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Original Article

Analysis of the Barriers to Equipping Agricultural Lands with the New Irrigation Technologies (Case study: Shahrabaad Rural District of Bardaskan County, Iran)

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Abstract

Purpose- Due to its special geographical location in the arid and semi-arid climate belt of the world, Iran suffers from water scarcity and limited usable water resources, notably considering the population growth and increasing demand for water and food. High water consumption in agriculture as one of the main waters use sectors is estimated as 90% of total water, thereby necessitating consideration of water conservation methods. However, there are a number of barriers to use the current water conservation practices. Thus, the present study aimed to investigate the barriers to equipping agricultural lands with the new irrigation technologies in Shahrabaad rural district, Bardaskan city.

Design/methodology/approach-This is an applied study in terms of purpose and descriptive-analytical in terms of method, carried out using the random sampling method. The sample size was 338 households in the research area which was determined using Cochran's formula. Data were collected based on field and library studies. The validity of the questionnaire was confirmed by university professors and experts. The reliability coefficient of the questionnaire was 0.78 using Cronbach's alpha coefficient. Moreover, the TOPSIS fuzzy model was used to rank the villages in terms of the effect of barriers to using the new irrigation technologies, and SPSS software was used for analyzing the research questions.

Findings: The study showed that the economic dimension was the most important barriers to using the new irrigation technologies. In addition, low-socioeconomic status of the farmers and small loans are the most prominent barriers to equipping agricultural lands with the new irrigation technologies in the research rural district.

Research limitations/implications-Unavailability of statistical information when referring to the Agricultural Jihad and the Governor's Office, and completing the questionnaire, depending on the subject at the village level, is one of the main challenges of the present study.

Practical implications-Given the specific research findings, it is necessary for agriculture and water policy-makers take serious measures concerning the incentive (low-interest and long-term loans, micro-land integration and the like) and punitive (imposing restrictions on traditional land users and stipulating other supports to change the irrigation method) instruments, because otherwise water restriction and the consequences of water scarcity will be challenging in many areas and even may lead to a serious crisis.

Originality / Value: This study is prima facie significant in terms of statement of the reasons for the barriers to equipping agricultural lands with the new irrigation technologies from the users' perspective and then, in terms of a more detailed analysis of the research findings to change the implementation of traditional irrigation methods.

Keywords: Irrigation Systems, Land Equipment, Barriers, Water Scarcity, Shahrabaad Rural District

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1. Introduction

The greatest ancient civilizations of the world, including early advanced agricultural civilizations flourished in arid and semi-arid regions; however, the lack of sufficient available water resources to meet the demands within these regions led to the human migration for finding a habitat with reliable water resources. Considering the main role of agriculture in economic development of societies and human dependence on water, for many religions, customs and beliefs, water plays a leading role in rituals and practices, even as a sacred element (Baghani et al., 2011). With the start of industrial revolution and the reduction of the economy's dependence on water resources, as well as the extraction of water resources using the new technologies, water lost its first place; however, the rapid population growth and food crisis led to increased water consumption, notably in agriculture sector as the largest water consumer (Masoumi Jashni et al., 2016). This has led to a crisis in many parts of the world, especially in Iran, whose agriculture is dependent on groundwater resources, and led to the resource crisis as well as challenging the principle of agricultural sustainability (Nowruzi & Chizari, 2006). It is well-known that the planet undergoes a more critical ecological period compared to thousands years ago. The incompatibility between the needs of modern man with the earth facilities and resources is one of the basic challenges of modern human and one of the main research concerns. Water, among others, is the scariest factor in the production of agricultural crops and there is a direct relationship between the development of the agricultural sector and the quantity and quality of water resources as well as water management and usage strategies (Khalilian & Mousavi, 2005). Old management theories based on the assumption of abundance of natural resources should be reformulated by considering the assumptions of limited water resources (Bagheri & Moazzezi, 2012). Accordingly, it is widely accepted that the movement of human society based on sustainable development is the only solution to survive life on the earth (Afrakhteh et al., 2013). Therefore, sustainable development management theories and the limitation of natural resources, notably, the limitation of Iran's water resources should be seriously taken into account (Samadyar et al., 2008). Thus, water management and proper use of water resources can play an efficient and sensitive role in the sustainable development of Iran (Karim Koshteh et al., 2001). Limitation of water resources as well as increasing population growth and agriculture product consumption necessitates the consideration of the economical methods of water consumption and improvement of irrigation systems, thereby, on one hand, providing sufficient water resources and on the other hand, increasing production and improving the Iran's economy, especially the status of rural households. Given that agricultural crops play a vital role in the survival of rural economy, increasing crop production with reduced costs may lead to the social stability and economic growth of villages (Gongn & Lin, 2000). Hence, the use of modern irrigation systems in rural economics (agriculture sector) may be one of the effective policies for water demand management so as to protect and promote economic efficiency as well as increase water use productivity (Asadi & Soltani, 1999; Mohseni & Zibaei, 2008). As a result, it is necessary to deal with the new irrigation systems and their operation in different regions of Iran, particularly, in terms of increasing the production of comparatively advantageous agricultural products, given the limited resources. Shahrabaad village in Bardaskan city in Khorasan Razavi province which is located in an arid and semi-arid region suffers from a major drop in the average annual rainfall in recent years. Severe constraints on available water resources and anticipation of future droughts increasingly threaten the farmers' livelihoods and economic well-being. The low surface water and severe changes in annual rainfall has led to the low water supply. Lack of surface water resources and its use for agricultural purposes justify the importance of using water consumption optimization strategies, especially when water scarcity and drought occurs (Moinuddini et al., 2015). The use of modern irrigation systems in the region is one of the water consumption optimization strategies. It may be effective to achieve the above-mentioned objectives according to the practical experiences on using modern irrigation systems in Khorasan Razavi province. However, in spite of the great support for this technology, farmers do not use it (Jalali & Karami, 2005). Consequently, considering that

agricultural activities are dominant in most of the villages of Shahrabaad in Bardaskan and most of the farmers use surface irrigation, it is required to study the barriers to equipping agricultural lands with the new irrigation technologies in this region. To this end, this study aimed to answer the following questions:

1. What are the barriers to equipping agricultural lands with the new irrigation technologies?
2. Which barriers to equipping agricultural lands with the new irrigation technologies is of great importance?
3. What is the difference between the studied villages in terms of barriers to equipping agricultural lands with the new irrigation technologies?

