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Affecting Factors on Adoption of Sustainable Water Resources Management in Agriculture

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ABSTRACT
The purpose of this research was identifying affecting factors on adoption of Sustainable Water Resources Management (SWRM) in agriculture of Khouzestan Province of Iran. The research method was quantitative research. For study of farmers the Behbahan, Shoushtar and Ahwaz Townships of Khuzestan Province were chosen based on stratified random sampling. Sample size was determined using a formula. From this formula it was determined that 352 farmers (N = 4108, n = 352). Based on results, farmers with greater amount of using SWRM in agriculture had better perceptions (r = 460, Sig. = 0.000) and more knowledge (r = 0.331, Sig. = 0.000) regarding SWRM in agriculture. They had more participation in agricultural extension courses (r = 0.370, Sig. = 0.000), social participation (r = 0.271, Sig. = 0.000), using information sources (r = 0.330, Sig. = 0.000), income (r = 0.172, Sig. = 0.000) and level of mechanization (r = 0.376, Sig. = 0.000). Finally, the farmers with a greater amount of irrigated land, have applied more SWRM in agriculture. For predicting adoption behavior of farmers regarding sustainable water resources management in agriculture by multiplicity model the discriminant analysis was used. The results showed farmers that had high using level of SWRM accurately classified with 84.6% of the cases correct. Overall, 81.8% of the original cases were correctly classified.

Key words: Sustainable water resources management, extension experts, farmers

INTRODUCTION
The success of sustainable agriculture depends on the motivation, skills and knowledge of farmers (Ommani *et al*., 2009). Extension programs have vital roles in this content. Extension can demonstrate the feasibility of sustainable practices. Consequently, sustainability is the successful management of resource to satisfy the challenging human needs, while maintaining or enhancing the quality of environment and conserving natural resource.

In Iran, many researches have done about water management in the agro-business sector. They have looked at the problems and suggested possible solutions to improve the situation. Most of these researchers have tried to integrate certain facets of water management in the agricultural field (Keshavarz *et al*., 2003; Sepaskhah and Fooladmand, 2003; Tavakoli and Ahmadinejad, 2003; Arasteh *et al*., 2003; Khatoonabadi, 2003; Aghaee *et al*., 2003; Ommani *et al*., 2006). Based on the above consideration, one of the major objectives of environmental, social and economical programs of Iran has been to identify ways such as supportive policies and dimensions of sustainable water resources management in agriculture and appropriate characteristics of agents and target groups of extension system.

Iran is located in arid and semiarid areas of the world. The average precipitation is 250 mm that is less than one-third of the world average precipitation. Also, the evaporation in Iran is more than the world average and about 72% of total rainfall directly evaporates. Therewith, spatial variation precipitation of the country is varied. Approximately, 50% of precipitation is raining at 24% of area of country and other 50% is raining at 76% of the country.

Province of Khuzestan is located in the Southwest of the country, bordering Iraq and the Persian Gulf. Its capital is Ahwaz and it covers an area of 63,238 km^2. Khuzestan is the most ancient Iranian province and is often referred to in Iran as the birthplace of the nation.

The variety of agricultural products such as wheat, barley, oily seeds, rice, eucalyptus, medical herbs; the existence of many palm and citrus farms; having mountains suitable for raising olives and of course sugar cane-from which Khuzestan takes its name-all show the great potential of this fertile plain (Ommani *et al*., 2006).

In recent years, Khuzestan Province encountered shortage of water resource. Water resources management in agriculture and increasing the water use efficiency in Khuzestan province has a vital role for conservation of water resource.

Therefore, focus on efficient use of water through irrigation efficiency and improvements in management of water use will be the major challenges in the coming years. Recent events of drought in the country have resulted in the reduction of water productivity in farming. Sustainable water resources management in agriculture and increasing the water use efficiency in Khuzestan Province has a vital role in conservation of water resources.

Ommani *et al*. (2009) Indicated that Iran's extension system does not pay enough attention to necessary characteristics of extension organization for accomplishing environmentally sound agriculture and these attributes are not favorable situation. These conditions necessitate reorganizing of extension institutions to achieve sustainability.

Considering unsustainable agricultural conditions of Iran (Ommani and Chizari, 2008), organizational recession and the inability of current extension organizations (Allahyari and Chizari, 2008) to accomplish of sustainability, it seems that extension systems require a new structure and contents to achieve sustainability objectives (Ommani *et al*., 2009).

