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A Study of Factors Influencing Development of Pressurized Irrigation Systems in Iran (Case Study in West Azerbaijan Province)

Solieman Rasouliazar

Department of Agricultural Management, Mahabad Branch, Islamic Azad University, Mahabad, Iran

Abstract: The main purpose of this research was to identify the factors influencing development of pressurized irrigation systems in Iran. Research population of this study was consisted of farmers in West Azerbaijan Province (N=2565). A number of 301 farmers were selected through proportional stratified random sampling. A pilot test was conducted to find if the questionnaire reliable and Cronbach's Alpha ranged from 0.84 to 0.87. The findings of this study showed that the Technical Extension Agents have important role in encouragement farmer to application pressurized irrigations systems. Farmers reported that Agricultural Extension Center was their main technical information resource. Findings also indicated that economical factor was the most important factor in expanding of pressurized irrigation systems in West Azerbaijan Province.

Key words: Irrigation systems · Farmers · West Azerbaijan · Iran

INTRODUCTION

Statistics shows that over 75 percent of Earth's surface is covered by water. Earth's fresh water resources, make up only 2.5 percent [1]. Water is the first source for saving our life in the Earth. Access and optimal use of water is necessary to achieve economical and social development and poverty reduction [2]. World Bank estimated that until 2035 year three billion people live purgatory under tolerate of water stress conditions [3]. Qadir and his colleagues [4] believed that the water will find value of the oil in the present century. Shahroudi and Chizari [5] also expressed that the issue of water shortage will become one crisis that threat human life in the near future and will become one of the main challenges of the nations.

Agriculture is a vital sector of the economy of Iran. Currently, about one-fourth of the nation's GNP, one-third of the work force, more than four-fifths of the nation's food needs, one third of non-oil exports and nine-tenths of industry is dependent on agriculture [6]. Also Iran has advantages in producing agricultural goods [7-9]. Iran with average annual rainfall of 252 millimeter is located in dry regions in the world. 65 percent of arid and semi-arid regions of Iran, that their average amount of rainfall is less than 150 millimeter [10]. Sydan and Firooz [11] in their studies indicated that Iran Will experience water stress and water crisis In the next decade.

In recent years, drought has had adverse effect on the Iran agricultural sector. Saleh and Mokhtari [12] pointed to poverty and uncontrolled rural migration, lack of access to adequate water for irrigation of agricultural farms that is some unpleasant consequences of water shortages in the agricultural sector. Program planners considered developing optimal agricultural water management as one way to effectively achieve to agricultural development and economic progress [13]. However, unfortunately in Iran more than 70 percent of water resources in the agricultural sector are outside [14].

In Iran the use of traditional irrigation methods (Surface Irrigation, Basin Irrigation, Border Irrigation, Irrigation) efficiencies ranged between 23 and 32 percent. This subject causes that the balance between amount of using groundwater sources (55 billion m^3) and extraction of groundwater (45 billion m^3) eliminates [15]. One of the effective ways to increase utilization of agricultural water resources is irrigation system. According to the pressurized irrigation system characteristics, these systems can increase the yield per unit area, saving water, increasing irrigation performance (70 to 95 percent) and irrigation land and the post land [16]. Radmanesh [17] stated that if Iranian farmers increase their irrigation efficiency by only 5 percent, there will be saved more than 4 billion cubic meters of water per year.

Corresponding Author: Dr. Solieman Rasouliazar, Department of Agricultural Management, Mahabad Branch, Islamic Azad University, Mahabad, Iran. E-mail: rasouli88s@yahoo.com.

Iran's Agricultural Ministry [18] indicated that only about 12 percent of the country's farms were equipped with pressurized irrigation systems. National Committee of Irrigation and Drainage [19] stated in his report that Iran's irrigated lands, except the first ten countries in the world. Unfortunately, less than 10 percent of Iran irrigated land is under irrigation systems. While countries such as Lithuania, Austria and England close to 100 percent of their agricultural lands covered by pressurized irrigation systems. This comparison shows that in Iran use pressurized irrigation systems by farmers is very low.

However, this question could be considering that which factors must be considered by farmers and program planners for expanding pressurized irrigation systems? Many researchers have investigated the factors influencing the adoption of pressurized irrigation system [20,21,8,22,23,24,25]. Farmer's financial ability to operate irrigation system was identified as one of the main influencing factors in studies of Noruzi and Chizari [26], Jahannema [21], Karbassi [27] and Rogers and Shomiker [28].