2. Research Theoretical Literature

Nowadays, economic growth and development (Ashrafi et al., 2014) as one of principles of the sustainable development is viewed as one of the main concerns of the most societies (Roknuddin Eftekhari & Ghaderi, 2002). The transformation and improvement of the economic system is owed to the comprehensive sustainable development where the agricultural sector at the regional levels is of great importance for a variety of reasons such as providing food security and industrial raw materials, industrial development, labor force and the like (Irish Leader Net work, 2000). In fact, the sustainable growth of the agricultural sector affects the stability and economic growth of societies (Srdjevici, 2004). In general, the economic growth of each country is not possibl without the growth and development of agricultural hardware and software at the regional level (Taleb & Anbari, 2008). In fact, development literature shows that environmental potentials, the agricultural soil quality and especially sufficient water resources, which are considered the spatial themes of each region, facilitate the spatial activities and plays an essential role in agricultural development (Roknuddin Eftekhari et al., 2009). At the same time, water is the most precious wealth available to human beings, especially in arid areas that cover a large area of Iran. Due to the dry and unsustainable climate of Iran and considering the recent droughts, water as a vital element become more and more important. Therefore, without a sustainable development planning for water resources, Iran will face unsolvable problems in future. On the other hand, considering that more than 94% of the Iran's water resources are consumed in the agricultural sector, further studies should be carried out on agriculture irrigation systems (Mirzaei Khalilabadi & Chizari, 2004). The water scarcity will be the main issue dealt with in future, because the world population will reach 9.4 billion people by 2050 and will be the most important concern of managers and leaders on water and food supply and environmental protection. This is especially a matter of concern for Middle Eastern countries, because with 5% of the world's population have access to only 1% of fresh water (Mahboubi et al., 2011). For this reason, it is required to discover new methods in agricultural development based on the protection of agricultural resources which, simultaneously, employ new ecological methods and knowledge (Sarmadian, 2009). The higher irrigation losses than the global average in agriculture sector of Iran that is located in arid and semi-arid region (Asadi & Yazdanpanah, 2012), occurs due to a number of reasons such as losses of water transfer from source to consumption place, high water losses in agricultural farms, inappropriate shape and size of farms relative to the amount of water and irrigation method, farmers' awareness of optimizing water consumption, the lack of use of proper irrigation methods, and low irrigation efficiency. Thereupon, in recent years, in order to improve irrigation efficiency, a number of measures have been taken in Iran, the most important of which is to introduce and develop the use of new irrigation systems by farmers. Currently, the use of new irrigation technologies and economic water management is one of the major effective solutions to deal with the water scarcity crisis in the agricultural sector (Nowruzi & Chizari, 2006). The industrialization of agriculture in most countries threatened by water scarcity, has led to the more serious control over water consumption. That is, it is possible to use water in any amount, whether small or large, at any time by farmers. Using the surface irrigation is relatively difficult, and therefore, the water resources should be transferred to a closed system such as a pipe and then be consumed. Pressurized irrigation methods rather than surface irrigation (gravity) methods are preferred for land use due to more uniform distribution of water resources on the land and adaptability to different types of soils and topography. On the other hand, they can be considered within the sphere of sustainable agriculture (Behbahani Motlagh et al., 2017). Pressurized irrigation refers to any irrigation

method in which water is distributed by pipe at a pressure of more than one atmosphere (relative pressure) on the surface of the land. In a simple division, irrigation methods are classified into two categories: gravity irrigation and pressurized irrigation. Pressurized irrigation is also divided into two types: sprinkler and drip irrigation. The use of sprinkler irrigation methods in the world traces back to 65 years ago (1945) and the use of drip (micro) irrigation methods in the world traces back to 42 years ago (1968); the latter can provide soil with moisture (Sohrabi & Paydar, 2004). Previous studies show that many countries around the world (including developing countries) have focused on improving water efficiency and productivity since the development and use of various pressurized irrigation methods. In the last two decades, the scope of sprinkler irrigation systems has been gradually reduced and the use of various micro-irrigation methods has been developed. Pressurized irrigation methods in Iran officially flourished since the 1970s and the area covered by lands equipped with this type of irrigation before the Islamic Revolution is estimated at 50,000 ha (Valizadeh, 2003). Analysis of the development of various types of pressurized irrigation methods also reveals that although the use of pressurized irrigation methods in lands is increasing, various types of micro-irrigation methods have gradually been accepted by the farmers. The variety of sprinkler and drip irrigation systems has increased to such an extent that it is very difficult to categorize all of them under the two general names of sprinkler and drip irrigation, and it is more appropriate to use the term *pressurized* irrigation.

A review of the relevant literature reveals that a number of studies have been already conducted on equipping agricultural lands with new irrigation systems in the villages of Iran and a few studies have been conducted on barriers to equipping agricultural lands with the new irrigation technologies, some of which are reported in Table 1 .