Agricultural sustainable water resources management describes the set of approaches particular to transmittal, consumption and conservation of water resource in agriculture (Chen, 2005). It is consists of multiple approaches that include (Keshavarz *et al*., 2003):

- Special attention to the integrated use of water and other agricultural inputs (e.g., fertilizers and pesticides) and their impact on environment
- Use of pressurized irrigation systems for optimized water consumption
- Optimization of Irrigation efficiency and water productivity of agricultural lands in farm scale
- Improvement on surface irrigation in farms
- Reduction of evaporation losses from soil surface in irrigated farms
- Modifications on current cropping patterns for the optimum use of water resource for agricultural production and to increase agricultural productivity
- Notice to nutrient soil management to increase maintenance ability of water
- Manufacturing water maintenance pool for increase velocity water entry to farms
- Allocating water resource to high economic value plants

Research questions: The three main research questions are:

- What is the level of using SWRM in Khouzestan province of Iran?
- What is affecting factors on adoption of SWRM in Khouzestan province of Iran?

Basic challenges: Environmental pollution and destruction of natural resource is one of the serious problems faced by the people in Iran. Rapid population growth, industrialization and urbanization in country have been adversely affecting the environment. Though the relationship is complex, population size and growth tend to expand and accelerate negative impacts on the environment (Razavi, 2001).

Population growth and natural resource depletion: Environmental pollution is one of the serious consequences of population growth. According to Nagdeve (2002), 1.5 billion people are exposed to dangerous levels of air pollution, 1 billion live without clean water and 2 billion live without sanitation. The increase in population has been tending towards alarming situation. The world's population was estimated to be 6.14 billion in mid 2001 and projected 7.82 and 9.04 billion in the year 2025 and 2050, respectively.

Impact of agriculture on soil degradation and erosion: Direct impacts of agricultural development on the environment arise from farming activities, which contribute to soil erosion, land salination and loss of nutrients (Ommani *et al.*, 2009). In Iran, like other developing countries, soil erosion is one of the most important factors that affect on agricultural productivity. The content of annual soil erosion in Iran is estimated 2.5 billion ton. This amount is equivalent with 8 percent of soil erosion at world scale.

Nevertheless, there is a variety of evidence that agriculture in Iran still lags far behind what it could potentially achieve considering the available resource in the country. For instance, research reveals that more than 50% of the total available land, water and natural resource have not yet been used in agriculture and only 37% of all cultivable land and 58% of all acquirable water, have been utilized (Ommani *et al.*, 2009). On the other hand, sustainable land use has not yet been achieved in Iran. Chizari and Ommani (2009) claimed that the difficulties within Iranian agriculture were caused by the mismanagement of human resource by actors within the sector and not because of shortages of natural resource in agriculture.

Impact of agriculture on water resource pollution: Another direct impact of agricultural development on the environment arises from farming activities, which contribute to water pollution (Ommani *et al.*, 2009). Usage of chemical material in agricultural practices has significantly impacted water quality. Seepage of pollution waters that produce by agricultural practices is main factor to pollution of suberranean water resource.

Agriculture, as the single largest user of freshwater on a global basis and as a major cause of degradation of surface and groundwater resource through erosion and chemical runoff, has caused concerns about the quality of water. The associated agro food processing industry is also a significant source of organic pollution in most countries. Aquaculture is now recognized as a major problem in freshwater, estuarine and coastal environments, leading to eutrophication and ecosystem damage. The principal environmental and public health dimensions of the global freshwater quality problem are highlighted below (Edwin, 1996):

- Ecosystem dysfunction and loss of biodiversity
- Five million people die annually from water-borne diseases
- Contamination of marine ecosystems from land-based activities
- Contamination of groundwater resource
- Global contamination by persistent organic pollutants

