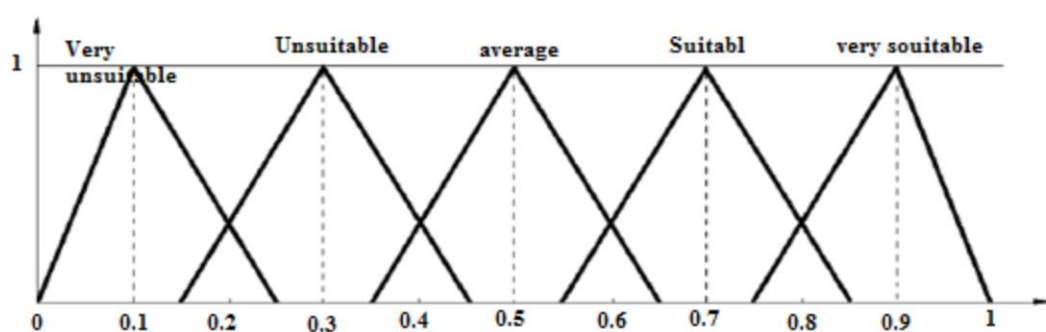
$$d(A, B) = \sqrt{\frac{1}{3}[(a^l - b^l)^2 + (a^m - b^m)^2 + (a^r - b^r)^2]}$$

After receiving expert opinions in the first stage, the fuzzy numbers ($\tilde{a}_{ij}$) are then

Table 2. The effects of agricultural land consolidation

Components	Variables	Indicator
Changing in production rate	Crop yield per unit area in agricultural lands	E1 ^a
	The production rate in garden products	E2
	Cultivating market products with guaranteed purchase	E3
	Reducing the diversity of cultivated products	E4
	Increasing production due to the possibility of using agricultural machinery	E5
	The possibility of cultivating uneven lands in farm	E6
	Increasing the land under cultivation because of the use of rain irrigation	E7
	Increasing yield per unit area	E8
Investing in agricultural activities	Establishing facilities on the farm (Warehouse, labor resting place ...)	E9
	Ability to provide timely delivery of facilities and machinery	E10
	Access and use of agricultural credits and insurance of crops and livestock	E11
	Investing in soil leveling	E12
	Investing in water conveyance	E13
	Investing in improving the cultivation process	E14
	Buying agricultural machinery	E15
	Increasing investment in improving land quality (Using micronutrient fertilizers and ...)	E16
Increasing incomes and employment in the agricultural sector	Job diversification	E17
	Increasing agricultural incomes and sustainability	E18
	Reducing immigration among active people and among families	E19
	The variety of income sources	E20
	Using family workforce	E21
Agricultural activities costs	Saving time at different stages and reducing the resulting risk	E22
	Saving in the consumption of agricultural inputs	E23
	Saving by decreasing movement of machinery	E24
	The simultaneous performing of agricultural activities and livestock maintenance at the farm	E25
	Increasing the level of family members' cooperation in agricultural activities	E26
	Saving in water consumption	E27
	Accessing and transferring inputs and products to the farm and vice versa	E28
	Common ownership of machinery	E29

^a E in column of indicator is abbreviation of the word Effect.

**Figure 3.** The representation of membership function

calculated in the next step in this model. Given the choice of triangular fuzzy numbers in the research model, these numbers are defined in the form of quadruple relations:

$$(3): \alpha_{ij} = (\alpha_{ij}, \beta_{ij}, \gamma_{ij})$$

$$(4): \alpha_{ij} = \text{Min}(\beta_{ijk}), k = 1, \dots, n$$

$$(5): \delta_{ij} = (\prod_{k=1}^n \beta_{ijk})^{1/3}$$

$$(6): \gamma_{ij} = \text{Max}(\beta_{ijk}), k = 1, \dots, n$$

Where, β_{ij} represents the relative importance of the parameter i on the parameter j from the k th expert's point of view, γ_{ij} indicates the upper limit of the experts' opinions and α_{ij} is the lower limit of the experts' opinions for the research variables. In these relations, δ_{ij} is the geometric mean of experts' opinions. Obviously, the fuzzy components should be defined as follows: $\gamma_{ij} \leq \delta_{ij} \leq \alpha_{ij}$. Table 3 presents the values of components or fuzzy numbers for evaluating the experts on the research indicators.