Table 1. Relevant studies

(Source: Authors' library studies, 2019)

Author	Results
Taghvaei et al. (2010)	The results showed that the fragmentation and dispersion of farmers' lands has been the most important barrier in the development of pressurized irrigation systems. Pressurized irrigation systems and encouragement of farmers in the region, with financial support and easier provision of banking facilities are among the suggestions for further studies.
Kiani & Shaker (2019)	Results showed that despite the development of supportive programs and policies by the parliament and the government, no serious action has been taken and cultural, social, economic and technical barriers played a key role in the lack of development.
Noori et al. (2017)	Results showed that four hardware barriers to the use of irrigation systems are: executive system, agricultural characteristics, behavioral and environmental incompatibility.
Gholikhani Farahani (2013)	Results showed that factors such as communication channels can be effective in removing barriers to the use of these systems, and visiting, television, participation in training courses had the first to third ranks. Also, the high cost of spare parts, land dispersion, lack of skilled labor had the first to third ranks of the existing barriers.
Gholikhani Farahani (2013)	Results of stepwise multivariate regression showed that arable land area, increasing crop yield, cost-effectiveness of sprinkler irrigation, insurance impact, obtaining innovation information from promotional centers totally explain 77.7% of the acceptance of innovations of advanced irrigation systems.
Mahboubi et al. (2011)	The results showed that it is important to hold training classes and facilitate farmers' use of loans to establish new irrigation methods.
Niknami et al. (2013)	The results showed that the variables of educational level, history of gardeners' activity, history of using pressurized irrigation system, participation in the promotional training courses, visiting pressurized irrigation systems, and the like had a significant relationship with the variable of gardeners' knowledge in using pressurized irrigation systems. The results of multiple stepwise regression also revealed that the variables of contact with promoters and participation in promotional classes explained the proper use of pressurized irrigation systems.

Author	Results
Amini & Afzali Abarghuei (2013)	The results showed insignificant success of users in installing the pressurized irrigation systems. The research findings show that the variables "Individual characteristics, exploitation, management, economic of operators" and "participation, encouragement and cooperation of related organizations in the implementation of pressurized irrigation systems" affect the success of operators. It has had a positive effect on the establishment of these systems. In contrast, the "status and social activity of users" had a deterrent effect on their success.
Nazari et al. (2013)	The results showed that land integration and reduction of the number of land plots are noticeable, and on the other hand, with the implementation of sprinkler irrigation systems, the area of sugar beet cultivation has sharply increased (doubled). The results of evaluating the effect of systems on the production of crops in the region showed that the average production of wheat, barley and sugar beet increased by 1.31, 0.52 and 31.84 tons per hectare, respectively.
Al-Ghobari & Dewidar, (2018)	Crop and tomato yields were evaluated for two consecutive years under surface and subsurface drip irrigation and three methods: 1 full irrigation supply (T1), 0.8% full irrigation supply (T2) and 0.6% of complete irrigation (T3). The results showed that the highest yield is in the types that are irrigated by subsurface drip irrigation at T1 (94.1 tons per hectare) and T2 (81.4 tons per hectare).

According to the available information (theoretical research foundations), it seems that despite the many advantages of using pressurized systems in irrigation efficiency in Bardaskan, this type of irrigation has not been enough considered due to climatic conditions and the dominance of the agricultural sector in supply residents' livelihoods (Figure 1).

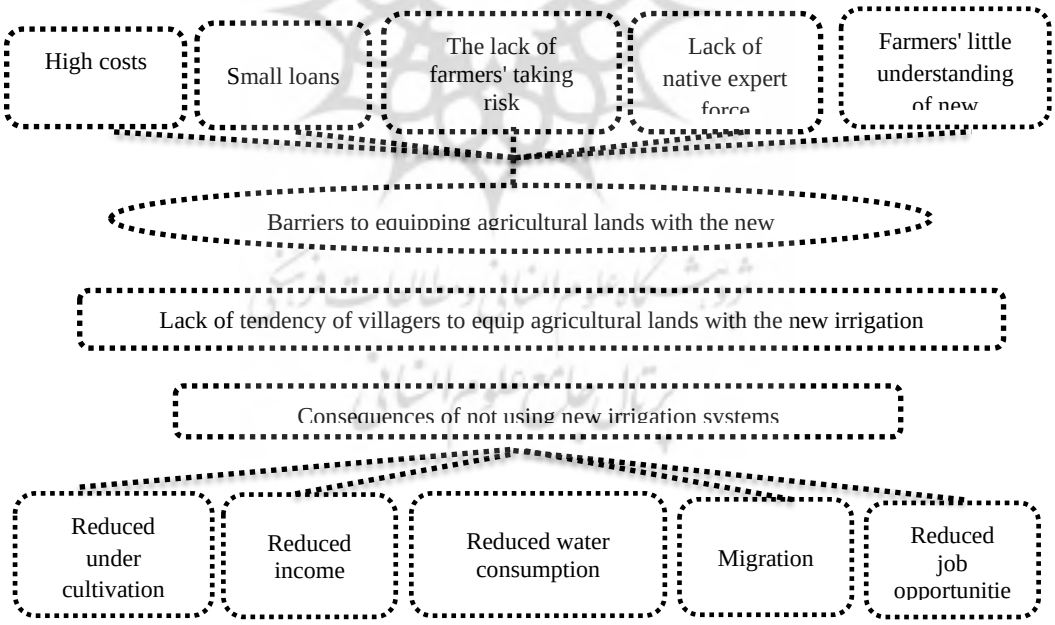

Figure 1. Conceptual model of the study
(Source: Authors, 2019)

3. Research Methodology

3.1 Geographical Scope of the Research

Bardaskan is located in the southwest of Khorasan Razavi province, with an area of 7664 km^2 in the southwestern Khorasan Razavi province. It is confined to Shahroud in Semnan province from west, to Khalilabad and Kashmar cities from the east and northeast, to Sabzevar city from the north and to Tabas city from the south (Figure 2). In the 2016 census, Bardaskan had 21,732 households with a

population of 75,631. According to the latest political divisions of the country, it consists of three parts (Anabad, Markazi and Shahrabaad) and six villages (Jolge, Shahrabaad, Sahra, Daroneh, Kenar Shahr and Kuhpayeh) and three cities (Bardaskan, Anabad and Shahrabaad). Shahrabaad rural district as a research area of Bardaskan city has 2830 households with a population of 9000, of whom 4601 are men and 4399 are women (Statistics Center of Iran, 2016).