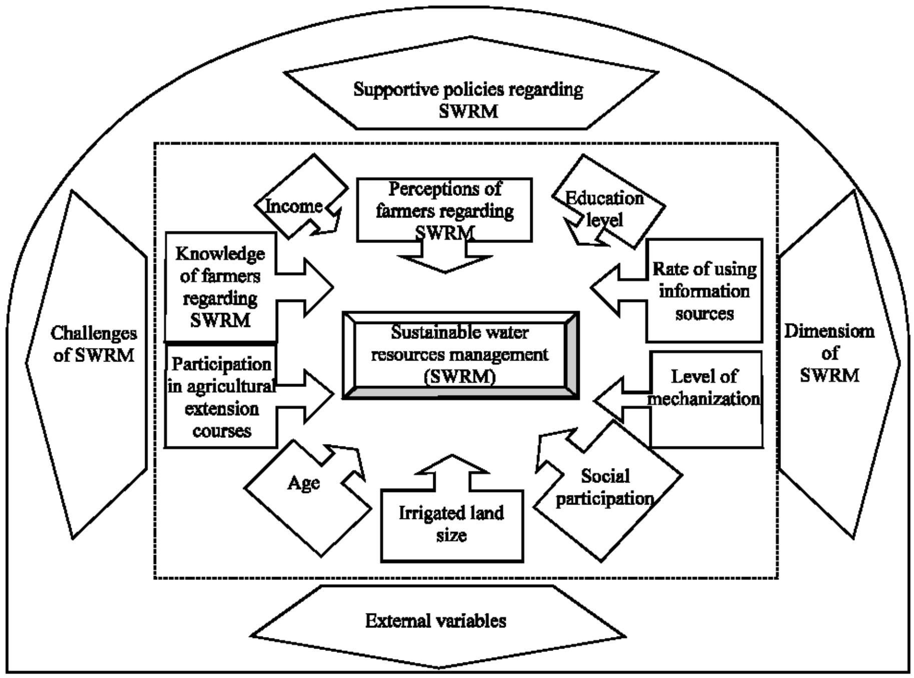

Fig. 1: Theoretical framework of research

In addition to problems of water logging, desertification, salinization and erosion, that affect irrigated areas; the problem of downstream degradation of water quality by salts, agrochemicals and toxic leachates is a serious environmental problem. It is of relatively recent recognition that salinization of water resource is a major and widespread phenomenon of possibly even greater concern to the sustainability of irrigation than is that of the salinization of soils. Indeed, only in the past few years has it become apparent that trace toxic constituents, such as Se, Mo and As in agricultural drainage waters may cause pollution problems that threaten the continuation of irrigation in some projects (Rhoades, 1993).

Based on literature review and different researches theoretical framework was designed (Fig. 1).

MATERIALS AND METHODS

The research method was quantitative research. Major forms of nonexperimental quantitative research that has been used in this research are causal comparative and correlation study. This research was conducted in Khouzestan provinces, Iran in 2008 year.

Causal comparative research: In this method, independent variable is not manipulated by the researcher but has already occurred in the natural course of events. The researcher then compares groups differing on the independent variable to determine its effect on dependent variable (Gay and Airasian, 2003).

Correlation research: This method seeks to determine relationships among two or more variables (Creswell, 2007).

Total population of farmers in the study included all wheat farmers in three township of Khuzestan Province that were selected based on stratified random sampling. Wheat farmers in

Ahwaz, Behbahan and Shoushtar Townships who cultivated wheat by the use of irrigation in the year of 2008 were the target population for this study. A random sample of wheat farmers selected from Ahwaz (N_1 = 1428), Behbahan (N_2 = 1389) and Shoushtar (N_3 = 1291) Townships. Stratified random sampling and cluster sampling were used in this study. In stratified random sampling, the population is first divided into a number of parts or strata according to some characteristic, chosen to be related to the major variables being studied. A select stratified sampling method was applied to cover all different areas. Based on geographical condition, Khuzestan Province was divided into three strata that consisted of the following parts:

- Northern; the Townships of Andimeshk, Shoushtar, Dezful, Masjed Soliman, Izeh and Shoush
- Centeral; Ramhormoz, Baghmalek, Ahwaz and Susangerd
- Southern; Bandar Mahshahr, Shadegan and Behbahan

In this study, the Townships that were chosen consisted Behbahan, Shoushtar and Ahwaz based on stratified random sampling. Sample size was determined using Krejcie and Morgan (1970) formula. From this formula it was determined that 352 farmers (N = 4108, n = 352). In addition, based on following formula the number of sample for each Township has been determined:

$$Pk = \frac{Nk}{N} \qquad nk = n \times Pk$$

Where:
N = Total of wheat farmers in Ahwaz, Behbahan and Shoushtar Townships (N = 4108)
Nk = Number of wheat farmers of each Township (Ahwaz = 1428, Behbahan = 1389 and Shoushtar = 1291)
Pk = Proportion of wheat farmers for each Township to all wheat farmers
n = Total of sample (n = 352)
nk = Number of sample for each Township (Ahwaz = 122, Behbahan = 119 and Shoushtar = 111) (Table 1)

In addition, was used cluster sampling for determining villages.

