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PROMOTING FACTORS OF LAND CONSOLIDATION OF PADDY FIELDS IN IRAN: CASE OF WEST PART OF GUILAN PROVINCE

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ABSTRACT

Golichenari E, Firouzi S, Allahyari MS (2014) Promoting factors of land consolidation of paddy fields in Iran: case of west part of Guilan province. *J. Soil Nature* 7(2), 1-6.

To identify the promoting factors of paddy field consolidation in Iran, a cross sectional survey was performed in western part of Guilan province of Iran. All stakeholders of the Agricultural Organization (*Jihad-e-Keshavarzi*), including managers, technical agents, water and soil experts, herbaceous production experts, and rice supervisors were considered as sample respondent of this study. One hundred nineteen structured questionnaires containing determining items of the promoters of land consolidation were performed with the sample respondents. For examining the validity of the questionnaire, the face and content validity were used. Cronbach's alpha was used to measure the reliability of the instrument, which was 0.887 and confirmed the reliability of the instrument. Findings indicated that "eliminating extra borders", "access to roads and drainage facilities", "decreasing production costs", and increasing farmers' incomes" are the most important promoters of land consolidation of paddy fields in west part of Guilan province. "Increasing yield and second crop cultivated area" and "establishment of production cooperative and unions" are found as the least effective promoters. Using the factor analysis technique, the promoting factors were classified as productive inputs, social, mechanization, economic, management, and cost factors. These factors explained 66.9% of the total variance.

***Key words**: rice, factors, land consolidation*

INTRODUCTION

Rice is the second most popular staple food in the world. Over 90% of rice is produced and consumed in Asia. Rice supplies 80% of the calories for more than two billion people in Asia and 33.3% of calories for millions of people in Latin America and Africa. Rice is produced in more than 50 countries worldwide. Population growth and changes in diet have increased rice consumption so much that Iran imports a considerable amount of rice annually (Zamani and Alizadeh, 2005).

Different rice cultivars in Iran make up an estimated 574000 ha of cultivated area. Mazandaran province, having 38.4% of the total acreage, is the largest rice producing province, followed by acreage of 31.2% for Guilan Province. However, because of the low income from rice farming, some paddy fields are being converted by residential and commercial buildings. Consequently, the acreage dedicated to rice farming is decreasing. One of possible solutions of this problem is to increase the economic returns of rice production. Therefore, investigations into different methods of cultivation and development of various agricultural infrastructures such as the land consolidation are essential to decrease the production costs and then increase of the income of rice production in Iran.

The economic problems faced by the rice producers in Iran have increased motivation towards mechanized rice cultivation. However, the difficulties of using farm machinery in traditional paddy fields have posed numerous problems for mechanized farming. This has increased production costs considerably; therefore, farmers' incomes have decreased. In addition to this problem, the efficient use of agricultural inputs and maximizing irrigation efficiency, have caused the implementation of Land Consolidation (LC) projects for paddy fields, are to be considered as a good basis for many development plans.

Many developed countries applied land reformation programs and consolidation plans years ago (Yazdani 2004; Sobhani pour 1997; Tashakori and Mirzaei, 2002). Many European counties have developed different land consolidation plans to use farmland more efficiently and to improve farmers' livelihoods. These plans have been executed in line with the process of land management and comprehensive rehabilitation of land, i.e., changes in farmland boundaries, integration of small and scattered farms and improvement of their structure, the creation of roads to access agricultural inputs, supplying rural infrastructures, and drainage facilities. Such activities facilitate agricultural development in the rural area (Van der Molen *et al.* 2005). After the successful implementation of this plan in Lithonia, the average farm area increased from 6.12 ha to 13.07 ha (Gaudėšius 2011).