Rasouliazar and Feli [29] in their research showed that economic factors such as size of cultivated land, appropriate engineering design, system economic consequents, extension-education supports for sprinkler irrigation systems, social supports for use of sprinkler irrigation systems, type of system had an impact on continuing or discontinuing sprinkler irrigation systems influence in adoption of sprinkler irrigation systems among farmers. Kashani [30] distinguished the role of agricultural experts and extension agents in encouraging farmers to use irrigation systems. Also, Khaledi [31] identified factors in the development of pressurized irrigation systems in Iran, as economical, social, technical, educational and extension factors in his research. Karami and his colleagues [32] finding indicated that the planners don't pay attention to social and financial factors, in the expanding of pressurized irrigation systems. These factors have an important role in the adoption of pressurized irrigation systems among farmers in Iran.

West Azerbaijan Province is located in northwest of Iran and produces many agricultural crops such as wheat, alfalfa, sugar beet, corn and barely. This province is located between 36° and 39°E and 44° and 47°N. It has an area covering 37590 square kilometers and has a population of 2873459, out of which, 1148505 live in rural areas. Its annual rainfall average is 300-400 mm.

The main purpose of this study was to examine the effective factors toward expanding of pressurized irrigation systems among farmers in West Azerbaijan Province of Iran. The specific objectives were:

- To determine personal and farming characteristics of farmers;
- To identify viewpoints of farmers about factors motivating them to use pressurized irrigation systems.
- To identify viewpoints of farmers about technical information resource about pressurized irrigation systems.
- To identify the major components of expanding pressurized irrigation systems among farmers.

MATERIAL AND METHODS

A survey was conducted to achieve the research objectives. The survey was conducted between 16 October 2010 and 12 December 2011. The research population included all farmers that accepted pressurized irrigation system in the West Azerbaijan (N = 2565). By Using Krejice and Morgan's [33] table, sample size was determined at 301. The sampling method that used in this study was proportional stratified random sampling technique. Therefore first of all, West Azerbaijan province were divided to three categories: North (Khoy, Maku and Chaldoran townships), central (Urmia and Salmas townships) and southern (Takab, Shahindeg, Bukan, Mahabad, Sardasht, Piranshahr, Miyandoab, Naqade and Oshnavieh townships). Then the sample size was dividing to the population of each category. In the next stage, the Khoy Township in north, the Urmia Township in central and Mahabad Township in South category were chosen to collect data. A questionnaire was the main instrument for data collection. Content and face validity were established by a panel of experts consisting of faculty members and irrigation experts in the Department of Agriculture. A pilot test was conducted to find if the questionnaire reliable and Cronbach's Alpha ranged from 0.84 to 0.87. For determining effective factors that influence development of pressurized irrigation systems among farmers, Factor analysis was employed using by using Statistical Package of Social Science (SPSS18).

RESULTS

The results of descriptive statistics show that the average age of farmers was 41 years and the majority of them were in the 49-34 age group (55.8 percent). The average of age experience in agricultural activity was 23. The average of farm size was 7.5 hectares. Majority of the respondents (31.6 percent) had a guidance school degree. The average distance to agricultural extension centre was 14.6 kilometers (Table1).

Table 1: Personality characteristics of respondents

Variables	Mean	SD.	Min.	Max.
Age	41.34	10.8	18	75
Years of experience	23.67	12.46	2	61
Years of Education	7	4.71	0	18
Farm size (Hectare)	7.51	10.15	1.5	80
Distance to agricultural extension centers (kilometer)	14.60	8.48	3	50

Table 2: Priorities of resources that encourage farmers to application pressurized irrigation systems

