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COMPREHENSIVE MODELING OF AFFECTING FACTORS ON THE ADOPTION OF CONSERVATION PRACTICES AMONG PADDY FARMERS IN NORTH OF IRAN

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Abstract

Iran, and especially its northern provinces, lose a large amount of agricultural soil annually due to erosion, and this is one of the reasons why productivity in Iranian agriculture is low. Hence, there is a great need for measures to protect water and soil resources and prevent their pollution, which are called "water and soil conservation measures" (WSCM). The main purpose of this study was to investigate the factors that were effective in determining the adoption of WSCM by farmers in Lasht-e-Nesha district (northern Iran). Binary logistic regression was used to analyze the data. The results showed that the variables of the total amount of rice production, cooperation with other farmers and participation in development-extension and training courses, which all are quantitative, had a positive and significant relationship with the adoption of WSCM. Other quantitative variables used in this study (e.g. number of household members, farmer's experience in rice cultivation, farm size, number of paddy plots, dealing with other agricultural activities) showed a negative and significant relationship with the adoption of WSCM. Also, all the attitudinal variables used in this study, including behavioral intention, facilitating conditions and initial trust, had a strong, positive and significant effect on the adoption of WSCM by Lasht-e-Nesha farmers. The strong suggestion of the authors of this article is that by holding various meetings in rural areas and the presence of experts in all branches of agriculture, especially water and soil, farmers should be more familiar with the benefits and efficiency of WSCM.

Key words: *Binary logistic regression, conservation agriculture, soil erosion, water*

INTRODUCTION

Soil is one of the natural resources necessary for human survival [4], [65]. It is considered a scarce and non-renewable resource [91]; it takes a long time (between 600 and 700 years) to form 2.5 cm of soil, which is suitable for agriculture. Soil erosion is one of the causes of the degradation of agricultural lands around the world [11], [56], [67], [90]. When a nation's agricultural lands are degraded, the agricultural sector faces problems and crises, and sustainable development slows down, especially in developing countries [122].

Nearly 80 percent of the world's farm lands are involved in various levels of soil erosion each year [76]. Indeed, the amount of soil that is out of reach each year due to soil erosion is estimated at 75 billion tons, causing the loss of $ 400 billion [29]. How a farmer uses arable lands, as well as knowledge of managers, are critical and determining factors to occurring soil erosion [60], [99], [46].

Soil erosion can have many reasons. From the point of view of Muchena et al. [81], erosion can be the result of climate change (e.g. heavy rainfall, drought), farm land characteristics (e.g. slope, type of soil) or even personal characteristics of farmers (e.g. level of education, experience in farming, access to credit resources, access to promotional and extension courses). In addition to the factors mentioned earlier, the slope gradient of agricultural land [71] and the use of old and inefficient methods in cultivation can be added to the factors involved in soil erosion [104]. Unfortunately, there are still farmers who use old and inefficient methods and are reluctant to adopt techniques and measures designed to conserve the soil [9].

In addition to soil, water is another natural and scarce resource that plays a vital role in agriculture activities. The growing population of the world, industrialization of countries, frequent droughts, increasing agricultural land to provide food for the hungry population and, most importantly, climate change have led to water resources depletion and scarcity [44], [58], [119], [53]. With the current trend of population growth and over-exploitation of water resources, it is expected that by 2025, more than half of the world's population will face water shortage [13], [113]. Similarly, by the end of 2040, a large number of countries in the Middle East, often in arid and semi-arid regions, will experience severe water shortages [72]. It is also projected that by the end of 2030, global demand for water will be 40 percent higher than supply [116]. In addition, the Middle East is expected to experience a very serious water crisis due to overpopulation and climate change [115], [18]. Iran, is one of the arid and semi-arid countries, and drought and water scarcity are observed in most of its regions [31], [120], [123], [19].

Water shortages and declining groundwater aquifers over recent decades have increased soil salinity and desertification. The Iranian Soil Science Association has also issued a statement that water shortages in Iran have caused 31.5 million hectares of agricultural land to be abandoned [117].

In 2013, the Forests, Rangelands and Watershed Management Organization of Iran released statistics showing that more than 80 percent of the country's arable lands were out of reach and have lost their fertility due to a sharp increase in population, followed by rising water demand, successive droughts and climate change. This has had detrimental effects on Iran's economy, such as a 4.4 percent drop in the Gross Domestic Product (GDP), a significant drop in exports of non-oil products, and an increase in food imports and inflation [98].

The agricultural sector is one of the most important sectors in the world in terms of water consumption, and Iran is no exception [51]. Therefore, designing and introducing water resources conservation methods should be a priority for all countries.