1st Step: Of 7 regional that exist at these three Townships was chosen three regional
2nd Step: Of 10 districts that exist at these three regional was chosen six districts
3rd Step: Of 95 villages that exist at these ten districts was chosen forty districts

To test the validity of a questionnaire, content-related evidence of validity was used. To test the content-related evidence, 20 copies were provided and distributed among faculty members of

Table 1: Population and sample of farmer

Township	Population	Sample	Completed questionnaires	Analyzed questionnaires
Shoushtar	1291	111	108	106
Behbahan	1389	119	116	113
Ahwaz	1428	122	120	117
Total	4108	352	344	336

Table 2: Cronbach alpha for each part of farmers' questionnaire

Variable	Cronbachalpha
Using SWRM	0.804
Social participation	0.814

Islamic Azad University, Tarbiat Modares University, Shahid Chamran University and Phd agricultural extension students. Based on their idea the questionnaire modified.

For examine reliability evidence of questionnaire of farmers and experts, 30 copies of each questionnaire distributed among Esfahan farmers and experts. For examine reliability evidence used Cronbach Alpha (Table 2).

RESULTS

Demographic profile of the participating farmers: The age, level of education, irrigated land size and income of the farmers who participated in this study is described in Table 3. Approximately, 21.1% of respondents were between 20-30 years of age and 21.7% of them between 31-40 years of age.

As can be seen in Table 3, only, 11.9% were uneducated. Of the respondents 28.6% had reached primary school level, 31.0% secondary school level, 9% high school level and about 20% possessed a high school diploma or a higher degree. Also, a considerable number of respondents (42.8%) possessed between zero to five hectares of land under irrigation cultivation and 26% had between 5-10 ha of land. Based on the results of this study, the income of 26.2% of farmers were between fifty million to one hundred million Rials and 23.8% of them upper than two hundred million Rials.

Using Sustainable Water Resources Management (SWRM) in agriculture: Sustainable water resources management in agriculture covered the set of approaches particular to transition, consumption and conservation of water resource in agriculture (Chen, 2005). It is consisting of multiple approaches that include (Keshavarz *et al.*, 2003; FAO, 2001):

- To pry special attention to the integrated use of water and other agricultural inputs (e.g., fertilizers and pesticides) and their impact on environment
- To use pressurized irrigation systems for optimized water consumption
- To optimize the irrigation efficiency and water productivity of agricultural lands in farm scale
- To improve the surface irrigation in farms
- To reduce the evaporation losses from soil surface in irrigated farms
- To improve the nutrient soil management
- To build the channel cement in farms water paths
- To manufacture the water maintenance pool for increase water velocity entering to farms
- To allocate the water resource for high value plants

Using of sustainable water resources management in agriculture were examined by 15 questions that were asked of farmers to rate their using in the questionnaire on a 6 point scale. For calculating rate of using SWRM in agriculture by interval of standard deviation from the mean (Mean = 28.716, SD = 9.841) were used below formula:

Table 3: Demographic profile of the participating farmers

Variables	f	Percentage	Cum (%)
Age (years)*			
20-30	71	21.1	21.1
31-40	73	21.7	42.9
41-50	94	28.0	70.8
50<	98	29.2	100.0
Total	336	100.0	
Level of education			
Uneducated	40	11.9	11.9
Primary school	96	28.6	40.5
Secondary school	104	31.0	71.4
High school	30	8.9	80.3
Graduate from high school	26	7.8	88.1
Associate and bachelor	40	11.9	100.0
Total	336	100.0	
Irrigated land size (hectares)			
0-5	143	42.8	42.8
5.1-10	87	26.0	68.9
10.1-15	40	12.0	80.8
15<	64	19.2	100.0
Total	334	100.0	
Income (million rials)**			
<50	64	19.0	19.0
50-100	88	26.2	45.2
100-150	64	19.0	64.3
150-200	40	11.9	76.2
200<	80	23.8	100.0
Total	336	100.0	

*: Mean: 43.285; SD: 11.968; **: Mean: 254.557; SD: 198.230

A = Very low: A≥Mean-2SD
B = Low: Mean-2SD<B≥Mean-SD
C = Moderate: Mean-SD<C<Mean+SD
D = High: Mean+SD≥D<Mean+2SD
E = Very high: Mean+2SD≥E

Based on the results that presented in Table 4, 31.0% of respondents stated that the leguminous plants never were used by farmers.

