

## Discriminant analysis to identify the farmers for develop the sprinkler irrigation systems in Iran

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**Abstract:** The effective and sustainable use of water for agriculture has become a global priority requiring urgent and immediate solutions in view of intensifying competition. Water resource development is imperative as regards sustainable agriculture in Iran. The research was conducted to a survey study and the statistical population was the farmers who use the sprinkler irrigation systems in Behbahan county in Iran (N= 150). Using questionnaire the necessary data were collected. After conducting a pilot study for each structure the reliability of questionnaire was calculated by Cronbach Alpha coefficient for different sections calculated more than 0.7. The result of research showed that variables such as: desire to lend and risk, receiving the knowledge of the channels of mass communication, having the awareness about the quality of components, existing laws and credit institutions was the most important indicators that could be discriminated the two groups of farmers (reducer and developer) to use of sprinkler irrigation systems.

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### 1. Introduction

Water scarcity is a growing concern for sustainable agriculture worldwide. About a third of the population in developing countries is likely to experience severe water scarcity by the year 2025. Many nations have attempted to reform their water management systems by improving their irrigation systems (Sangtaek and Leatham, 2008). The vastest parts of Iran are semi-arid, with an average annual precipitation of 250 mm (30% of global mean precipitation) and water is increasingly becoming scarce worldwide. Recent studies have indicated that the total annual precipitation in Iran is about 430 billion m<sup>3</sup> of which about 20 percent is lost in flash floods to the seas. Therefore, water resource development is imperative as regards sustainable agriculture in Iran (Ahmadvand and et al, 2013). The great challenge for the current century is to use less water to produce more food, particularly in countries with more limited water and land resources. The effective and sustainable use of water for agriculture has become a global priority requiring urgent and immediate solutions in view of intensifying competition (Smith, and Munoz, 2002). Irrigation development directly boosts yield and gives farmers the water security they need to take risks with new crops and to enhance inputs such as fertilizer and seeds. The World Bank pointed out that agricultural water management (AWM) is not a goal in itself but part of a process of resource management that provides critical

input to agricultural production and farmer incomes (World Bank, 2005). Adoption of more technically efficient irrigation systems may be a way to facilitate production during severe droughts by maintaining consumption with reduced applications. More technically efficient irrigation systems, such as low-pressure sprinkler, transmit a higher proportion of applied water to the root zones of crops. This allows a higher level of water consumption for crops at a given level of water application, and can allow an irrigator to reduce irrigation application rates while still meeting the consumptive demands of the crops (Webb, 2005).

### The research background

Chandran and Chackacherry (2004) found that the socio-psychological variables, including social participation and attitude of the individuals significantly influenced the extent of farmers' participation in irrigation management. Schuck & Green, (2001) study showed that Both yield effects and cost reductions can improve on-farm profits and should promote adoption. However, not all irrigators will be able to take advantage of these alternative technologies or management practices. On-farm variations in land attributes, historical cropping patterns and water costs may make changes in irrigation systems that are generally more profitable less so in specific cases.

The result of Byn (2003) study showed that the Many state agricultural development programs with the knowledge and skills attitude is often emphasized. Dinar and Yaron (2003) reported a significant

correlation between application of pressurized irrigation system and increases on prices of water and agricultural products. Shresta and Gopalakrishnan (1998) found that increasing in the price of water, income and work force had an important role in the use of pressurized irrigation systems by farmers.

(Azizi khalkheili and Zamani (2009) Results reveal that farmers' attitudes toward participation in irrigation management, attitudes toward personnel of the State Water Authority and the Agricultural Extension Service Centers (AESCs), family size, the problem perception, dependence on the dam for water, and educational background have influenced their participation in irrigation management. By contrast, contact with information sources, animal units, sociability, age and agricultural experience did not affect farmers' participation. Moreover, based on farmers' perspectives, unequal water distribution among farms, dissatisfaction with Water Authority operators and high water fees and charges were the main problems and obstacles toward farmer participation in irrigation management.

Kulecho and Weatherhead (2005). study showed that poor maintenance, lack of social protection and water resources of the main reasons for the lack of an unstable continued use of pressurized irrigation systems in Nigeria .( Bagheri and Ghorbani(2011) study showed that To improve the acceptance of new technologies as well as sprinkler systems: 1. It is essential to encourage young and literate people to engaging in agriculture using suitable incentives such

as long-term and low interest rate loans; 2. Local tv and radio stations should prepare and broadcast appropriate agricultural programs especially in soil and water conservation aspects; 3. Training local agricultural experts and extension agents before training farmers; considering agro-ecological conditions for selecting sprinkler systems; 4. Conducting adaptive researches to fit new irrigation technologies with farms situations before transferring them; designing and implementing training and educational courses for farmers; 5. Creating suitable conditions for land integration as a basic principle for applying sprinkler systems; field trips and visiting successful farms with operating sprinkler systems; 6. Enacting some regulations for urging the setting companies to be responsible for appropriateness of installed irrigation systems and to offer after-sales and after-setting service.