	Very low		Low		Average		High		Very High				
	%	F	%	F	%	F	%	f	%	f	Mean	Sd.	CV
Agricultural Experts	14.3	43	13.6	41	26.2	79	37.5	113	8.3	25	4.11	1.09	0.26
Local leaders	29.9	90	25.6	77	30.2	91	10.6	32	3.7	11	3.42	2.04	0.59
Other farmers and neighbors	14	42	22.6	68	30.9	93	19.6	59	13	39	3.95	1.09	0.27
Companies Executive pressurized irrigation Systems	21.1	63	21.4	64	29.8	89	19.7	59	8	24	3.72	1.22	0.32
NGOs	42.9	129	25.2	76	19.9	60	10	30	2	6	3.02	1.09	0.36
Banks and governmental organizations	48	144	16.3	49	18.7	56	10.3	31	6.7	20	3.11	1.29	0.41
Radio and television advertising	25.8	77	29.4	88	20.1	60	12.7	38	12	36	3.55	1.32	0.37

1=Very low, 2=Low, 3=Average, 4=High and 5=Very high

Table 3: Information resources from which farmers obtain information about irrigation systems

	Very low		Low		Average		High		Very High				
	%	F	%	F	%	F	%	f	%	f	Mean	Sd.	CV
Radio and television	24.7	72	23	67	29.2	85	14.4	42	8.6	25	3.58	1.24	0.346
Educational film	32.3	94	35.4	103	19.6	57	8.6	52	4.1	12	3.16	1.09	0.344
Extension publications	32	93	26.5	77	26.5	77	12	35	3.1	9	3.27	1.12	0.342
Companies Executive Pressurized Irrigation System	9.9	29	19.5	57	35.4	105	26	77	9.2	27	3.86	1.03	0.266
Agricultural Extension Center	13	38	11.2	43	31.7	93	29.4	86	14.7	43	4.88	1.08	0.221
Agricultural consultants	19.2	56	20.9	61	39	114	15.4	45	5.5	16	3.67	1.11	0.302
Neighbors and other farmers	15.5	45	23.1	67	26.9	78	23.4	68	11	32	3.91	1.23	0.335
Demonstration farm	21.1	62	27.3	80	25.3	74	15	44	11.3	33	3.67	1.22	0.332
Classes and extension workshops	27.3	80	23.5	69	25.3	74	18.8	55	5.1	15	3.5	1.21	0.345
Local leaders and extension workers	20.5	60	25.9	76	34.5	101	15.4	45	3.8	11	3.55	1.09	0.307
Internet	54.5	159	23.6	69	11.3	33	6.5	19	4.1	12	1.82	1.12	0.61

1=Very low, 2=Low, 3=Average, 4=High and 5=Very high

Several people motivated farmers use the pressurized irrigation systems. The findings indicated that agricultural experts were introduced as the most effective people (CV=0.26) in encouraging farmers to use the pressurized irrigation systems. Kashani's studies (1992) finding also showed that agricultural experts and extension agents have important role in encouraging farmers to use pressurized irrigation systems. Due to this, extension and educational institutions should have a significant effort to provide adequate and comprehensive information regarding installation of pressurized irrigation systems. Neighbors and other farmers (acceptor pressurized irrigation systems) had a major role in encouraging other farmers to set up these pressurized irrigation systems in their farms (CV=0.27). Table 2 shows people and institutions that encourage farmers to develop pressurized irrigation systems. Unfortunately, provider organizations, funding sources (banks and financial suppliers) played a major role in encouraging farmers to develop pressurized irrigation systems.

Technical Information Resources in Expanding Pressurized Irrigation Systems: In agricultural extension programs after farmers began to accept the new technology (innovations), they search for additional information for better use of new technologies and resolve technical defects [28]. In this research, various sources were identified to provide technical information to farmers. As observed in table 3 Agricultural Extension Center (CV=0.221) has been introduced as the main source for providing technical information in the field about pressurized irrigation systems to farmers.

Table 4: Eigen values and the cumulative variance percentage of extracted determinants toward expanding irrigation systems

	Rotation sums of squared loading		
Factor	Eigen values	variance percentage	cumulative variance percentage
1	3.57	23.57	23.57
2	2.70	19.86	43.43
3	2.49	16.80	60.23
4	1.41	13.30	73.35

Table 5: Related variables to each factor for expanding pressurized irrigation systems with their factor loading