In reference to the frequency of respondents about using levels of SWRM in agriculture, for example 30.24% of respondents stated that this level was low and 40.42% of them stated that this level was moderate (Table 5).

Correlation studies: The farmers with greater amount of using SWRM in agriculture had better perceptions (r = 460, Sig. = 0.000) and more knowledge (r = 0.331, Sig. = 0.000) regarding SWRM in agriculture. They had more participation in agricultural extension courses (r = 0.370, Sig. = 0.000), social participation (r = 0.271, Sig. = 0.000), using information sources (r = 0.330, Sig. = 0.000), income (r = 0.172, Sig. = 0.000) and level of mechanization (r = 0.376, Sig. = 0.000).

Finally, the farmers with a greater amount of irrigated land have applied more SWRM in agriculture (Table 6).

Table 4: Using rate for different items of sustainable water resources management in agriculture

	Never		Very low		Low		Average		High		Very high			
Items	f	%	f	%	f	%	f	%	f	%	f	%	Mean	SD
Leguminous	104	31.0	40	11.9	72	21.4	80	23.8	32	9.5	8	2.4	1.76	1.46
Animal manure	40	11.9	48	14.3	40	11.9	120	35.7	80	23.8	8	2.4	2.47	1.31
Biological control practices	160	47.6	72	21.4	48	14.3	40	11.9	14	4.2	2	0.6	1.04	1.23
Farming control for weed	32	9.5	48	14.3	72	21.4	152	45.2	32	9.5	-	-	2.30	1.12
Integrated pest management	120	35.6	56	16.7	80	23.8	64	19.0	16	4.8	-	-	1.40	1.27
Organic practices	56	16.7	48	14.3	96	28.6	96	28.6	40	11.9	-	-	2.04	1.25
Mechanical weed control	32	9.5	56	16.7	96	28.6	104	31.0	40	11.9	8	2.4	2.23	1.17
Crop rotation	40	11.9	24	7.1	40	11.9	80	23.8	144	42.9	8	2.4	2.85	1.40
Pressurized irrigation systems	168	50.0	48	14.3	56	16.7	48	14.3	16	4.8	-	-	1.09	1.28
Cementations channel	104	31.0	72	21.4	48	14.3	72	21.4	40	11.9	-	-	1.61	1.41
Water maintenance pool	208	61.9	32	9.5	24	7.1	48	14.3	24	7.1	-	-	0.95	1.38
Plastic pipe for transmit water to farm	136	40.5	32	9.5	40	11.9	48	14.3	80	23.8	-	-	1.71	1.65
Pesticides*	8	2.4	72	21.4	176	52.4	72	21.4	-	-	8	2.4	2.02	0.86
Commercial fertilizers*	-	-	8	2.4	8	2.4	48	14.3	192	57.1	80	23.8	2.02	0.83
Hormones/growth stimulators*	48	14.3	16	4.8	24	7.1	72	21.4	88	26.2	88	26.2	3.19	1.68

Scale: 0: Never; 1: Very low; 2: Low; 3: Average; 4: High; 5: Very High; *: Score domains for these items were reverse

Table 5: Using levels of sustainable water resources management in agriculture

Levels	f	Percentage	Cum (%)
Very low	44	13.17	13.17
Low	101	30.24	43.41
Average	135	40.42	83.83
High	25	7.48	91.31
Very high	29	8.68	100.00
Total	334	100.00	

Scale: 0: Never; 1: Very low; 2: Low; 3: Average; 4: High; 5: Very high; Mean: 28.716; Median: 3.00; SD: 9.841

Table 6: Correlation between using of SWRM in agriculture by farmers and different variables

	Using of SWRM in agriculture by farmers	
Variables	$r_{(s)}^1$	p-value
Perceptions of farmers regarding SWRM in agriculture	0.460**	0.000
Knowledge of farmers regarding SWRM in agriculture	0.331**	0.000
Participation in agricultural extension courses	0.370**	0.000
Age	-0.252**	0.000
Level of education	0.321**	0.000
Level of mechanization	0.376**	0.000
Income	0.172**	0.002
Irrigated land size	0.376**	0.000
Rate of using information sources	0.330**	0.000
Social participation	0.271*	0.021