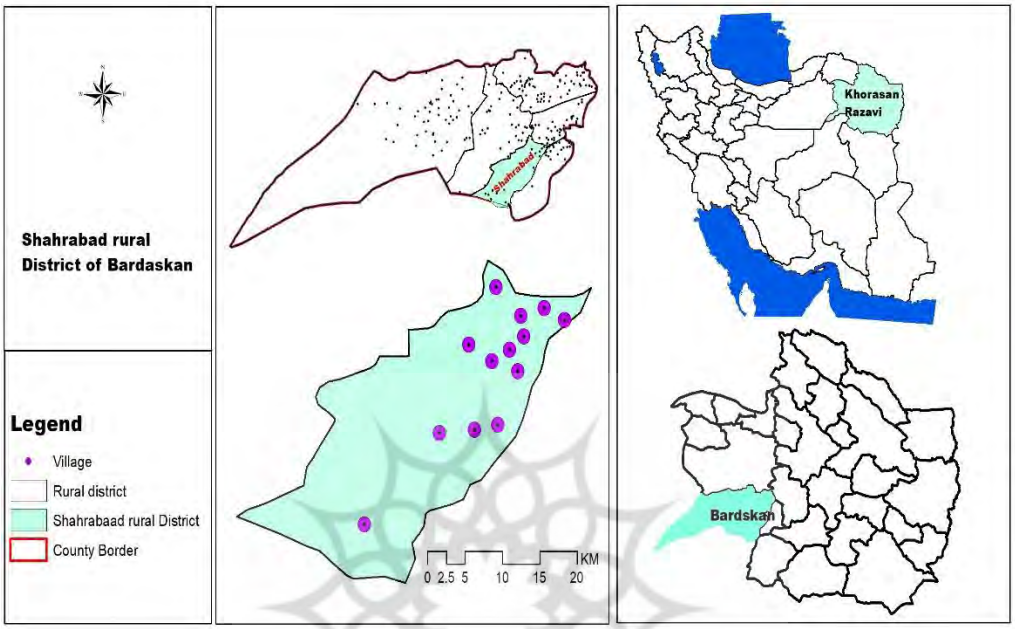

Figure 2. Location of the research area
(Source: Authors, 2019)

Water resources consist deep and semi-deep wells; there are 57 wells in Shahrabaad. In Bardaskan, residents mainly earn living through agricultural activities due to its geographical location and population (rural) texture (Table 2).

Table 2. Area of pistachio, grape and saffron under - cultivation lands in the research villages (ha)
(Source: Agricultural Jihad Office of Bardaskan County, 2019)

Village	Village Area of arable land	Number of water resources	Pistachio orchards	Grape orchards	Saffron cultivation area
Kooshe	437	6	437	5	62
Mohammadabad	180	3	195	15	77
Khorramabad	424	3	91	20	53
Zangineh	276	3	259.5	5	50
Zirakabaad	526	5	195	15	58
Hassanabaad	815	8	520	75	62
Kazemabad	711	12	624	60	80
Jalalabaad	750	9	585	5	70
Rahmaniyeh	726	8	520	0	0

According to the data reported in Table 2 and the significant ratios between horticultural products as products with high water requirements and saffron as a crop with very low water requirement, and climatic conditions of the research area, change in irrigation methods is of great importance.

3.2. Methodology

This is an applied study which uses the descriptive-analytical method to study the research parameters and consists of two main parts. The first part covers the library and documentary studies for examining theoretical literature and research background, and

the second part consists of field research and survey to collect data and information from related organizations and centers, as well as completing the questionnaire in the studied villages. Similarly, in the framework of field (researcher-developed) and library studies, a wide range of indicators in socio-economic and structural dimensions were examined in the questionnaire (Table 3).

Table 3. Indicators considered in the analysis of the barriers to equipping agricultural lands with the new irrigation technologies in the research area
(Source: Authors, 2019)

Criterion	Indicator(s)
Economic	Economic small loans, farmers' financial status, difficult conditions for receiving loan, difficult loan repayment conditions, high cost of pressurized irrigation systems, insufficient profit from agricultural income, lack of easy access to loans in terms of guarantors and collateral, providing free facilities for farmers
Social	lack of supply of equipment and tools with reasonable prices and quality, lack of support companies, Lack of sufficient knowledge about pressurized irrigation systems, lack of training courses on system construction, lack of local experts, lack of acceptance of innovation, lack of taking risk, lack of coordination between farmers, poor management capacity, variety of crops, illiteracy and low level of literacy, lack of consideration of justifying and training of farmers to implement the system, encouraging farmers to benefit from the new irrigation system, difficulty in using the modern irrigation systems, lack of farmers' awareness of challenges of water scarcity and water crisis, and lack of land ownership
Structural	dispersion of parts and inefficiency of new irrigation systems, small parts, lack of access to information and results of agricultural research, lack of insurance of pressurized irrigation systems

On the other hand, the statistical population of the research area consists of 2830 households from Shahrabaad rural district. Using the Cochran's alpha, 338 questionnaires were selected as the sample size and based on the proportional allocation formula, the sample size in each village was determined (Table 4)

Table 4. Estimating the number of samples by villages
(Source: Statistics Center of Iran, 2016)

No.	Village	Household	Number of questionnaires
1	Koshe	511	61
2	Mohammadabad	291	35
3	Khorramabad	237	28
4	Zangineh	269	32
5	Zirakabaad	338	40
6	Hassanabaad	468	56
7	Kazemabad	378	45
8	Jalalabaad	284	34
9	Rahmaniyeh	54	7

Moreover, content and face validity were used in this study in order to increase its validity, relying on the experts' views (university professors) on research questions in so as to determine the extent to which the questions are representative in terms of content and objectives of the research. Then, 30 questionnaires were prepared. After completing the questionnaire and entering data into SPSS software, Cronbach's alpha coefficient was calculated (Table 5). The alpha value was higher than 0.70, indicating the high internal correlation of the research tool (questionnaire) and its high reliability. Finally, SPSS software was used for data analysis

Table 5. Cronbach's alpha
(Source: Research findings, 2019)

No	Dimensions	Cronbach's Alpha
1	Economic	0.82
2	Social	0.70
3	Structure	0.75

4. Research Findings

Findings show that, out of 338 heads of households in the sample population, 97% were male and 3% were female. Respondents were divided into five age groups, of whom, 40-49 years old age group had the highest frequency (34.9%, 118 people) and 20–29 years old age group had the lowest frequency (36%) of all participants. The maximum number of household members was 10 and the average number of members in the participating households was 4.4. Concerning the respondents' educational level, people with elementary literacy had the highest frequency and people with a bachelor's degree or higher had the lowest frequency. Furthermore, 68.3% of the respondents were exclusively engaged in agricultural activities, 29.6% were engaged in both agriculture and animal husbandry, and 2.1% were engaged in the livestock sector (Table 6).