In the following, after quantifying indicators based on Table 1, the matrix of the required indices is formed as follows:

$$G = [G_{ij}]_{m \times n} = \begin{matrix} & \begin{matrix} C_1 & C_2 & \dots & C_n \end{matrix} \\ \begin{matrix} A_1 \\ A_2 \\ \vdots \\ A_m \end{matrix} & \begin{bmatrix} G_{11} & G_{12} & \dots & G_{1n} \\ G_{21} & G_{22} & \dots & G_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ G_{m1} & G_{m2} & \dots & G_{mn} \end{bmatrix} \end{matrix} \quad (7)$$

Here, $A_1, A_2, \dots, A_m$ are possible options that experts should evaluate. $C_1, C_2, \dots, C_n$

Table 3. Linguistic variables to evaluate the importance of indicators.

The importance of indicators	Fuzzy numbers
Very little important	(0, 0, 0.1)
Little important	(0, 0.1, 0.3)
Slightly important	(0.1, 0.3, 0.5)
Not Important	(0.3, 0.5, 0.7)
Moderately Important	(0.5, 0.7, 0.9)
Important	(0.7, 0.9, 1)
Very important	(0.9, 1, 1)

(Source: Ataei, 2011)

are Criteria that are considered with respect to the options. G_{ij} represents the rate of A_i option versus the Criterion C_j , and W_j is the Weight of C_j . In the process of evaluating these weights, the importance degree of the criteria presented by experts (in this research, the councils) is represented by linguistic terms (Wang, 2008).

We assume that $b_{ij}(e)$ indicates the value of the representing index j in the period of e , where $i = 1, 2, \dots, m, j = 1, 2, \dots, n$ and $e = 1, 2, \dots, t$. Regarding the concept of triangular fuzzy numbers, we define G_{ij} as:

$$G_{ij} = (g_{ij}^l, g_{ij}^m, g_{ij}^r)$$

Where,

$$g_{ij}^l = \min\{b_{ij}(e) \mid e = 1, 2, \dots, t\}$$

$$g_{ij}^m = \frac{1}{t} \sum_{e=1}^t b_{ij}(e)$$

$$g_{ij}^r = \max\{b_{ij}(e) \mid e = 1, 2, \dots, t\}$$

Therefore, $[G_{i1}, G_{i2}, \dots, G_{in}]$ indicates the performance ranks of A_i in n criteria.

In the following, using MAX and MIN operators, the positive ideal (A^+) and negative ideal (A^-) solutions are identified for the options set.

$$A^- = [G_1^-, G_2^-, \dots, G_n^-]$$

$$A^+ = [G_1^+, G_2^+, \dots, G_n^+]$$

In above relations, G_n^- and G_n^+ , which are triangular fuzzy numbers as the relation (9), are composed of the smallest and largest quantities of g_{ij}^l , g_{ij}^m , and g_{ij}^r for the n th option, respectively, d_{ij}^- and d_{ij}^+ represent the distance of G_{ij} from G_j^- and G_j^+ , respectively, and are calculated using the following formulas:

$$d_{ij}^- = d(G_{ij}, G_j^-) = \sqrt{\frac{1}{3}[(g_{ij}^l - g_j^{l-})^2 + (g_{ij}^m - g_j^{m-})^2 + (g_{ij}^r - g_j^{r-})^2]} \quad (i=1, 2, \dots, m), (j=1, 2, \dots, n)$$

$$d_{ij}^+ = d(G_{ij}, G_j^+) = \sqrt{\frac{1}{3}[(g_{ij}^l - g_j^{l+})^2 + (g_{ij}^m - g_j^{m+})^2 + (g_{ij}^r - g_j^{r+})^2]} \quad (i=1, 2, \dots, m), (j=1, 2, \dots, n)$$

(9)

Fuzzy Numbers are used to determine the coefficient of the importance of different decision criteria. In this case,

