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Evaluating the Elements Influencing the Sustainable Management of Water Resources in Agriculture

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ABSTRACT:
Currently, the qualitative and quantitative decline in water resources presents a global challenge. In Rajasthan, this issue has led to numerous challenges in the agriculture sector. The primary focus of this study was to analyze the sustainable management of agricultural water resources. Employing applied research methods, including descriptive and correlational analyses, the study utilized factor analysis to identify the factors influencing sustainable water resource management in agriculture. The statistical sample comprised 1296 farmers in the region, with a subset of 144 selected through simple random sampling. Data collection involved questionnaire surveys conducted in 12 villages. The questionnaire's validity was assessed using the Cronbach Alpha coefficient (85%). Findings revealed a significant positive correlation ($p < 0.001$) between sustainable water resource management and factors such as on-farm demonstration visits, social participation, utilization of communication channels, participation in training programs, income levels, mechanization levels, consultations with fellow wheat farmers, and interactions with agricultural promoters. Additionally, factor analysis was employed to identify key factors affecting sustainable water resource management. The Kaiser-Meyer-Olkin (KMO) test confirmed the suitability of the data for factor analysis. Results indicated that five factors—economic characteristics, educational and promotional activities, social engagement, knowledge and information dissemination, and governmental support—explained approximately 75% of the variance in sustainable water resource management. This suggests that prioritizing these factors in planning initiatives could significantly enhance the technical knowledge of wheat farmers in Kashan township regarding sustainable agriculture practices.

Keywords: Factor analysis, Sustainable management, Agriculture water resources.

INTRODUCTION

Currently, it is seen that industrial and agricultural waste waters have caused many changes in the natural ecosystems, which put the wildlife into risk. Using pesticides has caused the outbreak of resistant pests and intense effects in other beings (Molden, 2007). Intensification of water resources limitation is a complex process dependent to a set of natural and social items (Oweis and Hachum, 2003). Totally, interaction of this items causes an irregularly increase of water use, reduction of suitable high-quality water, and inappropriate use of water in different uses (Ommani, 2002). At present, both food and water resources security face a high risk. this is mainly because of the irregular increase of the world`s population and reduction of water resources due to the unlimited use of these resources, involvement of mankind in the natural cycle, and use of chemical pollutants (Esfandiiary, 1993). Status of water resources exploitation, capacities, and amenities are available. Agriculture is one of the main resources of water use having an important role in the nutrition of people. Since the beginning of 21st century`s, access to the water resources in agricultural activities has been exceedingly reduced (Kadi, 1997). utilizing new agricultural methods and suitable use of water resources are vital factors in order to achieve the objective of providing food for the world`s growing population. Despite three –quarters of the earth`s surface is covered by water, a little part of it is used as drinkable freshwater (Ommani, 2011).

MATERIAL AND METHODS

This study is an applied one with descriptive and correlation methods; factor analysis technique was used, too. This study was carried out with documentary study and field research using questionnaire to determine factors affecting the level of sustainable management of agriculture water resources. In this study, number of the statistical sample, from the case study society, was estimated using Cochrane Formula (N= 1296 and n= 144) and selected through random sampling. Information collection was carried out in two sections; firs one includes the collection of information in the field of theoretical basis and records of the completed researches, which carried out by library study. The second one includes the collection of the needed information from the local farmers using a questionnaire in the form of field operation. Information collection tool was a questionnaire. Panel of experts` method was used to determine the validity of the questionnaire, and finally Alpha Coronbach coefficient (%84) was calculated for the entire questionnaire using SPSS software.
Independent and dependent variables are listed herein below:

X1: use of plastic pipes to transfer water to the farm, X2: use of legume in agricultural periodicity,
X3: use of livestock fertilizers in land fertilization, X4: use of integrated pest management method against pests and X5: use of optimal cultivation pattern in water use.
Dependent variable: rate of using chemical fertilizers, rate of using poisons, and rate of agricultural products cultivation.

RESULTS AND DISCUSSION

The based-on-age frequency distribution of individuals is indicated in table 1. Maximum frequency is related to the age group of 41-45 and the minimum one is related to the group under 25. Frequency distribution of individuals based on the levels of sustainable management of agriculture water resources is shown in table 2. The following indicator was used to evaluate this variable:
Method of 1 standard deviation above the mean was then used to classify individuals based on the different levels of agriculture water source management.