Results also showed that participants stated that they mainly used flood irrigation system (98.8%) and drip irrigation system (1.2%) (Table 7).

Table 6. Statistical results of some descriptive variables

(Source: Research findings, 2019)

Variable	Group	Frequency	Percentage	Rank
Age	20 – 29	12	3.6	5
	30 - 39	73	21.6	3
	40 - 49	118	34.9	1
	50 - 59	87	25.7	2
	above 60	48	14.2	4
Gender	Male	328	97	1
	Female	10	3	2
Educational level	Illiterate	59	17.5	4
	Elementary school	100	29.6	1
	Middle school	92	27.2	2
	Diploma	64	18.9	3
	Bachelor's and higher	23	6.8	5
Occupation	Agricultural	231	68.3	1
	Livestock	7	2.1	3
	Agriculture - Livestock	100	29.6	2
Total		338	100	---

Table 7. Frequency distribution and percentage of irrigation system type in rural households in the research area

(Source: Research findings, 2019)

Type of irrigation system	frequency	percentage
flood irrigation system	334	98.8
drip irrigation system	4	1.2

In terms of annual income, results showed that 15–30 m Toman income group had the highest frequency as 34.9% and the over 30 m Toman income group had the lowest frequency. This group includes 15.7% of the respondents or 53 persons. In the agricultural land area, the maximum area in the group is less than 5000 m with 1.33% and the minimum area is in the group was more than 2 ha. In other words, more than 60% of farmers were land owner with less than 1 ha (Table 8).

Table 8. Frequency and percentage of annual income variables, agricultural land area and agricultural work experience in research area

(Source: Research findings, 2019)

Variable	Group	Frequency	Percentage	Rank
Annual income	1-5 m-toman	82	24.3	3
	5-15 m-toman	85	25.1	2
	15-30 m-toman	118	34.9	1
	Above 30 m-toman	53	15.7	4

Variable	Group	Frequency	Percentage	Rank
Agricultural land area	Less than 5000 m	112	33.1	1
	1-5000 ha	108	32	2
	1-2 ha	74	21.9	3
	More than 2 ha	44	13	4
Agriculture work experiences	less than 5 years	42	12.4	4
	5 – 10 years	82	24.3	2
	10 – 15 years	78	23.1	3
	More than 15 years	136	40.2	1
Total		338	100	---

On the one hand, the majority of rural households (71.8%) in the research area use promotional services, 62.1% are members of production cooperatives and 55.5% are members of rural organizations (Table 9).

Table 9. Frequency distribution and percentage of rural households' use of promotional services and membership in cooperatives and rural organizations in the research area

(Source: Research findings, 2019)

Criterion	Item	Frequency	Percentage
Use of promotional services	Yes	240	71.8
	No	98	28.2
	Total	338	100
Membership in production cooperatives	Yes	208	62.1
	No	130	37.9
	Total	338	100
Membership in the rural organizations	Yes	186	55.5
	No	152	44.5
	Total	338	100

On the other hand, most rural households in the study area uses 47.31% of common wells as a water source and also the majority of rural households reported that 80% of the amount of water available for irrigation was "less" than the amount required for irrigation

Table 10. Frequency distribution and percentage of use of rural households according to water source and amount of water available for irrigation in the research area

(Source: Research findings, 2019)

Criterion	Item	Frequency	Percentage
Water source for irrigation	River	70	20.3
	Spring	10	3
	Qanat	57	17
	Common well	160	47.3
	Dedicated well	41	12.4
	Total	338	100
The amount of water available for irrigation	More	12	3
	Enough	58	17
	Less	268	80
	Total	338	100

As shown in Table 11, in the villages, indicator of "providing free facilities for farmers" with 3.71% had the highest average and "insufficient profit from agricultural income" with 3.18% had the lowest average in the economic dimension. In terms of social dimension, indicators of "lack of farmers' awareness of challenges of water scarcity and water crisis, ineffective government policies in implementing new irrigation systems and the lack of executive companies" with the values of 3.75, 3.70 and 3.59, respectively had the highest average. Indicators of lack of land ownership, lack

of acceptance of innovation, lack of local experts and increased household members with the values of 2.72, 2.94 and 2.99 had the lowest average. Finally, in terms of structural dimension, dispersion of parts with the value of 3.28 had the highest average and the lack of insurance of pressurized irrigation systems with the value of 3.09 had the lowest average.