$W_{jk} = (w_{jk}^l, w_{jk}^m, w_{jk}^r)$ is a triangular fuzzy number, expressing the linguistic Weights expressed by the E_k Expert in the case of the Criterion C_j as fuzzy: ($j= 1, 2, \dots, n$ and $k= 1, 2, \dots, p$). W_j is considered as the mean Weight of C_j Criterion and calculated by using the following relation:

$$W_j = (w_j^l, w_j^m, w_j^r) = \left(\frac{1}{p}\right) \otimes (W_{j1} \oplus W_{j2} \oplus W_{j3} \oplus \dots \oplus W_{jp})$$

($j=1, 2, \dots, n$)

The signs $\oplus$ and $\otimes$ indicate fuzzy multiplication and summation. Finally, the proximity coefficient of A_i option, which is shown with A_i^* , is calculated by using the following relation:

$$A_i^* = \frac{A_i^-}{A_i^- + A_i^+}$$

$$i = 1, 2, \dots, m.$$

RESULTS AND DISCUSSION

The analysis of the limitations of

agricultural land consolidation in the studied areas indicated that (Table 4) the main obstacles to land consolidation in the studied villages were the individual and social obstacles (the existence of laws such as inheritance and endowment, as well as the low literacy of farmers and the aging of most of them), economic obstacles (fear of loss of individual ownership), and technical obstacles (high number of employed people). One of the most important obstacles to land consolidation is the study villages.

Further, the analysis of the effects of land consolidation in the studied villages revealed that land consolidation caused changes in production rate and investment in agricultural activities and increased income and, consequently, reduced the agricultural activities costs. Also, results of research showed in survey studied variables based on its components. Based on the results, land consolidation increased the amount of crops production per unit area, reduced the diversity of cultivated products and increasing production performance per unit area is eliminated for duplication above. In

Table 4. The obstacles of agricultural land consolidation.

Components	Indicator ^a	D ⁺	D ⁻	A*	Rate
Social and individual barriers	O1	4.085	3.950	0.492	6
	O2	4.108	4.019	0.494	5
	O3	3.134	4.938	0.612	4
	O4	2.572	5.545	0.683	2
	O5	1.987	6.177	0.757	1
	O6	2.790	5.175	0.650	3
	O7	4.510	3.518	0.438	7
	O8	6.229	1.861	0.230	8
Economic barriers	O9	2.549	5.476	0.682	2
	O10	1.987	6.177	0.757	1
	O11	3.134	4.938	0.612	3
Technical barriers	O12	2.630	5.376	0.672	3
	O13	1.987	6.177	0.757	1
	O14	3.134	4.938	0.612	5
	O15	2.572	5.545	0.683	2
	O16	1.987	6.177	0.757	1
	O17	2.790	5.175	0.650	4
	O18	4.510	3.518	0.438	6
Organizational barriers	O19	1.987	6.177	0.757	1
	O20	3.478	4.512	0.565	2
	O21	3.932	4.159	0.514	3

^a O in column of indicator is abbreviation of the word Obstacle.



the component of accomplished investments, land consolidation caused investment in soil leveling and investment in improving the cultivation process and improve ability to timely supply inputs. On the other hand, consolidation increased the income resulting from agriculture and its sustainability, enhanced job diversification and decreased migration among active people and between families in the component of increased incomes and employment. In addition, the process of consolidation led to saving in water consumption and time at different stages, and reduced the risk of it and simultaneous performance of the agricultural activities and keeping livestock on the farm in the component of agricultural activities costs (Table 5).

The effect of effective obstacles on

agricultural land consolidation in the studied villages was investigated by using the linear regression method. In this method, two parameters of the standardized effect factor Beta (β) and the Sig. value are used for better interpretation. In this regard, any variable whose Sig. value is closer to zero and its Beta coefficient is closer to 1 indicates the level of significance of its effect. The results indicated that the maximum impact was related to the economic ($\beta=0.419$) and technical obstacles ($\beta=0.304$), respectively.

This suggests that the difference between land prices and the unfavorable economic conditions of farmers and the fear of losing the individual ownership of agricultural land, along with the extensive dispersion in lands, traditional exploitation, multiple plots

Table 5. The effects of agricultural land consolidation.