Fukuda *et al.* (2003) stated that the mechanization of Japanese farmlands increased farmers' income and reduced rice production costs. Farmers who work mechanized farms earn 10% more than farmers who work traditional ones. In Thailand, farms were restructured to operate through cooperatives, and consequently, land consolidation resolved the problems of distribution of farms and multiplicity of landowners (Fukuda 2005). Atsushi (2005) reviewed the history of farmland consolidation and compared it with the ownership system before and after WWII. He investigated the implementation of land consolidation plans, especially farm relocation, water supply, and the establishment of drainage channels. He concluded that this program increased

production and developed the mechanization and efficiency of farms. March *et al.* (2006) concluded that land reformation should be accompanied by land consolidation as this could develop efficiency, reduce costs, increase production, and rural regions would be properly developed. In Iran, land consolidation projects were initiated in the 1960s, but their expansion to rice farms faced difficulties. Amirnejad and Rafiei (2009) studied the factors affecting adoption of the land consolidation process and realized that the distance between plots, availability of training programs, and financial support significantly impacted the land consolidation process.

Previous studies in Iran have indicated that implementing strategic paddy-field consolidation plans, like in other parts of the world, faces serious problems which need broad investigation. Therefore, to fulfill the shortage of available literatures and to solve the problems of the time-consuming and costly modality of land consolidation projects, it was necessary to identify the promoting factors in paddy-field consolidation in Iran. Considering these issues, this study was undertaken to analyze the promoting factors of implementation and development of paddy-field consolidation in west part of Guilan province in Iran.

MATERIALS AND METHODS

The present research is based on the cross-sectional survey. The sample respondents of the survey consists of all 119 experts of LC of paddy fields in west of Guilan province, Iran. The researcher structured designed questionnaire used to collect data by reviewing related literature and experts. The first part of the questionnaire considered demographic characteristics (e.g., gender, age, marital status, level and field of education, organizational position, job history, activity in the agriculture sector, and activity in LC of paddy fields). The second part included items designed to identify the promoting factors of LC of paddy fields by using a five point Likert type scale (nothing=1; low=2; to some extent=3; much=4; very much=5). For determining the validity of the questionnaire, the face and content validity was used. Pretesting of the questionnaire was performed to determine the reliability of the questionnaire, and Cronbach's alpha was used to measure test reliability. The alpha value was 0.887.

Data were analyzed using SPSS software. Different descriptive statistics such as range, mean (M), standard deviation (SD) and inferential measurement like exploratory factor analysis were used to analyze the data.

RESULTS AND DISCUSSION

The characteristics of respondents

The youngest participant in the current study was 26 years old and the oldest was 55 years old (M=40, SD=6). Most respondents (80.7%) were male, and 111 respondents (93.3%) were married. Eighty respondents (67.7%) had a degree on bachelor of Science in Agricultural Engineering. 48.7% of respondents were working in public organizations, whereas, 58% of respondents had 5 to 15 years of work experience, and 64.7% of respondents had 5-15 years experience working in LC activities.

Identification of promoting factors in the consolidation of paddy fields

The mean scores and standard deviations indicated that eliminating extra borders, providing access to roads and drainage facilities, reducing production costs and increasing farmers' incomes, and efficient farm management were the most effective promoters in paddy-field consolidation (Table 1). The four factors of increased production per unit area, increased second crop acreage, establishment of production cooperatives, and job security were the least effective based on mean scores and standard deviations.

Factor analysis of components of the paddy-field consolidation promoting factors

In order to classify the promoting factors and identify the contribution of each factor in paddy-field consolidation, an exploratory factor analysis was conducted (results are presented in Table 2). The factor analysis used was a principal component analysis with factor extraction and Varimax rotation. The four commonly used decision rules were applied to identify the factors: (1) minimum Eigenvalue of 1; (2) minimum factor loading of 0.4 for each indicator item; (3) simplicity of factor structure; and (4) exclusion of single item factors. Bartlett's test and KMO measure showed that the research variables were appropriate for factor analysis (KMO = 0.773, Bartlett = 685.884, $p<0.05$). Results of the factor analysis revealed that based on opinions of respondents, six factors affect as promoters of paddy-field consolidation (Fig. 1).

These factors in combine account for 66.9% of the total variance and about 33.1% of the remaining variance was related to other factors. Productive inputs had the highest percentage of variance (28.434% of the total variance with an Eigenvalue of 5.118) followed by the social, mechanization, economic, management, and cost factors.