Table 11. Barriers to equipping agricultural lands with the new irrigation technologies in different economic, social, structural dimensions in the research area

(Source: Research findings, 2019)

Dimension	Indicator	Rate					Average	Sig
		Very low	Low	medium	high	Very high		
Economic	small loans	38	67	79	90	64	3.22	1.27
	insufficient profit from agricultural income	52	51	81	91	63	3.18	1.32
	farmers' financial status	34	42	99	70	93	3.43	1.28
	difficult conditions for receiving loan	30	31	56	123	98	3.67	1.23
	difficult loan repayment conditions	24	36	75	107	96	3.64	1.20
	high cost of pressurized irrigation systems	18	48	72	108	92	3.62	1.17
	lack of easy access to loans in terms of guarantors and collateral	45	52	43	75	123	3.53	1.44
	providing free facilities for farmers	27	30	71	95	115	3.71	1.24
Social	lack of supply of equipment and tools with reasonable prices and quality	33	51	77	95	82	3.42	1.27
	lack of support companies	31	55	57	123	72	3.44	1.24
	lack of enough awareness of irrigation systems	27	43	85	81	102	3.56	1.26
	lack of training courses on system construction	45	36	83	97	77	3.37	1.30
	lack of farmers' awareness of challenges of water scarcity and water crisis	26	32	67	87	126	3.75	1.26
	lack of land ownership	91	68	82	38	59	2.72	1.42
	lack of local experts	21	64	76	128	49	2.99	1.19
	lack of acceptance of innovation	37	86	106	62	47	2.94	1.24
	lack of taking risk	57	65	94	86	37	3.30	1.30
	lack of coordination between farmers	۳۴	71	71	82	80	3.49	2.10
	poor management capacity	35	62	68	106	67	3.04	1.24
	variety of crops	45	71	98	75	49	2.98	1.23
	illiteracy	45	86	77	90	40	2.98	1.23
	lack of consideration of justifying and training of farmers to implement the system	42	54	78	81	83	3.32	1.33
	encouraging farmers to benefit from the new irrigation system	29	70	83	97	59	3.26	1.21
	Lack of executive companies	29	46	70	122	71	3.59	1.86
Structural	Failure to repair the system on site	23	71	83	102	59	3.30	1.18
	Lack of tools for repair	57	58	75	99	49	3.07	1.31
	High cost of repairs	38	77	83	102	38	3.42	1.29
	difficulty in using the modern irrigation systems	37	50	68	101	82	3.14	1.11
	Ineffective policies of the government in implementation	32	58	116	96	36	3.70	1.26
	Lack of compatibility of the cultivation operation of the crops with the new irrigation method	27	55	85	76	95	3.46	1.27
	dispersion of parts	22	86	78	78	74	3.28	1.24
	Small parts	48	62	91	69	68	3.14	1.32
	lack of access to information and results of agricultural research	32	60	95	90	61	3.26	1.21
	lack of insurance of pressurized irrigation systems	59	45	89	95	50	3.09	1.30

In order to measure the barriers to equipping agricultural lands with the new irrigation technologies in the studied villages, fuzzy-TOPSIS similarity method was used. These dimensions include economic, social and structural. Fuzzy-TOPSIS final score calculations show that Koosheh, Hassanabad and Kazemabad have the highest rate of barriers to equipping agricultural lands with the new irrigation technologies in Shahrabaad rural district. The villages of Mohammadabad, Jalalabaad, Zirakabaad, Zangineh have lower rate of the barriers to equipping agricultural lands with the new irrigation technologies (Table 12).

Table 12. Classification of villages in terms of barriers to equipping agricultural lands with the new irrigation technologies using the fuzzy TOPSIS method in the study area

(Source: Research findings, 2019)

Village	Ideal solution	Anti-ideal solution	Similarity index	Effectiveness
Khorramabad	3.25	2.71	o.37	Less
Rahmaniyeh	3.10	2.88	0.42	
Mohammadabad	3.55	2.23	0.38	Medium
Jalalabad	3.62	2.18	0.38	
Zirakabaad	3.65	2.15	0.33	
Zangineh	۴.۱۲	2.41	0.23	
Kooshe	4.32	2.10	0.17	More
Hassan Abaad	4.25	2.19	0.15	
Kazem Abaad	4.38	2.08	0.11	

Barriers to using such systems by rural households in the study area are: economic, social and structural. Accordingly, the findings show that most of the barriers to equipping agricultural lands with the new irrigation technologies can be seen in the economic dimension. Low financial status of farmers, small loans and similar factors are the most important factors that lead to the lack of farmers' tendency towards the equipment of the agricultural lands with modern irrigation systems (Table 13).

Table 13. Results of Student t test in investigating barriers to equipping agricultural lands With the new irrigation technologies in Shahrabaad rural district

(Source: Research findings, 2019)

Indicators	T value	(Sig 2- tailed)	Std. Deviation	Rank
Economic	12.525	0.000	0.625	1
Social	11.12	0.000	0.502	2
Structural	9.42	0.000	0.381	3

The results of Kruskal-Wallis test in economic, social and structural dimensions show the barriers to equipping agricultural lands with the new irrigation technologies in the villages of the research area with a significance level (Sig) of less than 0.1. Therefore, hypothesis H0, namely equality of barriers to equipping agricultural lands with the new irrigation technologies in economic, social and structural dimensions in the villages of the study area is rejected and the opposite assumption (H1), namely the difference between barriers to equipping agricultural lands with the new irrigation technologies in terms of economic, social and structural dimensions in the villages of the study area is confirmed.

Table 14. Kruskal-Wallis test results in terms of economic, social and structural dimensions in the study area
(Source: Research findings, 2019)

items	Structural average	Social average	Economic average
Chi- Square	47.847	41.589	36.634
Df	8	8	8
Asymp. sig	0.000	0.000	0.000