Components	Indicator ^a	D ⁺	D ⁻	A*	Rate
Changing in production rate	E1	1.987	6.177	0.757	1
	E2	4.108	4.019	0.494	5
	E3	3.134	4.938	0.612	4
	E4	2.572	5.545	0.683	2
	E5	1.987	6.177	0.757	1
	E6	2.790	5.175	0.650	3
	E7	4.085	3.950	0.492	6
	E8	2.412	5.745	0.704	2
Investing in agricultural activities	E9	5.125	2.802	0.353	6
	E10	4.108	4.019	0.494	3
	E11	5.219	2.666	0.338	7
	E12	2.572	5.545	0.683	1
	E13	4.153	3.804	0.478	4
	E14	2.790	5.175	0.650	2
	E15	4.510	3.518	0.438	5
	E16	6.229	1.861	0.230	8
Increasing income and employment in the agriculture sector	E17	2.148	5.976	0.736	2
	E18	1.987	6.177	0.757	1
	E19	2.265	5.869	0.722	3
	E20	2.572	5.545	0.683	4
	E21	6.229	1.861	0.230	5
Agricultural activities costs	E22	3.421	4.682	0.578	2
	E23	4.108	4.019	0.494	5
	E24	6.002	2.085	0.258	7
	E25	2.572	5.545	0.683	3
	E26	3.684	4.450	0.547	4
	E27	2.790	5.175	0.650	1
	E28	5.461	2.624	0.325	6
	E29	5.805	2.292	0.283	6

^a E is symbols for show research indicators.

of agricultural lands in each household, lack of access to water resources (wells, rivers etc.), as well as the traditional exploitation system of agricultural land have prevented consolidation of agricultural land (Table 6 and Figure 4).

Figure 4 shows the relationship between independent variables (horizontal axis) and dependent variables (vertical axis). Given that the direction of the linear axis is from low values to incremental values, the analysis of this graph shows that there is a direct relationship between the variables and the higher the density of the points around the linear axis. This indicates that the relationship between the variables is significant, as seen in Figure 4.

Further, the average change in the components of agricultural land consolidation was investigated in the studied

villages, in order to increase the efficiency of production factors and improve productivity in the period before the implementation of the land reform plan and after implementation of consolidation as an agreement between the beneficiaries, based on the results of the study. The results revealed the difference in all measured components, in such a way that the greatest difference was seen in the component of the change in production and the change in the cost of agricultural activities. This result suggested that land consolidation improved the productivity and reduced production costs in the studied villages (Table 7).

CONCLUSIONS

The present study aimed to analyze the

Table 6. The effects of effective obstacles components on agricultural land consolidation.

Model	Non-standard coefficient		Standardized effective coefficient	t	Sig
	B	Std Error	Beta		
(Constant)	5.428	3.708	-	1.464	0.150
1 Social and individual barriers	-0.066	0.088	-0.110	-0.745	0.460
Technical barriers	0.335	0.132	0.304	2.547	0.014
Economic barriers	0.379	0.159	0.419	2.383	0.021
Organizational barriers	0.210	0.150	0.215	1.399	0.168

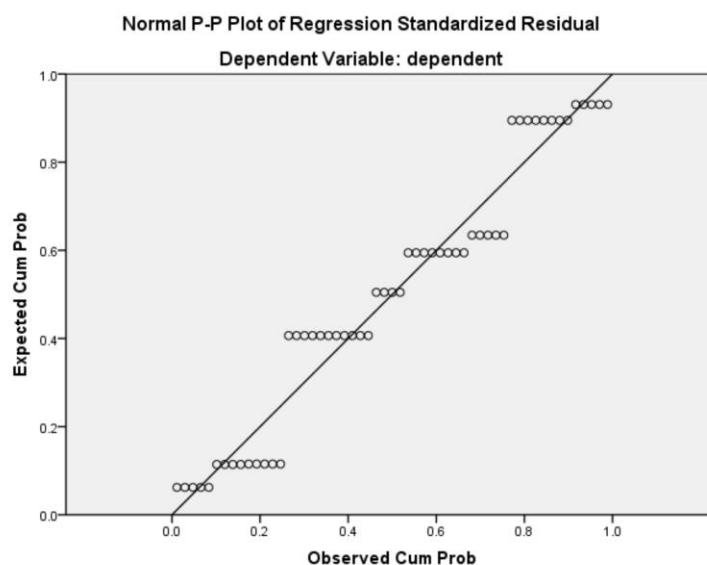


Figure 4. The spatial orientation of the impact of obstacles on agricultural land consolidation.