In weighted factor analysis, the variables explain the variance of that factor; i.e., the extent the variables can affect the behavior of that factor. Therefore, a higher factor loading indicates higher convergent validity. Factor scores after Varimax rotation are given in Table 2, choosing variables with factor loading of more than 0.4 (Field 2009).

Table 1. Priority of promoting factors in paddy-field consolidation in western Guilan province, Iran

Rank	Promoting factors	Mean	SD
1	Eliminating extra borders	4.40	0.667
2	Access to roads and drainage facilities	4.36	0.662
3	Reducing production costs and increasing farmers' income	4.35	0.386
4	Efficient farm management	4.10	0.763
5	Willingness to mechanize the farming practices	4.04	0.856
6	The efficient use of water	4.04	0.837
7	Decrease of agricultural practices' working time	3.86	0.881
8	Solving the problems of access to a labor force	3.86	0.882
9	Increase of the value of paddy fields	3.73	0.937
10	Better control of pests and crop diseases	3.70	0.867
11	Defining ownership of each farmer	3.67	0.921
12	Avoid land use change	3.41	0.860
13	Decrease of neighborhood disputes	3.59	0.950
14	Efficient consumption of agricultural inputs	3.52	0.937
15	Increased production per unit area	3.32	0.893
16	Increased second crop acreage	3.19	0.893
17	Establishment of production cooperatives and unions	2.94	0.950
18	Job security	2.82	0.879

Scales (nothing=1; low=2; to some extent=3; much=4; very much=5)

Based on the factor analysis results, the promoting factors of LC in paddy- fields in west part of Guilan province were classified into six groups. These factors include productive inputs, social and economic factors, mechanization, management, and costs. Productive inputs explained 28.434% of the whole variance. Social factors and mechanization explained 8.248% and 10.085% of the whole variance, respectively. Ebrahimi *et al.* (2012) identified five groups: social, infrastructural, environmental, economic, and organizational factors. Comparing the results of the current study with those of Ebrahimi *et al.* (2012) showed that different factors affect paddy-field consolidation.

In the present study, factor analysis also indicated that better control of pests and crop diseases with a factor loading of 0.819 and efficient consumption of agricultural inputs with a factor loading of 0.809 were the most important promoting factors. Consolidating small irregularly-shaped plots, forming larger plots, and providing access to roads would provide good conditions for the utilization of agricultural machinery and more appropriate usage of agricultural inputs. Moreover, more control in consumption of chemical inputs like nitrate and phosphate fertilizers could contribute greatly to maintenance of the environment (Kopeva 2002).

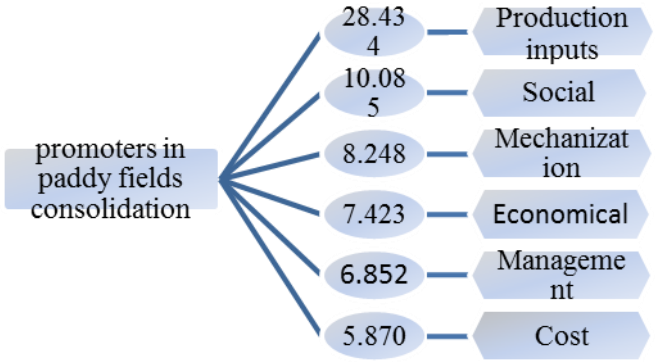

Fig. 1. Factor analysis model of promoting factors in paddy-field consolidation along with their specific variance

The efficient use of water with a factor loading of 0.706 was identified as the third factor of productive inputs. Asgari *et al.* (2012) showed that in Mazandaran province of Iran, the consolidation of paddy fields would manage water consumption more efficiently than traditional farms. Tubing and plumbing channels in LC plans for agricultural lands would minimize water loss in channels. Furthermore, smoothing plots would contribute to unifying the depth of irrigation water and as a result increase water consumption efficiency. The appropriate use of water and a reduction in labor used for irrigation are two important advantages of land consolidation (Anonymous 2000).