$r_{(s)}^1$: Spearman correlation coefficient; **: Correlation is significant at the 0.01 level; *: Correlation is significant at the 0.05 level

Table 7: Comparison between levels of using SWRM in agriculture based on different variables

	Kruskal-wallis test				
Variables	n	Mean rank	df	Chi-square	Sig.
Type of farming system					
Tenure	64	121.27	3	46.872**	0.000
Crop sharing	20	132.63			
Ownership	185	218.76			
Integrated	64	140.81			
Type of farming					
Rotational	256	177.75	2	20.035**	0.000
Continual	48	115.17			
Integrated	32	182.15			
Type of cultivation					
By seeder	264	158.44	2	14.843**	0.001
By hand	16	178.50			
Both	55	213.07			

**: Correlation is significant at the 0.01 level; *: Correlation is significant at the 0.05 level

Comparative studies for different groups of farmers: Differences between different groups of farmers based on levels of using SWRM in agriculture were tested by Kruskal-Wallis test. The comparisons revealed that the differences between using of SWRM in agriculture based on type of farming system (χ^2 = 46.872, Sig. = 0.000), type of farming (χ^2 = 20.035, Sig. = 0.000) and type of cultivation (χ^2 = 14.843, Sig. = 0.001) were significant (Table 7).

Discriminant analysis for predicting adoption behavior of farmers: For predicting adoption behavior of farmers regarding sustainable water resources management in agriculture the discriminant analysis was used. Discriminant analysis is a technique use to build a predictive model of group membership based on observed characteristics of each case. A discriminate function is usually of the form:

$$D = b_1 z_{1+} b_2 z_{2+} b_3 z_{3+} \ldots \ldots_+ b_k z_k$$

Analysis multiplicity model regarding adoption of Sustainable Water Resources Management (SWRM) in agriculture:

The multiplicity theory provides a model for integrating the display of variables defined in farm structure and diffusion models to explain their influence on an actor's decision to adopt an innovation. Based on multiplicity model, different variables such as income, farm size, mechanization level, age, education level, perceptions to SWRM, on-farm SWRM knowledge, access to information and social participation were analyzed. For predicting adoption behavior of farmers regarding sustainable water resources management the discriminant analysis was used (Table 8). Based of results a discriminant function is:

D1 = 0.457 Irrigated land+0.015 income+0.290 mechanization level+0.148 experience in agriculture+0.160 phosphate manure+ 0.157 nitrate manure - 0.789 age + 0.514 level of education+0.336 level of perceptions+0.649 knowledge+0.590 social participation+0.211 unirrigated land+0.412 extension education

Table 8: Discriminant analysis function regarding multiplicity model

	Mean			Pooled within-group correlation matrix													
V	G_1	G_2	G_3	Sign	IL	I	ML	EA	PM	NM	A	EL	LA	KN	SP	UI	EE
IL	6.53	9.68	9.93	0.001	1.000												
I	21.00	18.00	25.00	0.000	0.494	1.000											
ML	33.19	35.62	39.98	0.000	0.209	0.150	1.000										
EA	26.30	21.31	20.97	0.000	-0.127	-0.026	-0.060	1.000									
PM	118.10	125.00	111.10	0.000	-0.130	-0.355	-0.088	0.107	1.000								
NM	142.30	176.60	127.70	0.001	0.451	0.036	0.106	-0.059	0.166	1.000							
A	46.69	43.31	43.28	0.000	0.068	0.209	0.055	0.862	0.002	0.058	1.000						
EL	5.10	5.90	7.10	0.000	0.040	0.296	0.408	-0.380	-0.302	-0.017	-0.386	1.000					
LA	50.38	53.12	55.20	0.000	-0.116	-0.137	0.261	0.007	0.392	0.600	-0.165	0.204	1.000				
KN	33.84	36.32	41.60	0.000	-0.047	0.126	0.309	-0.123	-0.510	-0.196	-0.063	0.443	-0.157	1.000			
SP	7.84	7.81	9.20	0.000	-0.335	0.111	0.032	0.201	0.027	-0.164	0.333	-0.028	0.089	0.176	1.000		
UI	7.84	12.93	20.21	0.000	0.298	0.718	-0.006	0.059	-0.431	-0.082	0.289	0.055	-0.345	0.127	0.101	1.000	
EE	1.90	2.30	3.10	0.000	0.124	0.438	0.382	-0.234	-0.328	-0.293	-0.501	0.493	0.610	0.390	0.581	0.018	1.000