**Table 7.** Effects of agricultural land consolidation in the period before and after its implementation

Components		Average
Change in production rate	Before	0.251
	After	0.413
Investing in agricultural activities	Before	0.255
	After	0.293
Change in income and employment	Before	0.026
	After	0.059
Agricultural activities costs	Before	0.320
	After	0.192

advantages and limitations of land consolidation in the villages of Dehgolan Township. Given the importance and position of the agricultural sector in development at various levels, especially rural development, creation of employment areas, income, and population welfare, this sector faces numerous structural challenges. The ownership structure of agricultural lands, such as the fragmentation of land belonging to each farmer and, consequently, the increase of the agricultural activities costs, the loss of production inputs, and the reduction of production efficiency are among the main challenges associated with the productivity of the production factors. Therefore, integration policies have been used as a successful tool in mobilizing rural development. Investigation of the economic effects of land consolidation programs and identification of the weaknesses and strengths of these programs and their rooting can be effective in achieving the goals of agricultural and rural development programs, which is the increase of the rural production and income and the optimal exploitation of production factors. Over the past two decades, agricultural land consolidation has been implemented in the studied area in a few villages that have access to water resources (wells and rivers) as cooperative and adaptive. In some other villages of the studied area, this plan has not yet been comprehensively implemented due to its challenges and obstacles, despite the importance of the issue.

In this regard, the limitations and advantages of land consolidation in the

studied villages indicated that the economic and technical issues were the main obstacles to consolidation. This suggests that the difference between land prices and the unfavorable economic conditions of farmers and the fear of losing the individual ownership of agricultural land, along with the extensive dispersion, traditional exploitation, multiple plots of agricultural lands in each household, and lack of access to water resources (wells, rivers etc.) have prevented the consolidation of agricultural land. These results are in accordance with or in accordance with the findings of Mahdavi *et al.* (2017). These issues have caused other problems in the studied villages, which are:

- Reduction in the area under cultivation of agricultural crops
- Reduction in the yields of agricultural and horticultural crops
- Wasting water resources
- Increasing costs of planting, maintaining, and harvesting
- Reduction in sustainable income
- Lack of investment

Furthermore, the results in the study of obstacles showed that the existence of laws such as inheritance and endowment, as well as the low literacy of farmers and the aging of most of them, fear of loss of individual ownership, high number of employed people in agriculture, lack of access to water resources (wells, rivers, etc.), the difference in land quality and access to water resources and roads, and inexistence of written and precise rules for land valuation are among the most important obstacles in each of the

research components. The findings of this section are consistent with the findings of Mahdavi *et al.* (2017).

Regarding the effectiveness of the land consolidation plan in the studied villages on issues such as increase in crop production rate per unit area, reducing the diversity of cultivated products and increasing the yield per unit area, increasing investment in soil leveling and improving the stages of cultivation and the ability to ensure the timely provision of institutions and machinery, increasing the income from agriculture and its sustainability, job diversification and the reduction of immigration among active people and families, the results of this section are consistent with the findings of Wu *et al.* (2005), Yasuri *et al.* (2012), Fall Soleyman *et al.* (2011), Zarifian *et al.* (2011), Einali *et al.* (2013), and Ghaffari *et al.* (2016).

In order to explain the positive effects of land consolidation plan, it is necessary to mention some points: Wherever (for example the village of Dehrashid) the consolidation plan took place, the productivity and the level of cultivation of some products, including alfalfa, increased. This has led to the development of livestock husbandry and even the development of livestock processing industries and related service industries and some other businesses in the countryside, including cereals packing, which has also flourished in the countryside. Therefore, agricultural land consolidation can boost employment, diversify jobs and income sources in rural areas. Affected by these consequences, over the past two decades, the return of young migrants from the city to the countryside has occurred and the survival rate of the population in the village has improved. In the village of Dehrashid, especially in the seasons of planting and harvesting, unemployed young people are attracted to agricultural activities, especially in the fall season. To harvest agricultural products, the labor force population (including unemployed youth, urban households), from nearby cities (Dehgolan, Ghorveh and Sanandaj) come to work in this village. However, in the village of Telvar, which is located about three

kilometers from Dehrashid and does not include land consolidation, during the last decade, immigration rate has been on the rise and population has declined, and there has been a downturn in the rural economy.