5. Discussion and Conclusion

Nowadays, human development, especially in most Third World countries, is highly dependent on the development and reform of water resources management. Hence, water is one of the vital resources with no alternative. Despite this, agriculture sector is the main consumer of water. However, the distribution of water in terms of time and space often does not meet the needs of this sector. Water is the most important factor limiting agricultural development in the world, especially in arid and semi-arid regions. Moreover, Iran is considered as one of the water-scarce regions in the world because its average annual rainfall is less than 250 mm, which is equivalent to one third of the world's annual rainfall. Thus, the limitation of water resources as well as the growing population and consumption of agricultural products, necessitates the consideration of economical methods of water consumption and improvement of irrigation systems. The present study sought to analyze the barriers to equipping agricultural lands with the new irrigation technologies which is of great importance in terms of analysis of barriers to equipping agricultural lands with the new irrigation technologies. The results of statistical analysis revealed that reducing and eliminating the barriers to equipping agricultural lands with the new irrigation technologies in rural households in Shahrabaad lead to increased level of equipping agricultural lands with modern irrigation systems. The results of this study are consistent with those of Masoumi Jashni (2016) who reported that the challenges of modern irrigation in rural areas lead to the lack of use of this irrigation system by the rural households and may not result in achieving the research objectives. Hence, the comparison of the results of this study with those of other studies indicated that Koosheh, Hassanabad and Kazemabad villages had the highest rate of barriers to equipping agricultural lands with the new irrigation technologies in Shahrabaad in terms of village ranking using the fuzzy TOPSIS analytical model. Mohammadabad, Jalalabad, Zirakabad, and Zangineh villages had the medium rate of barriers to equipping agricultural lands with the new irrigation technologies. And finally, Khorramabad and Rahmaniyeh had the lowest rate of barriers to equipping agricultural lands with the new irrigation technologies. On the other hand, three economic, social and structural dimensions were used in order to determine the most important reasons of barriers to equipping agricultural lands with the new irrigation technologies in the research village. To this end, one-sample t-test with a value of μ=3 (expected mean) was performed to determine the main reason. The research findings showed that economic components had the highest rank (12.525). Thus, if the barriers to equipping agricultural lands with the new irrigation technologies are not eliminated, it may lead to the negative consequences, economic vulnerability and threat livelihood of residents in the study area. The Kruskal-Wallis test was used in order to answer the second research question. The results of Kruskal-Wallis test in three economic, social and structural dimensions showed that the barriers to equipping agricultural lands with the new irrigation technologies in the studied villages had a significance level (sig) less than 1. Therefore, hypothesis H0, namely the equality of barriers to equipping agricultural lands with the new irrigation technologies in terms of these dimensions was rejected and hypothesis (H1), namely the difference of barriers to equipping agricultural lands with the new irrigation technologies in terms of these dimensions was confirmed.

Finally, considering the findings and results of the research, the following suggestions are provided to eliminate barriers to equipping agricultural lands with the new irrigation technologies in Shahrabaad rural district:

- Paying special attention to the participation of rural households in the implementation of plans and projects related to the new irrigation system in the study area;
- Encouraging the rural households in the study area to use and equip their agricultural lands to

the new irrigation system by providing facilities such as low-interest loans, guaranteed purchase of products in order to reduce potential damages, payment of subsidies, and the like;

- Using appropriate promotional methods such as face-to-face consultation with experienced experts who are accepted by the farmers of the area to convince and direct them, providing a pilot farm in the city and visiting rural households (who tend) to use the new irrigation system similar to the successful farmers who equipped their lands with this system can lead to the effective mental orientation of rural households in the study area to consider and use this technology;
- Eliminating the traditional time-consuming bureaucracy for the implementation of such projects to equip agricultural lands with a new irrigation system by the users as soon as possible.

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Research Article

بررسی عوامل بازدارنده تجهیز اراضی کشاورزی به سیستم‌های آبیاری نوین (مطالعه موردی: دهستان شهرآباد، شهرستان بردسکن)

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چکیده مبسوط

۱. مقدمه

با حرکت جوامع بشری به سوی صنعتی شدن و کم شدن وابستگی اقتصاد به منابع آبی و همچنین استحصال منابع آب به کمک فناوری های جدید، آب جایگاه خود را از دست داد اما با رشد فزاینده جمعیت نیاز به غذای بیشتر برای سیر کردن آن ها، باعث شده تا بخش کشاورزی عمده ترین مصرف کننده آب به شمار رود. این امر در بسیاری از نقاط دنیا و مخصوصا در مناطقی مانند ایران که کشاورزی آنها به منابع آب زیرزمینی وابسته است، باعث ایجاد بحران در آن منابع گردیده و اصل پایداری کشاورزی را به چالش کشیده است (. دهستان شهرآباد واقع درشهرستان بردسکن دراستان خراسان رضوی به لحاظ قرار گرفتن در اقلیم خشک و نیمه خشک و رویارویی با کاهش بارندگی در سال‌های اخیر، در وضعیت بسیار نامطلوبی قرار گرفته است. محدودیت شدید حاکم بر منابع آب موجود و پیش بینی خشکسالی در آینده، احتمال به خطر افتادن معاش و رفاه اقتصادی کشاورزان را بالا برده است. با توجه به پتانسیل کم تولید در جریان‌های سطحی و تغییرات شدید بارندگی از سالی به سال دیگر، ذخیره آبی بسیار ناچیز است. کمبود منابع آب سطحی و استفاده از آن برای مصارف کشاورزی اهمیت کاربرد استفاده از استراتژی‌های بهینه‌سازی مصرف اب به خصوص در شرایط کم آبی و خشکسالی بیان می‌کند. یکی از این استراتژی‌ها استفاده از سیستم‌های آبیاری نوین در منطقه است.

تجربیات در زمینه استفاده از سیستم‌های آبیاری نوین در استان، نشان می‌دهد که استفاده از این سیستم می‌تواند در دستیابی به اهداف مذکور کمک شایانی کند. اما با وجود حمایت‌های فراوان از این فناوری شاهد عدم استقبال زارعان از آن هستیم.