In Iran, rice is considered a very important, strategic and basic commodity, and one of the most widely consumed agricultural products [100]. The importance of this product is such that its per capita consumption per person and per year increased from 28 kg in 1972 to 41 kg in 2014 [78]. One of the most vital steps in planting rice is the irrigation stage, because in all stages of rice cultivation and growth, this crop must be completely submerged in water. Water has many benefits for the rice plant, and it is responsible for transporting nutrients from the roots to the stems, leaves, and seeds, and ultimately providing the dry matter. Also, another requirement for planting rice is soil free of any contamination [39].

Guilan province, located in the northern Iran, is one of the main suppliers of Iranian rice. The area under rice cultivation in Guilan province is 238,403 hectares, which produces 11,065,331 tons of rice [80]. Due to incorrect and unscientific exploitation of natural resources in this province, natural resources such as water and soil are wasted or polluted considerably every year. Therefore, in Guilan province, the need for water and soil conservation measures (WSCM) is one of the main priorities for sustainable agriculture [1].

Given the reasons discussed in the previous paragraphs about the importance and scarcity of two sources of water and soil, the use of WSCM seems necessary. Factors that directly or indirectly affect a farmer in adopting WSCM can play an important role in WSCM adoption. When policymakers are aware of these factors, they gain a broader and more in-depth view of issues and act in more detail on policy-making [43].

There have been many studies around the world on the factors that affect the adoption of WSCM.

Moges and Taye [79] examined farmers' attitudes toward investing in water and soil conservation technologies using a logistic regression model. The variables of education level and access to training and practice courses had a positive effect and the variables of age and farm-house distance had a negative effect on the adoption of water and soil conservation measures.

Darkwah et al [36] evaluated the determinants of the adoption of water and soil conservation practices (WSCP) in Ghana. They used the Poisson regression model and considered variables such as the number of household members, access to facilities, the distance from the farmer's house to the farm, and etc. Variables such as number of household members, farm size and access to credit had a positive effect and variables such as distance to the nearest product market, access to extension services and risk of using pesticides had a negative effect on WSCM adoption.

Sileshi et al. [102] also analyzed the factors influencing the adoption of physical and conservation measures of water and soil resources by Ethiopian farmers using a multiple probit regression model. Numerous demographic variables were used in the study, including age, gender, level of education, livestock maintenance, off-farm employment, and farm size. The results of the study showed that socioeconomic factors and characteristics of institutions were the main and determining factors in the adoption of WSCM by Ethiopian farmers.

Many other studies dealing with WSCM can be mentioned [10], [103], [27], [61], [9], [14], [15], [47], [2], [87].

However, it is safe to say that in most of the studies mentioned above, the researchers focused on the effect of demographic and quantitative variables on WSCM adoption, and only in small number of studies addressed the simultaneous effect of quantitative, demographic, dummy and attitudinal variables [15], [28], [93].

A person's attitudes and beliefs are directly related to his actions and behavior, and if these attitudes are not properly formed and oriented, we will see harmful results because human beings with these wrong attitudes cause the destruction of the environment and natural resources [57], [22], [7]. However, the determinant effect of attitude variables on WSCM adoption cannot be denied.

Based on the above review of literature, it was found that there is a gap in the study of variables affecting WSCM adoption, and that is the vacuum of attitude variables. Therefore, this paper tries to examine the factors influencing the adoption of water and soil conservation measures by considering both demographic and quantitative variables, and attitudinal and behavioral variables, as well as using an econometric regression model.

The measures that this study refers to as water and soil conservation measures (WSCM) and are carried out by farmers on agricultural lands are: equipping and renovating lands, second crop after paddy cultivation, maintenance of tertiary and quaternary irrigation canals, use of organic and green manure, weeding of irrigation canals, regular dredging of irrigation canals, use of plastic mulch on land boundaries, and water drainage from paddy fields.

MATERIALS AND METHODS

Study area description

This study was conducted in Lasht-e-Nasha district, which is geographically located 51'34.03"N longitude and 21'41.634"E latitude in Guilan province, located in the northernmost point of Iran (Fig. 1). Lasht-e-Nasha is located in the northeast of the center of Guilan province, i.e. the city of Rasht, and its distance to the center of the province is 31 km. The total area of Lasht-e-Nasha district is 162 square kilometers. Lasht-e-Nasha cosists of 47 rural areas and three urban areas, of which only 38 villages have taken conservation measures (most of which relate to equipping and renovating paddy farms). The land area equipped and renovated in Lasht-e-Nasha district until 2018 is estimated at 3,531 hectares. The reason for choosing Lasht-e-Nasha district among all the districts of Guilan province was that the highest WSCM adoption rate was recorded in this section. Most of the heads of households living in the Lasht-e-Nasha district are engaged in agricultural work and make a living out of it. The total number of active farmers in Lasht-e-Nesha district is reported to be 11,614, who cultivate annually 8,350 hectares of paddy farms. The amount of rice that is produced and supplied annually in

Lasht-e-Nesha district is estimated at 20,000 tons in 2019 [6].