Since agricultural sector is regarded as one of the three main sectors of the economy of each country and is responsible for supplying food in each country, both at the household level and at the industry level (due to the inter-sectional link.), it should receive due attention and the emphasis on the rapid development of agricultural sector should be considered as one of the main priorities of policymakers, planners, and decision makers.

ACKNOWLEDGEMENTS

The authors hereby express their special gratitude to all the rural people who completed the study questionnaires with great patience as well as the surveyors and interviewers who did their best in terms of data collection.

REFERENCES

1. Abbasian, A. R., Chizari, M. and Bijani, M. 2017. Farmers' Views on the Factors Inhibiting the Implementation of Soil Conservation Practices (The Case of Koohdasht Township, Iran). *J. Agr. Sci. Tech.*, **19(4)**: 797-807.
2. Alizadeh, K. and Kaykha, Z. 2010. The Impact of Land Consolidation on Farming Performance of Agricultural Products in Lutak District. *Quarterly Geographical Journal of Chashmandaz-E- Zagros*, **2(3)**: 139-152. (in Persian)
3. Ahmadi, A. and Amini, A. M. 2007. Factors Affecting Requests for Land Consolidation Projects in the Opinions of Experts in Kermanshah and Lenjanat Region in Isfahan. *Journal of Water and Soil Science (JWSS)*, **11(42)**: 283-296. (in Persian).
4. Abdollahzadeh, G. and Kalantari, K. 2006. Organizing and Consolidating Agricultural Lands Using the Experiences of Eastern European Countries, *Village and Development*, **8(3)**: 67-103. (in Persian)