Table 2. Values of factor loadings of the promoting factors in paddy field consolidation

Variables	Productive inputs	Social	Mechanization	Economical	Management	Cost
Better control of pests and crop diseases	0.819					
Efficient consumption of agricultural inputs	0.809					
The efficient use of water	0.706					
Solving the problems of access to a labor force	0.520					
Job security		0.764				
Defining the ownership of each farmer		0.704				
Eliminating extra borders		0.760				
Decrease of neighborhood disputes		0.550				
Access to roads and drainage facilities			0.724			
Willingness to mechanize the farming practices			0.695			
Establishment of production cooperatives and unions			0.502			
Increased production per unit area				0.777		
Increase of the value of paddy fields				0.731		
Increased second crop acreage				0.615		
Efficient farm management					0.726	
Decrease of agricultural practices' working time					0.547	
Avoid land use change					-0.553	
Reducing costs and increasing farmers' income						0.735
Eigenvalue	5.118	1.815	1.485	1.336	1.233	1.057
Percent specific variance	28.434	10.085	8.248	7.423	6.852	5.870
Percentage of cumulative variance	16.475	29.214	41.004	51.825	60.002	66.911

Solving the problems of access to a labor with a factor loading of 0.520 was considered the fourth productive input. Lack of a labor in high season is a significant problem in the production of rice (Socio-Economics and Planning Center, 2002). By implementing land consolidation plans, farming operations, especially transplanting and harvesting the rice in larger plots, would require less of a labor force. Reduction in working force is one of the most significant results of mechanizing paddy fields (Oshiro 1982).

Creation of job security and defining ownership of each farmer with factor loadings of 0.764 and 0.704, respectively, are rated among the first social factors. Merging the rice lands presents the possibilities of more cooperation between farmers and utilization of important inputs such as agricultural machinery which was not economic in small, traditional lands. The effectiveness of group demands upon organizations supporting the agricultural sector could significantly benefit the job security of farmers. However, since issuing the ownership documents is one of the commitments of the LC operators. Thus, the farmers which have no official ownership documents would benefit from the implementation of LC plans.

Eliminating extra boundaries with a factor loading of 0.760 is the third factor. Due to being uneven, small and irregular plots require longer borders for controlling irrigation. By implementing paddy-field consolidation plans, the length of irrigation borders would be effectively reduced. Accordingly, the useful cultivation area of the paddy fields would be increased.

Decrease in number of neighborhood disputes with a factor loading of 0.550 is the fourth promoting factor in the consolidation of paddy fields. Farmers' autonomy in using irrigation water and roads is the most important result of the implementation of this plan. Akkaya *et al.* (2007) considered this result as one aspect of land consolidation.

Access to roads with a factor loading of 0.724 is the most significant factor in the promoting factors of the mechanization of paddy fields. The construction of roads would facilitate and speed up transportation and the implementation of land mechanization on rice farms. Ebrahimi *et al.* (2012) identified this factor as the second most important factor of the land consolidation.

Willingness to mechanize with a factor loading of 0.695 was rated the second most important mechanization factor. Implementing mechanized operations in smooth, regularly-shaped, and large plots would allow the presence of modern machinery, decrease production costs, and speed up agricultural operations (Roy and Bazbarova, 2002). In another study, Ebrahimi *et al.* (2010) regarded the possibility of using appropriate agricultural machinery as the most important element in plans for paddy-field consolidation in Guilan province.

The establishment of production unions and enterprises with a factor loading of 0.502 was rated the third mechanization factor. The similarity of their technical-agricultural needs force farmers toward forming agricultural mechanization unions. Therefore, it would help establish the sustainability of rice production, and some workers would be employed in the form of unions.

CONCLUSION

According to the findings, "eliminating extra borders", "access to roads and drainage facilities", "reducing production costs and increasing farmers' income" and "efficient farm management" were considered as the most effective promoting factors in land consolidation projects in Guilan province of Iran. Based on the results, using mechanization in rice production process can reduce production costs, especially labor cost. In balance, production input and social factors had the most contribution among other promoting factors. Better control of pest and diseases in paddy fields, usage of agricultural inputs and water in efficient ways were the most advantages for land consolidation.

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