V: Variables; G1: Low user; G_2: Moderate user; G_3: High user; I: Income; IL: Irrigated Land; ML: Mechanization Level; EA: Experience in Agriculture; EL: Education Level; PhM: Phosphate Manure; NM: Nitrate Manure; LA: Level of perceptions; KN: Knowledge; SP: Social Participation; UL: Unirrigated land; A: Age; EE: Participation in extension education

Table 9: Grouping farmers based on level of using SWRM in agriculture

		Predicted group membership		
Actual groups	No. of cases	Low user	Moderate user	High user
Low user	104	88.0	8.0	8.0
		84.6%	7.7%	7.7%
Moderate user	128	16.0	96.0	16.0
		12.5%	75.0%	12.5%
High user	104	16.0	0.0	86.0
		15.4%	0.0	84.6%

Note: 81.0% of the original cases were correctly classified

Wilks' lambda = 0.486
Chi-square = 248.433
Sig. = 0.000
Eigenvalue = 0.855
Canonical correlation = 0.679

Wilks' lambda is used to test the significance of the discriminant function as a whole and the eigenvalue reflects the ratio of importance of the dimensions which classify cases of the dependent variable. The proportion of variance unexplained was 48.6% (Wilks' lambda = 0.486). Also the degree of association between the groups and the discriminant scores was expressed as a canonical correlation of 0.679:

D2 = 0.005 Irrigated land+0.826 income+0.922 mechanization level+1.176 experience in agriculture+0.062 phosphate manure+0.103 nitrate manure -1.402 age+0.038 level of education+0.480 level of perceptions+0.453 knowledge+ 0.532 social participation+1.372 unirrigated land+0.282 extension education

Wilks' lambda = 0.869
Chi-square = 46.094
Sig. = 0.000
Eigenvalue = 0.151
Canonical correlation = 0.362

The Table 9 shows that the farmers had high using level of SWRM accurately classified with 84.6% of the cases correct. Overall, 81.8% of the original cases were correctly classified.

DISCUSSION

In reference to the frequency of respondents about using levels of SWRM in agriculture, for example 30.24% of respondents stated that this level was low and 40.42% of them stated that this level was moderate. This result is confirmed in the research of Ommani and Chizari (2008), Allahyari and Chizari (2008) and Ommani (2009).

The farmers with greater amount of using SWRM in agriculture had better perceptions (r = 460, Sig. = 0.000) and more knowledge (r = 0.331, Sig. = 0.000) regarding SWRM in agriculture. They had more participation in agricultural extension courses (r = 0.370, Sig. = 0.000), social participation (r = 0.271, Sig. = 0.000), using information sources (r = 0.330, Sig. = 0.000), income (r = 0.172, Sig. = 0.000) and level of mechanization (r = 0.376, Sig. = 0.000). Finally, the farmers with a greater amount of irrigated land have applied more SWRM in agriculture. This result is confirmed in the research of Chizari and Ommani (2009), Ommani *et al.* (2006, 2009) and Ommani and Chizari (2009).

CONCLUSIONS

In-service training programs play a critical role in reinforcing staff capability, as well as renewing their skills. The organizations and institutes which are responsible for in-service training both for agricultural experts must consider training needs of them.

The results of this study were identified important supportive policies regarding SWRM in agriculture. Agricultural extension organizations in provincial and national levels can benefit from these proposed pol icies. The most important supportive policies regarding SWRM in agriculture were: encouraging farmers for using sustainable methods, considering financial credit for SWRM in agriculture, increasing knowledge of farmers regarding SWRM, dissemination of organic farming and limitations in pesticide using.

Based on the results, the farmers with greater amount of using SWRM in agriculture had better perceptions and more knowledge regarding SWRM in agriculture. They had more participation in agricultural extension courses, social participation, using information sources, income and level of mechanization. Therefore, governmental and nongovernmental organizations that are working regarding SWRM in agriculture must consider mentioned items.

Based on results the use of multiplicity model in extension system programming regarding SWRM has additionally increased the willingness of farmers to rely upon extension activities. In sum, it could be said that agricultural extension, as a whole, aims at improving the competencies (knowledge, skills and perceptions) of farmers in order to improve their career performance. Therefore, the researchers suggested that adjustable and flexible extension and research programs would improve the understanding of complex farming system and effectiveness of relevant activities.

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