5. Ataei, M. 2011. *Fuzzy Multi-Criteria Decision Making*. Unpublished Report. Shahrood University of Technology.
6. Aslan, S.T., Gundogdu, K.S., Yaslioglu, E., Kirmikil, M. and Arici, I. 2007. Personal, Physical and Socioeconomic Factors Affecting Farmer's Adoption of Land Consolidation. *Span. J. Agric. Res.*, **5(2)**: 204–213.
7. Bijani, M., Ghazani, E., Valizadeh, N. and Fallah Haghighi, N. 2017. Pro-Environmental Analysis of Farmers' Concerns and Behaviors towards Soil Conservation in Central District of Sari County, Iran. *Int. Soil. Water Conserv. Res.*, **5(1)**: 43-49.
8. Chang, Y. H. and Yeh, C. H. 2002. A Survey Analysis of Service Quality for Domestic Airlines. *Eur. J. Oper. Res.*, **139(1)**: 166-177.
9. Cronbach, L. J. 1951. Coefficient Alpha and Internal Structure of Tests. *Psychometrika*, **16(3)**: 297-334.
10. Derakhshanfar, F. 2011. Analysis and Evaluation of Farmers' Problems and Issues in the Land Consolidation Plan; The Application of PRA Method: Case Study Langrood. Unpublished Master Thesis of Agricultural Economics, Faculty of Basic Sciences and Agriculture, Payame Noor University, Tehran, Iran. (in Persian)
11. De Los Rios, I. and Díaz, J. M. 2011. The Social Reform at Land Consolidation. Projects- Working with People: Planning Experiences in Latin America and Europe. Case study: Spain, Madrid, PP. 1-29.
12. Einali, J., Farahani, H. and Sohrabi Vafa, S. 2013. The Evaluation of the Role of Agricultural Consolidation upon the Improvement of the Efficiency of Factor of Production Regarding Irrigated Lands Case Study: Khodabandeh County. *Journal of Space Economy & Rural Development*. **2(1)**: 52. (in Persian)
13. Falkgrad, S. M. and Sky, P. K. 2002. Mediation as a Component in Land Consolidation. *Paper Presented at FIG XXII International Congress*, TS-Land Consolidation: New Perspectives, April 19 - 26, Washington, DC.
14. Fall Soleyman, M., Moradi, M. and Abtahinia, A. 2011. Evaluation of the Effects of Land Consolidation on Rural Development in Rural Areas. *Journal of Arid Regions Geographical Studies*, **2(6)**: 67-85. (in Persian)
15. Ghaffari, H., Younesi, A. and Abedini, A. 2016. The Role of Land Consolidation on the Agricultural Sector Productivity; Case Study of Shazand City. *Quarterly Journal of Economic Growth and Development Research*, **6(23)**: 37-54. (in Persian)
16. Gonzales Garcia, I. 2007. Land Consolidation in Spain: The Land Registry Perspective. Effective and Sustainable Land Management – A Permanent Challenge for Each Society. *UNECE WPLA Workshop, Session III-Social and Constitutional Dimension of Land Management*, May 24, Munich, Germany.
17. Huang, Q., Li, M., Chen, Z., and Li, F. 2010. Land Consolidation: An Approach for Sustainable Development in Rural China. *AMBIO*, **40(1)**: 93-95.
18. Krejcie, R. V. and Morgan, D. W. 1970. Determining Sample Size for Research Activities. *Edu. Psychol. Measur.*, **30(3)**: 607-610.
19. Lisec, L. and Pintar, M. 2005. Conservation of Natural Ecosystems by Land Consolidation in the Rural Landscape. *Acta Agriculture Slovenia*, **85(1)**: 73-82.
20. Lisec, A., Sevatdal, H., Bjerva, Q. J. and Ferlan, M. 2012. *Comparative Analysis between Slovenia and Norway*. FIG Working Week, The Institutional Framework of Land Consolidation, Rome, May 6-10, 2012 (<https://www.fig.net/resources/proceedings>)
21. Mahdavi, E., Kiani, M. and Daneshvar Ameri, J. 2017. Evaluation of Obstacles to Agricultural Land Integration: (Case Study: Azna Towns Villages). *Iranian Journal of Agricultural Economics and Development*, **48(2)**: 333-342. (in Persian)
22. Mirzaei, A., Knierim, A., Fealy Nahavand, S., and Mahmoudi, H. 2017. Gap Analysis of Water Governance in Northern Iran: A Closer Look into the Water Reservoirs. *Environ. Sci. Pol.*, **77(2017)**: 98-106.
23. Pašakarnis, G. and Maliene, V. 2010. Towards Sustainable Rural Development in Central and Europe: Applying Land Consolidation. *Land Use Policy*, **27(2)**: 545-549.
24. Rembold, F. 2003. Land Fragmentation and Its Impact in Central and Eastern European Countries and the Commonwealth of Independent States, Land Reform: Land Settlement and Cooperatives. FAO-Internet: [ftp://fao.org/docrep/fao.Y T.pdf](ftp://fao.org/docrep/fao/Y T.pdf)
25. Roknoddin Eftekhari, A. R. 1998. Evaluation of Agricultural Land Consolidation Projects. *Quarterly Journal of Modares, Humanities*, **1(8)**: 131-149. (in Persian)
26. Rostami, S. B., Taleshi, M., Khanjari, F. and Sedaghat, M. 2008. Investigating the Cultural-