Table1. Frequency distribution of individuals based on age

Resource of age groups	Frequency	Percentage
To 25 years	6	4.2
26-30	10	6.9
31-35	12	8.3
36-40	28	19.4
41-45	37	25.7
46-50	28	19.4
More than 50	20	13.9
No answer	3	2.1
Total	144	100

Table2.Frequency distribution of wheat farmers based on the levels of sustainable management of agriculture water resources

Levels of sustainable management	Frequency	Percentage
Too low	30	21
Low	25	17
Mid	52	36
High	28	19
Too High	6	4
No Answer	3	2
Total	144	100

Spearman coefficient of correlation was used to determine the inter-variable relationship of the study and the variable of the level of agriculture water sustainable management (table 3). Results indicated that there is positive and significant relationship with a 99.9 percent of confidence between the level of agriculture water sustainable management and the variables of visiting on- farm demonstration , social participation , level of education , rate of using communicative channels , participation in training classes , income , level of mechanization , and rate of the agriculture promoters ` contact with wheat farmers. There is positive and significant relationship with a 99 percent of confidence between the variables of under cultivation area and accepting the insurance with the variable of wheat farmers` level of knowledge in the field of sustainable management of agriculture water resources. There is negative and significant relationship with a 99 percent of confidence between the variables of age and wheat farmers` level of knowledge in the field of sustainable management of agriculture water resources.

Table3. Coefficient of correlation between the variables of study and the variable of level

Variable	r	p
Age	0.235	0.004
Under cultivation area	0.19	0.000
Experience of wheat farming	0.101	0.003
Income	0.673	0.000
Insurance of product	0.583	0.000
Rate of participation in training classes	0.282	0.000
Level of mechanization	0.79	0.000
Number of household members	-0.56	0.138
Rate of promoters` contacts with farmers	0.64	0.000

Table4. Evaluation of the situation of Eigen value in the factor analysis of the agriculture water sustainable management

Factor	Eigen Value	Percent of Eigen value	Cumulative percent
1	3.4	18.3	18.3
2	2.7	17.5	35.8
3	2.3	13.1	48.9
4	1.2	10.2	59.1
5	1.5	8.4	67.5

According to the estimated Eigen value and the number of factors, cut test diagram was drawn. Based on the number of factors which are statistically significant and can be used for analysis, five factors were explained having an Eigen value greater than 1. Results of factor analysis(table 4) indicate that the five factors (variables of educational and promotional activities, economic characteristics , social activities, knowledge and information of farmers, and governmental supports) explains a total 67.5 percent of the variance of farmers` level of knowledge in the field of sustainable management of agriculture water resources, meaning that if these five factors are well considered, it can be believed that improvement of the technical knowledge of kashan township`s wheat farmers in the field of sustainable agriculture is highly covered . Results of regression identify the role of independent variables on the dependent one (level of agriculture water resources` sustainable management).

Table 5. Factors affecting the level of agriculture water resources` sustainable management in the form of main factors after the factor rotation

Factors	Factor Loading
1st: educational and promotional activities	0.567
Rate of using training publications	
Rate of using audio and visual equipment	0.576
Rate of participation in classes	0.653
Rate of participation in workshops	0.65
2nd: economic tendency	
Under cultivation area	0.72
income	0.902
Level of mechanization	0.702
3rd: governmental supports	0.6
Providing subsides	
Water resources management	0.75
4th : social activities	0.805
Social participation	
5th: impact of information	
Technical knowledge	0.67

Economic characteristics, social activities, knowledge and information of farmers, and governmental supports explains a total 67.5 percent of the variance of farmers` level of knowledge in the field of sustainable management of agriculture water resources, meaning that if these five factors are well considered, it can be believed that improvement of the technical knowledge of kashan township`s wheat farmers in the field of sustainable agriculture is highly covered.

Table 6. Multivariable regression results by means of enter method with dependent variable of the level of agriculture water resources` sustainable management

Model	B	STD	BETA	F	SIG
intercept	2.35	0.426	_	4.2	--
Social participation	0.365	0.25	0.320	3.1	0.002
income	0.442	0.263	0.290	4.1	0.002
Technical knowledge	0.312	0.12	0.280	4.05	--
Participation in class	0.478	0.211	0.350	4.7	--
Level of mechanization	0.0215	0.0175	0.230	4.002	0.235
Rate of using communicative channels	0.429	0.17	0.015	1.1	--

CONCLUSION AND SUGGESTIONS

During the recent years, most of the countries have faced the lack water. In this period of time, water must be considered as a valuable good (Pereira, 2005). Carefulness in managing the use of agriculture water resources is necessary. The most important results and suggestions of this study are indicated here in below:

Results of correlation indicated that there is positive and significant relationship with a 99.9 percent of confidence between the level of agriculture water sustainable management and the variables of visiting on-farm demonstration, social participation, rate of using communicative channels, participation in training classes, income, level of mechanization and

rate of the agriculture promoters ` contact with wheat farmers. Thus, considering the mentioned items in the national and regional planning is suggested to the planners.

Based on the results of regression related to the independent variables effect on the dependent one (level of agriculture water resources` sustainable management), improvement of the level of farmers` attitude and quick designation of financial resources have a positive effect on the progress of agricultural activities.

Based on the study results, it is suggested that the five identified factors of economic characteristics, educational and promotional activities, social activities, knowledge and information of farmers, and governmental supports are well considered so that the level of agriculture water resources` sustainable management can significantly improve.

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