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Effective factors on Hashtgerd farmers' participation rate in water optimum utilization

Seyed Mehdi Mirdamadi [a], Maryam Omidi Najafabadi [a*], Mona Arabseyfi [a]

[a] Department of Agricultural Extension and Education, Science & Research Branch, Islamic Azad University, Tehran, Iran.

[*] Corresponding author, E-mail address: m.omidi@srbiau.ac.ir

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Abstract

In current situations, quantitative and qualitative reduction of water resources has become global crisis. This subject has created many problems in Iran's agriculture sector. In this research, effective factors on participation rate of farmers in Hashtgerd regarding optimum Utilization of irrigation networks are studied. The statistical population included all 1500 farmers in Hashtgerd city. A total of 306 farmers were studied using Morgan table method. Internal and external validity of the questionnaire was confirmed by experts. Reliability was measured by using Bayesian Cronbach's alpha (max = 95%; min =78%) as estimated by R codes. Results show that there is a significant relationship among social participation, technical knowledge, social confidence, and instructive variables in the 1% level of confidence and between education, governmental support, informing, and modern irrigation methods in the 5% level with participation rate of farmers in optimum utilization of irrigation network. Also, social participation, technical knowledge, social confidence and instructive variables, education, governmental support, informing, and modern irrigation methods were entered in multivariable regression using Step-Wise method, which finally resulted in 46% of variable changes regarding these seven factors. The results of the regression indicated that the two variables, namely educational factors and History of Membership in Water User Associations (x2) are the most important predictors of Farmers' Participation rate in Water Optimum Utilization.

Keywords: *People's participation, Farmers, Optimum Utilization, Irrigation networks.*

1. Introduction

Adjusting the water management structure, developing the utilization of water resources, gathering the resources and organizing the water resource utilization systems, improving people's participation, and finally improving the economic efficiency of water particularly in agricultural sector have always been among the guidelines of economic, social and cultural development programs in Iran. These guidelines not only indicate the complications and barriers of developing the water section, but also emphasize the necessity of participation from public and private sectors in the country's water management process. This necessity is attributed to the internal characteristics of water including the ambiguity regarding the usage rights in many cases, water being among the public goods in some of its applications and the common ownership of water resources (due to lack of branching), the flowing property of water and its critical importance in maintaining the stability of the water basin, which are

considered the preventive barriers for fabrication of a market base or market failure in efficient allocation of water resources (Salehi et al., 2010).

Regarding this necessity, the guideline pattern of economic activities in the field of water and water management requires the participation of both public and private sectors and the sharing of tasks among these two sectors. One of the best patterns of creating and developing the water market is to encourage and help farmers improve execution of irrigation and drainage plans in order to realize the optimized usage of water in the country. If the execution of these plans is carried out with the participation of the farmers, it not only leads to the farmers paying a portion of the costs, which lowers the cost load of the government, but also makes it possible to gradually delegate water usage and maintenance to water usage cooperatives (Tohidianfar, 2009).

The participation of users in their own issues for the irrigation systems leads to an increased efficiency of these systems and also increases commitments to irrigation projects.

Regarding the irrigation status in regions served by irrigation systems of Hashtgerd Plain, it comes to mind that optimal usage and management of current facilities will lead to an increased irrigation efficiency in the agricultural sector. Considering the decreases int rainfall levels and acute watershed stroke in Hashtgerd Plain, using modern technologies is an obligation in this region. Accordingly, participation of farmers in the optimal usage of the region's irrigation networks and compliance with the plans of water suppliers are very important (Bahramian, personal communication, 2013).

Shahroudi and Chizari (2007) made efforts to identify the effective factors on farmers attitudes in Razavi Khorasan Province towards participation in water cooperatives and showed that the variables of education level, water cultivation surface area, annual income, contact with agricultural trainers, components of social capital, irrigation status of the region from the perspective of water suppliers, and farmers' participation in managing irrigation networks had a positive and significant relationship with farmers attitude towards participating in water supplier cooperatives. Similar studies have been conducted by Payandeh Najafabadi and Omidi Najafabadi (2010), Payandeh Najafabadi et al. (2013), and Omidi Najafabad et al. (2011, 2014). The study discuss farmers' attitudes and perceptions towards the "barriers" and the "benefits" of automatic irrigation systems. Factor analysis was performed to identify perceived ``barriers" and "benefits" and impact of these two factors on farmers' priority to adopt automation. Results suggest that farmers' attitudes, particularly with respect to "cost" and "lifestyle" influenced the priority given to adopting automatic irrigation systems. The area under pasture cultivation was also an important determinant in the farmers' priority for adopting automatic irrigation systems.