Factor name	Variables	Factor load	% of Variance
Economical factor	Increasing crop yield	0.780	
	Reducing agricultural water use	0.699	
	Reducing the need for manpower	0.507	23.57
	Easier to control weeds	0.617	
	Easy access to bank credits required	0.697	
	Guidance provided by the promoters	0.655	
Extension-educational factor	Training courses and classes	0.794	
	Use of technical experts for training farmers	0.703	
	Distribution of educational films and CDs	0.738	19.86
	Provide guidance for access to credit for use the system	0.756	
	Demonstration farms set up	0.662	
	Agricultural Consultants	0.647	
Executive factor	Ability to solve possible technical defects	0.817	
	Access to technical Experts systems	0.743	
	Agricultural department cooperation for technical problems	0.776	16.80
	Supportive services and warranty by the Company	0.786	
Socio-cultural factor	Water shortages affecting irrigation system acceptance	0.651	
	High efficiency of system in low-water condition	0.581	
	Government policies in support of planning and optimal use of water resources	0.666	13.30
	Sense of competition among the people for the use of pressurized irrigation systems	0.543	

This point shows that farmers still consider the agricultural extension services center as an important source of information and technical knowledge. Therefore, agricultural extension planners need to Pay due attention to the fact that agricultural extension center must provide sufficient information for farmers and lasting this relation. Executive pressurized irrigation systems companies, agricultural consultants are located in the next priorities for providing technical information for the farmers. Other important sources for obtaining technical information about irrigation systems have been shown in Table 3.

Factor analysis is a general term for some multivariate statistical methods whose main purpose to reduce the number of variables in a data set into smaller number of dimension. This method examines internal correlation in a large number of variables and eventually is explained in the form of general operating and restricted categories. Performed calculations display that internal coherence is proportional (KMO=0.801) and the Bartlett statistics is significant (χ^2= 6082.047 and P=0.000).

Table 4 shows the classification of the factors into four latent variables using the ordinal factor analysis. The variables were classified into financial, extension educational, socio-cultural and executive (technical) factors. The basic idea of factor analysis is to find a set of latent variables that contain the same information. The classic factor analysis assumes that, both observed and the latent variables are continuous variables. Results show that the four factors explain 73.53 percent of the total variance in expanding pressurized irrigation systems among farmers. Table (4) explains variance by each of the factors that influence expanding of pressurized irrigation systems among west Azerbaijan farmers (Table 4).

Table (5) explains factor loading by each of the factors that influence expanding of pressurized irrigation systems among west Azerbaijan farmers. As it can be seen financial, extension educational, socio-cultural and executive (technical) factors were identified as main components in the usage and expanding pressurized irrigation systems (Table 5).

The first factor referred to economical factor with Eigen value (3.57), which is higher than other factors, explains 23.57% of the total variance. The second factor was named extension-educational factor. This factor according to the Eigen value (2.70) could explain 19.86% of total variance. The third factor was named executive (technical) factors. According to the Eigen value (2.49) these factors could explain 16.80% of total variance. The fourth factor was named socio-cultural factor. This factor according to the Eigen value (1.41) could explain 13.30% of total variance.

Among these factors, economical factors can cause the influence in the expanding pressurized irrigation systems among farmers in West Azerbaijan province. Therefore, in order to increase adoption and development of pressurized irrigation system among farmers, point to some cases such as providing adequate funds and providing bank loans is necessary.

CONCLUSION

According to the finding following steps should be taken to develop irrigation systems in the West Azerbaijan province:

Increase awareness of farmers about of pressurized irrigation systems to them. Agricultural experts and extension agents were introduced by farmers as a major source of encouraging them to use pressurized irrigation systems and providing important information for them. So they must have sufficient scientific and technical knowledge about irrigation systems to meet the problems of farmers. These finding findings are consistent with prior researches, such as [29, 30].

Also promote the use of this technology (pressurized irrigation systems) among the farmers need to consider different components like economical, socio-cultural, extension-educational and executive factors in the application irrigation systems. Considering these factors could be increase expanding of pressurized irrigation systems in West Azerbaijan province among farmers. Economic factors are important components in establishment pressurized irrigation systems. Therefore government should set up credit resource to farmers. Research findings are in line with these studies [32, 29, 31].

Although this is necessary to mention that other studies must be identified other components that effective on adoption and development of pressurized irrigation systems in West Azerbaijan Province. Because factors were introduced in this study have only can explain about 74.53 percent in the development of pressurized irrigation systems. Therefore, other factors must also be identified. Understanding other mechanisms on promoting using irrigation technologies among farmers could provide desirable management in use water resources in the agricultural sector is in West Azerbaijan province of Iran.

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