**2. Materials And Methods**

This study is applied research, carried out by the survey method. The statistical population consisted of 150 farmers in Behbahan County of Khuzestan Province in Iran. The questionnaire-by-interview method was used for data collection. To examine the reliability of the questionnaire, a pilot test was conducted on 25 farmers, and the Cronbachs Alpha coefficients for the different variables on Likert type scales were calculated. The results of the Alpha coefficients (shown in Table 1) indicated that the selected scales were appropriate.

Table 1: Reliability Analysis (Alpha)

Scale Name	development			
	No. of items	Alpha Value	No. of items	Alpha Value
Support and extensional characteristic	10	0.835	7	0.702
Economic characteristic	7	0.878	5	0.838
Environmental and technical characteristic	10	0.710	4	0.80
Social characteristic	10	0.780	6	0.70

The main question of this study was to give the answer this question: there are many problems to encourage farmers to use modern methods of irrigation but why some of them after the adoption of these methods, to abandon it. Despite the number of other farmers' had developed the new irrigation systems in their fields. Therefore to investigate this aim was used the discriminant analysis.

Discriminant Analysis finds a set of prediction equations based on independent variables that are used to classify individuals into groups. There are two possible objectives in a discriminant analysis: finding a predictive equation for classifying new individuals or interpreting the predictive equation to better understand the relationships that may exist among the variables. In many ways, discriminant analysis parallels multiple

regression analysis. The main difference between these two techniques is that regression analysis deals with a continuous dependent variable, while discriminant analysis must have a discrete dependent variable. The methodology used to complete a discriminant analysis is similar to regression analysis.

DA involves the determination of a linear equation like regression that will predict which group the case belongs to. The form of the equation or function is:

$$D = v_1 X_1 + v_2 X_2 + v_3 X_3 + \dots + v_n X_n + a$$

Where D = discriminate function

v = the discriminant coefficient or weight for that variable

X = respondent's score for that variable

a = a constant

i = the number of predictor variables

**3. Results**

Influential factors on development the modern methods of irrigation (as discriminating group variables) were determined using discriminant analysis. Scores of these factors were imported as independent variables to the analysis for computation of their significance in the discriminant equation and their weights, in the other words to be revealed that which of them are capable for developer and reducer farmers sprinkler irrigation systems. Stepwise method was used for importation of independent variables to the analysis. Wilks' Lambda statistics was used in this method for importation and exportation of variables to

different steps and Split- sample was used for validity of discriminant function. For significance determination of independent variables in discrimination between adopter groups, structure correlation or structure matrix was used that indicates the positions of independent variables before entering to the analysis.

Wilks' Lambda statistics indicates that there are meaningful differences between two groups (developer) and (reducer). Canonical Correlation coefficient indicates that there is correlation between variables of groups and discriminant score. Another criterion in assessment of discriminant function is Eigenvalues which implies the model capability for discrimination(table2)

Table2: Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	Df	Sig.
1	.603	51.578	8	.000

According table 6, discriminative regression equation for two groups of using new methods and use of traditional methods of irrigation water, based on non standardized canonical discriminant function coefficient (Table 3), is as follow:

Table 3: Standardized and non standard canonical discriminant function coefficients

Variables	Standard coefficient	Non standard coefficient
Loan deficiency	0.333	1.174
Risk attitude	0.239	-0.647
TV program	0.222	-0.818
The low quality of parts	0.222	0.707
The lack useful laws	0.205	-0.971
Mismatches of irrigation systems with farm systems	0.133	0.893
credit institutions	0.130	0.575
Lack of installation skills	0.106	-0.755
Constant	-	-0.158

Table 7: Function at group centroids

Different groups	Coefficient (equation 1)
Developer group farmers	1.267
Reducer group farmers	-0.510

$$Y = -0.158 + 1.174X_1 - 0.647X_2 - 0.818X_3 + 0.707X_4 - 0.971X_5 + 0.893X_6 + 0.575X_7 - 0.755X_8$$

X<sub>1</sub>= Loan deficiency, X<sub>2</sub>= Risk attitude, X<sub>3</sub>= TV program, X<sub>4</sub>= The low quality of parts, X<sub>5</sub>= The lack useful laws, X<sub>6</sub>= Mismatches of irrigation systems with farm systems, X<sub>7</sub>= Credit institutions, X<sub>8</sub>= Lack of installation skills.

**4. Conclusion**

The result of discriminant analysis to distinguish the two groups of farmers (reducer and developer) to use of sprinkler irrigation systems showed that the variables such as: desire to lend and risk, receiving the

knowledge of the channels of mass communication, having the awareness about the quality of components, existing laws and credit institutions was the most important indicators that could be discriminated the two groups of farmers. It seems that by use of extension activities of awareness through mass media such as TV, and also help farmers to aware of the existing laws, irrigation system properties and credit institutions could be encouraged them to tends to receive the loans. Therefore could be expert the farmers developed the use of sprinkler irrigation systems in your crop fields.

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