Azizi and Zamani (2009) in a study investigating the participation of farmers in irrigation management, a case study in Drudzan dam, reached the conclusion that the antecedents (attitude towards irrigation management participation, attitude towards governmental water authorities and agricultural service centres as well as household size, awareness, dam water dependency) affected the participation of farmers in irrigation management.

Khedri (2005) in a study investigating the effective factors on the participation of users in irrigation and drainage networks in Khuzestan for proposing appropriate

approaches, evaluated public participation plans in Khuzestan Province and explored the effects of variables such as economic status, awareness level, desirable management, and following local leaders on the tendency of farmers for participating in the plans put forth by the water and electricity companies of Khuzestan.

Mendoza (2006) in investigating the effective factors on participation in environmental supervision programs reached the conclusion that farmers having a strong bond with local organizations and those who have higher incomes and are considered as big owners as well as farmers who were members of cooperative companies had a higher tendency towards participation. Those farmers who spent a lot of their time working outside the farm had a lower tendency to participate.

Qiao et al. (2009) also conducted a research in Inner Mongolia. The findings indicated that high degree of understanding about WUAs (water user associations) is one of the six factors that influence farmer's inclination to join WUAs. Other factors included being a village cadre; good state of health; small proportion of household members in the labor force; cropping income as a high percentage of family income and having had previous conflicts regarding water use issues.

Khushab and Namazi (2006) in a study titled "investigating the reasons behind the reluctance of farmers towards public participation plans" enlisted the present problems in attracting the participation of the public in irrigation and drainage network of the water farms of Band Amir Dam as follows:

1- land ownership and water rights;
2- cultural complications of rural and farming communities;
3- farmers lack of trust in plans proposed by official organizations;
4- financial costs of participation;
5- too many rules and regulations;
6- the high cost of initial investment;
7- expert workforce;
8- return on investment period;
9- problems related to examination and design.

Ben-Ayed (2002) in a study concerning public participation in rural development programs in Tunisia found out that the effective factors on farmers' participation in rural development plans were as follows: 1- Economic factors (interest expectation from new jobs); 2- Project related factors (type of activities, renewable capitals, explanations of the consultants; continuous follow up and support); 3- The relationship between people and development agents (positive attitude of development agents and trust building, their friendly behaviour, and frequent contact with the development agents); 4- Social factors (encouragement from friends and neighbours; good relationships with other people, and acquaintance with development agents).

The overall objective of the present paper is to investigate the effective factors on participation of farmers in Hashtgerd City in the optimal utilization of irrigation networks ("Optimum utilization" refers to the most economically feasible and, if possible, the most efficient way of use). The particular objectives include: 1- Investigating the personal characteristics of farmers in Hashtgerd City and their effects on their participation;

2- Investigating the economic factors affecting the participation of Hashtgerd City's farmers in optimal utilization of the region's irrigation networks;

3- Investigating social factors affecting the participation of Hashtgerd City's farmers in optimal utilization of the region's irrigation networks;

4- Investigating farmers' awareness and its effects on the participation of Hashtgerd City's farmers in optimal utilization of the region's irrigation networks;

5- Review of different training and educational factors affecting the participation of Hashtgerd City's farmers in the optimal utilization of the region's irrigation networks;

6- Investigating the regulatory factors affecting the participation of Hashtgerd City's farmers in optimal utilization of the region's irrigation networks;

7- Review of technical factors affecting the participation of Hashtgerd City's farmers in the optimal utilization of the region's irrigation networks.

2. Materials and Methods

Based on the literature review, the effective barriers are classified into different categories and the conceptual framework of the current study is as follows:

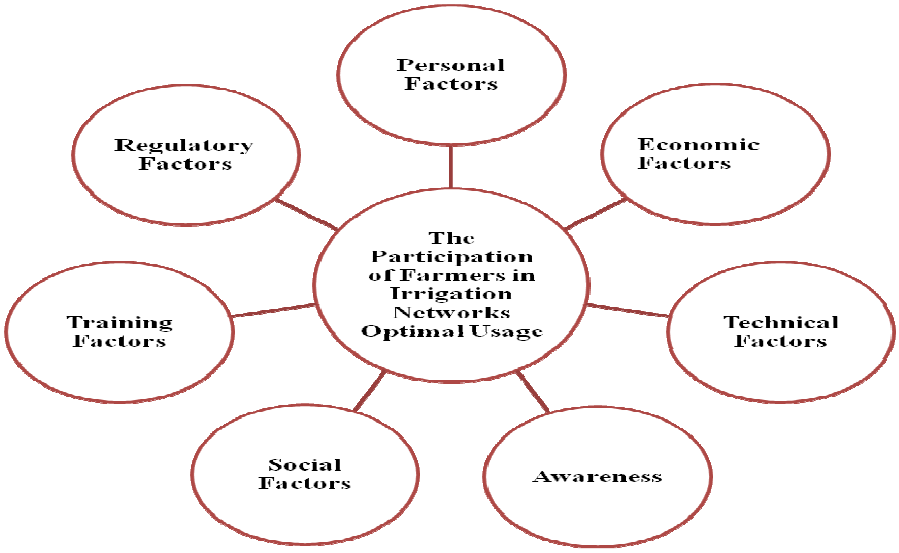

Fig. 1. The conceptual framework of the study

Based on the research objectives, this study is an applied study and its method is a correlative descriptive one. The data gathering tool was a questionnaire and for testing its reliability, 30 questionnaires were filled by the farmers and its Cronbach's Alpha coefficient was calculated to be 0.87. Also Reliability was measured by using Bayesian Cronbach's alpha (max = 95%; min = 78%) as estimated by R codes developed by Payandeh Najafabadi and Omidi Najafabadi (2016). The statistical population of this study includes 1500 farmers amongst 306 participants were chosen using Morgan's Table (because of precision estimation of sample size compared with Cochran equation) for this study. The independent variables of this study include educational, economic, technical, social, and regulatory factors affecting the participation of farmers in optimal utilization of the irrigation network and participation of farmers in optimal utilization of the irrigation network was chosen as the dependent variable. In order to analyze the obtained data SPSS software application version 16 was used. Mean and coefficient of variation were used in the descriptive section statistics and correlation analysis (Spearman's Correlation Coefficient) and multi-variable regression were used for deductive section statistics.

3. Results

Based on the results obtained from this study, the average age of participants was 48.89 years and 39.5 percent of participants had primary education. As for agricultural experience of the participants it was found that the average experience of all participants was 30.74 years. Regarding primary jobs of the participants and their membership history in water user associations (WUAs), the results were 82 and 50.7 percent, respectively. Regarding the position of the farm relative to the canal and water source, the results were 80.7 and 66.3 percent, respectively.

Table 1 shows the rankings of the farmers' attitudes towards the optimal utilization of irrigation networks. Rankings were based on social trust and were obtained using coefficient of variation. Also it was observed the factor "considering other farmers' opinions in farming issues" had the highest ranking whereas "paying attention to and trusting the promises of authorities" had the lowest ranking based on the views of the participants.

Rankings based on social participation using coefficient of variation indicated the "consultation with other farmers regarding issues and complications" factor having the highest ranking and "attending extensional and educational classes" as the lowest ranking based on the perspectives of the participants.

Rankings of educational factors based on coefficient of variation show that farmers believe factors such as "interest in using modern irrigation methods in case of attending educational classes" has the highest ranking and "interest in using media for acquiring information" has the lowest ranking.

Rankings of economic factors based on coefficient of variation also show that farmers believe factors such as "tendency to participate in utilization and maintenance of canals in case of increasing the guaranteed price of buying agricultural products" have the highest ranking and "tendency towards participation in canal building" have the lowest ranking.

Rankings of regulatory factors based on coefficient of variation show that "tendency towards using water sources in case of receiving credits from the government" is considered the highest ranking whereas "tendency to allocate a portion of the farm" has the lowest ranking.

Rankings of technical factors based on coefficient of variation show that farmers believe factors such as "the role of cement cover in reducing water waste" has the highest ranking and "using industrial and mechanical methods for utilizing and maintaining the network" has the lowest ranking.

Rankings of farmers' awareness based on coefficient of variation show that farmers believe factors such as "being aware of the activities of the organizations responsible for building irrigation networks" has the highest ranking and "being aware of the extent of water sources in the region" has the lowest ranking.