- Social Factors Affecting the Lack of Consolidation of Agricultural Lands: Case Study: Poshtdarband Rural District. *Scientific & International Journal of the Iranian Geographical Association*, **6**: 95. (in Persian)
27. Shirzad, H. 1998. Evaluation of Agricultural Land Consolidation Projects. *Journal of Modares Human Science*, **1(8)**: 131-149. (in Persian)
 28. Tahamipour, M., and Shahmoradi, M. 2007. Measurement of Total Productivity Growth of Agricultural Production Sector Factors and Survey amount that of Value Added. *Research of Sixth Iranian Conference on Agricultural Economics*, Iran Agricultural Economics Association, Ferdowsi University of Mashhad, Mashhad.
 29. Thomas, J. 2006. Property Rights, Land Fragmentation and the Emerging Structure of Agriculture in Central and Eastern European Countries. *Electronic Journal of Agricultural and Development Economics*, Agricultural and Development Economics Division (ESA) FAO, **3(2)**: 225-275
 30. Vitikainen, A. 2004. An Overview of Land Consolidation in Europe. *Nordic Journal of Surveying and Real Estate Research*, **1(1)**: 25-44.
 31. Valizadeh, N., Bijani, M. and Abbasi, E. 2018. Farmers' Active Participation in Water Conservation: Insights from a Survey among Farmers in Southern Regions of West Azerbaijan Province, Iran. *J. Agr. Sci. Tech.*, **20(5)**: 895-910.
 32. Wu, Z., Liu, M. and Davis, J. 2005. Land Consolidation and Productivity in Chinese Household Crop Production. *China Econ. Rev.*, **16(1)**: 28-49.
 33. Wang, Y. J. 2008. Applying FMCDM to Evaluate the Financial Performance of Domestic Airlines in Taiwan. *Expert Syst. Appl.*, **34(1)**: 1837-1845.
 34. Xiang, W. and He, G. 2012. The Relationship of Land Consolidation and New Rural Construction. *Interdisciplinary Journal of Contemporary Research in Business*, **4(4)**: 16-23.
 35. Yazdanpanah, M., Hayati, D., Hochrainer-Stigler, S. and Zamani, G. H. 2014. Understanding Farmers' Intention and Behavior Regarding Water Conservation in the Middle-East and North Africa: A Case Study in Iran. *J. Environ. Manage*, **135**: 63-72.
 36. Yasuri, M., Javan, J., and Sabounchi, Z. 2012. Effects of Social Consolidation Projects in Rural Areas (Markazi Province Selected Villages). *Journal of Geography and Planning*, **16(40)**: 201-208. (in Persian).
 37. Zarifian, Sh., Damavandi, A. and Heshmatollah, S. 2011. Factors affecting the consolidation of land plots in Kabudarahang Villages of Hamedan Province. *Journal of Agricultural Economics and Development*, **26(4)**: 237-243. (in Persian)
 38. Zou, X., Luo, M., Su, W., Li, D., Jing, Y., Ju, Z. and Wang, J. 2008. Spatial Decision Support System for the Potential Evaluation of Land Consolidation Projects. *WSEAS Transactions on Computers*, **7(7)**: 88-104.

یکپارچه‌سازی زمین‌های کشاورزی در ایران: مزایا و محدودیت‌ها (مورد مطالعه: روستاهای شهرستان دهگلان، ایران)

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چکیده

هدف این پژوهش توصیفی - تحلیلی، تحلیل مزایا و محدودیت‌های یکپارچه‌سازی زمین‌های کشاورزی در روستاهای شهرستان دهگلان بود. جامعه آماری این پژوهش شامل ۱۹۰ نفر از کشاورزان در روستاهای دهرشید (که در آن طرح یکپارچه‌سازی توافقی میان بهره‌برداران اجرا شده) و تلوار (که



در آن این طرح تاکنون میان کشاورزان اجرا نشده است)، بود. در این راستا، به عنوان نمونه، ۱۴۰ نفر با بهره‌گیری از جدول نمونه‌گیری کرجسی و مورگان و روش نمونه‌گیری تصادفی طبقه‌ای با انتساب متناسب انتخاب شدند. ابزار جمع‌آوری داده‌ها پرسشنامه‌ای محقق‌ساخته که جهت تأیید روایی صوری و محتوایی، در اختیار پانلی از اعضای هیأت علمی گروه جغرافیای روستایی دانشگاه خوارزمی قرار داده شد. همچنین، پایایی گویه‌های مورد سنجش با استفاده از آلفای کرونباخ، مورد تأیید قرار گرفت ($\alpha=0/81$). جهت تجزیه و تحلیل داده‌های به‌دست آمده از نظرات کشاورزان از روش‌های تحلیل تصمیم‌گیری چند معیاره (فازی - تاپسیس) و رگرسیون خطی در نرم افزار SPSS²⁴ استفاده شد. نتایج تحلیل رگرسیونی نشان داد که مهمترین عوامل اجرای یکپارچه‌سازی زمین‌های کشاورزی در ناحیه مورد بررسی، موانع "اقتصادی" ($\beta=0/416$) و "فنی" ($\beta=0/304$) هستند. همچنین تفاوت معنی‌داری میان دو دوره قبل و بعد از اجرای یکپارچه‌سازی در میزان تولید و کاهش هزینه‌های بهره‌برداری، مشاهده شد. در کل، اثرات یکپارچه‌سازی، بیانگر افزایش میزان تولید در واحد سطح در محصولات زراعی، عملکرد در واحد سطح، درآمد حاصل از کشاورزی و پایدار بودن آن، تنوع شغلی و نیز کاهش مهاجرت در روستاهای مورد مطالعه بود.