۲. مبانی نظری تحقیق

با توجه به اقلیم خشک و شکننده کشور و با در نظر گرفتن خشکسالی‌های اخیر اهمیت آب به عنوان یک نهاده حیاتی بیش از پیش مشخص می‌شود و در صورتی که براساس توسعه پایدار برای منابع اب برنامه‌ریزی نکنیم در آینده کشور با معظلاتی غیر قابل حلی مواجه خواهد شد. از طرف دیگر، نظر به اینکه بیش از ۹۴ درصد منابع اب کشور در بخش کشاورزی مصرف می‌شود، یکی از اساسی‌ترین نیازهای تحقیقاتی کشور مسائل مربوط به اب و آبیاری در این بخش می‌باشد. از این رو، نیاز به یافتن شیوه جدید در توسعه کشاورزی که بر مبنای حفاظت منابع مربوط به کشاورزی استوار بوده و در عین حال روش‌ها و دانش اکولوژیکی نوین را نیز به خدمت بگیرد، ضروری می‌باشد. در حوزه کشاورزی کشورهایی همچون ایران که در اقلیم خشک و نیمه خشک قرار گرفته است، بنا به دلایلی نظیر تلفات انتقال آب از منبع به محل مصرف، تلفات زیاد اب در مزارع کشاورزی، نامناسب بودن شکل و اندازه مزارع در رابطه با میزان اب و نحوه آبیاری، آگای کشاورزان از بهینه سازی مصرف آب، عدم استفاده از شیوه‌های مناسب آبیاری، کارآیی پایین آبیاری باعث شده است تا تلفات آبیاری بسیار زیادتر از میانگین آن در سطح جهان باشد.

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از این رو، در سال‌های اخیر به منظور بهبود راندمان آبیاری، اقداماتی در سطح کشور صورت پذیرفته که از مهم‌ترین آن‌ها طرح معرفی و گسترش استفاده از سیستم‌های نوین آبیاری به وسیله کشاورزان بوده است. در شرایط فعلی، استفاده از فناوری‌های نوین آبیاری و مدیریت اقتصادی آب، از جمله راه‌کارهای مهم و موثر مقابله با بحران کمبود اب در بخش کشاورزی محسوب می‌شود.

۳. روش تحقیق

تحقیق حاضر در در این مطالعه، از نظر هدف، کاربردی و از نظر روش، توصیفی- تحلیلی است. در این پژوهش، روش نمونه¬گیری تصادفی بوده است و با فرمول کوکران۳۳۸ خانوار در سطح محدوده مورد مطالعه، حجم نمونه تعیین گردید. داده¬ها بخشی، براساس مطالعات میدانی: پرسشنامه، مشاهده: شاخص‌های انتخابی و محقق ساخته و بخشی دیگر با استفاده از مطالعات کتابخانه¬ای جمع آوری شده است. روایی پرسشنامه ها توسط متخصصین مورد بررسی قرار گرفته است. ضریب روایی پرسشنامه نیز برابر با ۰/۷۸ بدست آمده است. در این میان، برای رتبه بندی روستاها از نظر میزان اثر گذاری عوامل بازدارنده برای تجهیز اراضی به سیستم¬های آبیاری نوین از مدل Fazy- Topsis و برای تجزیه و تحلیل سوالات تحقیق، از نرم افزار SPSS استفاده شده است.

۴. یافته‌های تحقیق

یافته‌های تحقیق از یک سو، موید آن است که بیشترین عوامل بازدارندگی در امر تجهیز اراضی کشاورزی به سیستم¬های آبیاری نوین، در بعد اقتصادی قابل مشاهده است. بضاعت مالی کم کشاورزان، پایین بودن میزان وام و عواملی از این قبیل باعث شده است که خانوارهای روستایی محدوده مورد مطالعه گرایشی به تجهیز اراضی کشاورزی به سیستم¬های آبیاری نوین نداشته باشند. از سویی دیگر، نتایج آزمون کروسکال – والیس در بعد اقتصادی و اجتماعی و ساختاری نشان می‌دهد که عوامل بازدارنده تجهیز اراضی کشاورزی به سیستم‌های آبیاری نوین در روستاهای محدوده موردمطالعه با سطح معنی‌داری (sig) که کمتر از(۰/۱)بوده است؛ بنابراین فرض HO، یعنی برابری عوامل بازدارنده تجهیز اراضی کشاورزی به سیستم‌های آبیاری نوین در بعد اقتصادی و اجتماعی و ساختاری در روستاهای محدوده مورد‌مطالعه رد شده است و فرض مخالف (H_1)، یعنی تفاوت عوامل بازدارنده تجهیز اراضی کشاورزی به سیستم‌های آبیاری نوین در بعد اقتصادی و اجتماعی و ساختاری در روستاهای محدوده‌ی موردمطالعه تأیید گردیده است

۵. بحث و نتیجه گیری

امروزه توسعه انسانی به ویژه در اکثر کشورهای جهان سوم به شدت وابسته به توسعه و اصلاح مدیریت منابع آب است. از این رو آب یکی از سرمایه‌های حیاتی است که جایگزینی دیگر ندارد. با وجود این بخش کشاورزی عمده‌ترین مصرف کننده آب به شمار می‌رود. این در حالی است که توزیع آب از لحاظ زمانی و مکانی اغلب منطبق با نیازهای این بخش نمی‌باشد. آب مهم‌ترین عامل محدودکننده توسعه کشاورزی در جهان، به ویژه در مناطق خشک و نیمه خشک محسوب می‌شود. در این میان ایران جز مناطق کم اب جهان به شمار رفته چرا که متوسط بارندگی سالانه آن حدود ۲۵۰-۳۰۰ میلیمتر است که معادل یک سوم باران سالانه کره زمین می-باشد. از این رو محدودیت منابع آب همراه با رشد روزافزون جمعیت و مصرف محصولات کشاورزی، ضرورت توجه هرچه بیشتر به شیوه‌های صرفه‌جویانه مصرف آب و اصلاح سیستم‌های آبیاری را طلب می‌کند. همان‌طور که مطرح شد، پژوهش حاظر بررسی عوامل بازدارنده تجهیز اراضی کشاورزی به سیستم‌های آبیاری نوین را مورد پژوهش و تحلیل قرار داده که در نوع خود در مقایسه با مطالعات مشابه در ارتباط با بررسی موانع وعوامل بازدارنده تجهیز اراضی کشاورزی به سیستم‌های آبیاری نوین قابل توجه است.

کلیدواژه‌ها: سیستم های آبیاری نوین، عوامل بازدارنده، کم آبی، دهستان شهرآباد.

تشکر و قدرانی

پژوهش حاضر حامی مالی نداشته و حاصل فعالیت علمی نویسندگان است.

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