Table 1. Rankings of farmers' perspective regarding optimal utilization of irrigation networks

Social Trust Factors	**Ranking**	**CV**	**SD**	**Mean**
Using other farmers' opinions in farming issues	1	0.150	0.513	3.412
Guarantee of other farmers for receiving loans	2	0.176	0.612	3.474

Social Trust Factors	**Ranking**	**CV**	**SD**	**Mean**
Using experts' opinions for reducing water loss	3	0.210	0.576	2.739
Using experts' opinions for choosing cultivation pattern	4	0.222	0.606	2.732
Effects of using irrigation plans done in the region	5	0.295	0.670	2.275
Paying attention to and trusting in the promises of authorities	6	0.361	0.809	2.239
Social Participation	**Ranking**	**CV**	**SD**	**Mean**
Consultation with other farmers regarding complications and issues	1	0.158	0.675	4.261
Expert consultation regarding complications and issues	2	0.176	0.734	4.167
Tendency to become a member in local organizations and associations	2	0.176	0.733	4.343
Attending extensional and educational classes	3	4.193	4.193	4.193
Educational Factors	**Ranking**	**CV**	**SD**	**Mean**
Interest in using modern irrigation methods in case of attending training classes	1	0.146	0.543	3.73
The role of councils in using modern agriculture methods	2	0.210	0.624	2.977
The role of expert human resources in extending modern irrigation methods	3	0.235	0.773	3.28
Interest in attending educational and extensional classes	4	0.281	0.927	3.30
Interest in meeting agricultural trainers	5	0.287	0.896	3.12
Interest in using the media for acquiring information	6	0.319	0.912	2.86
Economic Factors	**Ranking**	**CV**	**SD**	**Mean**
Tendency to participate in utilization and maintenance of canals in case of increasing the guaranteed buying price of agricultural products	1	0.243	0.822	3.38
Tendency to participate in utilization and maintenance of canals in case of paying a lower water bill	2	0.281	0.875	3.11
Tendency to participate financially against water shortage crisis	3	0.377	0.991	2.63
Tendency towards financial participation in building canals	4	0.487	1.002	2.056
Regulatory Factors	**Ranking**	**CV**	**SD**	**Mean**
Tendency towards using water sources in case of receiving funds from the government	1	0.159	0.635	3.99
The role of agricultural experts and managers in allocating water sources	2	0.176	0.687	3.89
Participating in utilization and maintenance of canals	3	0.181	0.619	3.42
The presence of governmental supports in associations	4	0.184	0.720	3.92
The tendency to allocate a portion of the farm	5	0.380	1.10	2.90
Technical Factors	**Ranking**	**CV**	**SD**	**Mean**
The role of cement covers in reducing water loss	1	0.158	0.652	4.11
The role of spreading pressured irrigation in reducing water loss	2	0.162	0.681	4.20
The role of changing cultivation patterns and reducing water loss	3	0.259	0.989	3.33
The role of using modern irrigation equipment in reducing water loss	4	0.200	0.762	3.81
Tendency towards reducing water loss in the farm	5	0.215	0.866	4.02
Tendency towards planning water distribution in 3rd and 4th degree canals	6	0.218	0.750	3.44
Using industrial and mechanical methods in using and	7	0.259	0.989	3.81

Social Trust Factors	**Ranking**	**CV**	**SD**	**Mean**
maintaining the network				
Farmers' Awareness	**Ranking**	**CV**	**SD**	**Mean**
Awareness of activities of organizations responsible for building irrigation networks	1	0.312	0.614	2.94
Awareness of the costs of irrigation networks' maintenance	2	0.235	0.651	2.77
Awareness of activities in water user cooperatives	3	0.249	0.702	2.82
Awareness of modern irrigation methods	4	0.267	0.750	2.80
Awareness of the water supply process for the farmers	5	0.297	0.823	2.76
Awareness of the procedure of building an irrigation network and its related issues	6	0.312	0.871	2.78
Awareness of the extent of water sources in the region	7	0.297	0.823	2.23

Based on the results presented in Table 2 the variables of social trust, social participation, and technical knowledge have a positive and significant relationship with the participation of farmers in optimal utilization of irrigation networks and the variables of governmental supports and modern irrigation methods have a negative and significant relationship with the participation of farmers in optimal utilization of irrigation networks, while the variables of agricultural experience, land ownership, tendency towards group work, and extent of water sources in the region showed no significant correlation.

Table 2. Results of correlation test between the dependent variable and the independent variables of the present research

No.	**Variable**	**r**	**Significance level**
1	Farmers' Age	-0.16	0.774
2	Educational Level	0.107	0.05*
3	Agricultural Experience	0.09	0.827
4	Land Ownership	0.01	0.99
5	Social Trust	0.204	0.000**
6	Social Participation	0.222	0.000**
7	Tendency towards Group Work	0.53	0.354
8	Technical Knowledge	-0.168	0.000**
9	Awareness	0.133	0.002*
10	Educational Factors	0.418	0.000**
11	Governmental Supports	-0.157	0.006*
12	Modern Irrigation Methods	-0.187	0.001*
13	The Extent of Water Sources in the Region	0.047	0.412

* 5% Error ** 1% Error

In this study, in order to predict the participation of farmers in optimal utilization of irrigation networks, multiple regression test was performed. After entering all the independent variables with a significant correlation, only the variables including

educational factors, history of membership in water user associations (WUAs), social trust, social participation, regulatory factors, technical knowledge, and educational level were entered into the equation. These variables were able to explain 46 percent of the variations in the dependent variable (R^2adj=0.462).

On the other hand, evaluation of standardized regression coefficients indicated that the variable of educational factors (B=0.432) has a more prominent role in participating in optimal utilization of irrigation networks.

Table 3. Step-wise multiple regression coefficients

Variables	B	Beta	t	sig
Educational Factors (x1)	0.177	0.432	0.098	0.000
The History of Membership in Water User Associations (x2)	0.133	0.326	7.464	0.000
Social Trust (x3)	0.135	0.220	4.354	0.000
Social Participation (x4)	0.81	0.232	5.031	0.000
Regulatory Factors (x5)	-0.107	-0.258	-5.687	0.000
Technical Knowledge (x6)	0.166	0.242	5.011	0.000
Educational Level (x7)	0.02	0.142	3.296	0.000
constant	1.951	-	15.702	0.000
R= 0.689 R^2adj= 0.462				

The standardized regression equation is as follows:

$$Y = 0.177x_1 + 0.133x_2 + 0.135x_3 + 0.081x_4 + 0.107x_5 + 0.166x_6 + 0.002x_7 \quad \text{Eq (1)}$$

Using the above formula we can estimate the participation rate in optimal utilization of irrigation networks.

4. Discussion and Conclusion

The research results indicated a significant relationship among variables of social participation, technical knowledge and educational factors in the 1% error level. There was also a significant relationship between variables of educational level, governmental supports, awareness, and modern irrigation methods and the participation of farmers in optimal utilization of irrigation networks in the 5% error level. There was no significant relationship between the agricultural experience, land ownership, tendency towards group work, and the extent of water sources in the region. Finally, the variables of educational factors, history of membership in water user associations (WUAs), social trust and participation, technical knowledge, and educational level were entered into the multi-variable regression equation step by step and it was ultimately concluded that 46 percent of the variations in the dependent variable were due to these seven factors. The results of the current paper are in accordance with the results obtained by Omidi et al. (2009), Azizi and Khalkhili (2009), Qiao et al. (2009), Tohidi et al. (2009) and Faham et al. (2008).

5. Recommendations

Based on the results obtained from this study it is recommended that:

Considering that amongst the most effective factors on participation of farmers in optimal utilization of irrigation networks are

educational and extensional factors, in order to improve the awareness of farmers through extensional brochures, television, the radio and other mass media means, educational classes and so on, needed measures should be taken into account in order to achieve the appropriate level of awareness for farmers.

Interest in using modern irrigation methods in case of attending educational and extensional classes is the first factor among the educational factors, hence it is recommended that the following issues are dealt with in educational classes: raising the awareness of farmers regarding the problems of water shortage due to traditional irrigation systems, paving the way for the farmers access to different services and water experts, increasing the usage of pressured irrigation and encouraging participation in managing water sources of the region.

Based on the positive significant relationship between the factors of social trust and social participation and the participation of farmers in optimal utilization of irrigation networks we should take measures to carry out all the stages of primary studies, management deeds, planning and executing irrigation and drainage networks in the region with the participation and cooperation of farmers.

Educational-Extension Mechanisms, which are activities promoted for improving farmers' knowledge, skills, and managerial insight in to water consumption in an effort to improve water resources management by the relevant organizations in charge of agriculture, and can include the following items: farmers 'attending educational - extension classes held by the agricultural mobilization organization water management, employing new higher efficiency irrigation techniques recommended by experts and heeding these recommendations, learning from the experiences of other farmers who already use modern irrigation methods, etc. These mechanisms can assist farmers at the time of water shortage or other problems associated with bottle necks of optimum water management. Therefore, these mechanisms can, due to the support they receive from authorities and in particular the management of agricultural mobilization organization, play an important role in improving water resources management in agriculture.

Based on the fact that there is a positive and significant relationship between the history of membership in water user associations (WUAs) and the optimal utilization of irrigation networks, it is recommended that measures be taken to attract the participation of non-member farmers.

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