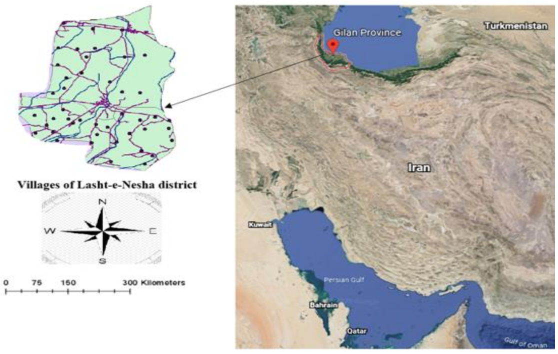

Fig. 1. GIS map of the Lasht-e-Nesha district in Northern Iran
Source: Google Earth and ArcMap.

Sample selection and size

Farmers engaged in rice cultivation in the Lasht-e-Nesha region have been targeted in this study. According to the statistics obtained from the Jihad Agricultural Organization of Guilan Province, the number of these farmers was 6,841. Using a table provided by Bartlett et al. [23], it is observed that the required sample size at a significance level of 5% was 367 but we choose 538 paddy farmers. Data from this study were collected between November and December 2019. Data collection tool was a questionnaire. Farmers in this study were divided into two categories: 1- WSCM adopters and 2- Ordinary or non-adopter farmers.

Table 1. Demographic variables and characteristics of survey respondents (n=538).

Distribution	Class	Frequency	%
Age (years)	20-29	5	9
	30-39	40	7.4
	40-59	261	48.5
	> 60	232	43.1
Education	Lower than BSc	528	98.14
	BSc or higher	10	1.85
Use of family labour	Yes	411	76.4
	No	127	23.6
Type of land tenure	Ownership	439	81.6
	Rent	14	2.6
	Sharing	85	15.8
Sloppy Paddy farm	Yes	116	21.6
	No	422	78.4
Access to development and extension services	Yes	77	14.3
	No	469	85.7

Source: Field survey data, 2019.

The number of adopters was 432 and the number of non-adopters was 106. Descriptive statistics of demographic variables of farmers located in Lasht-e-Nesha are shown in Table 1.

Research design and variables

As mentioned in the introduction, one of the goals of this study is to fill the gap that exists in terms of factors affecting WSCM adoption. Therefore, in addition to involving quantitative and demographic variables, we also included behavioral and attitudinal variables in this study to gain a deeper and more comprehensive understanding of the factors influencing the adoption of WSCM. Quantitative, demographic and dummy variables, which were thought to affect WSCM adoption, analyzed in this study were: farmer's level of education, number of household members, farmer's experience in rice cultivation, farm size, number of paddy plots, use of family labor in rice cultivation, doing other agricultural activities, off-farm employment, total amount of rice production, cooperation with other farmers, participation in development-extension and training courses. In addition, attitudinal variables affecting WSCM adoption such as behavioral intent (BI), facilitating conditions (FC), and initial trust (IT) were included in the analysis. Few studies are available on the attitudinal factors influencing WSCM adoption. The most recent study in this field is the study of Faridi et al. [43], which by merging two conceptual models of initial trust model (ITM) and unified theory of acceptance and use of technology (UTAUT), examined the attitudinal factors affecting the adoption of WSCM. Using the conceptual model used in this study and using variables that directly and indirectly affect the adoption variable, we examined the attitudinal factors affecting adopting WSCM with the logit regression approach. To examine the attitudinal and behavioral variables more accurately, the items used for these variables in different studies were also examined. These items are shown in Table 2.

Table 2. Introduction of attitudinal variables and items used in them

Constructs	Items	Contents	Sources
Behavioral intention (BI)	BI1 BI2 BI3 BI4 BI5	(1)I intend to implement WSCM in my paddy field next year. (2)I predict to apply WSCM on my paddy field next year. (3)I plan to have WSCM on my paddy field next year. (4)If I have access to WSCM next year, I intend to apply them to my paddy field. (5)If WSCM are financially viable, I will use them in my paddy field next year.	[111], [112], [97], [68], [70], [118], [121], [74]
Facilitating conditions (FS)	FS1 FS2 FS3	(1)I have the necessary resources (land, labor, capital) to implement WSCM. (2)I have the necessary knowledge to implement WSCM. (3)Experts are available in the area to address the problems and deficiencies of WSCM.	[63], [105], [95], [111], [108]
Initial trust (IT)	IT1 IT2 IT3	(1)WSCM lead to sustainable production in my paddy field. (2)WSCM are reliable. (3)WSCM are designed to help paddy farmers.	[64], [86]

Source: Own synthesis based on literature.

Data analysis

The binary logistics regression model is commonly used to investigate the relationship and correlation of a dual dependent variable and several independent variables [88]. Using this approach makes it possible to examine the simultaneous effect of several explanatory variables on a dependent variable. Through this measure, the explanatory variables can be graded according to the degree of effect on the dependent variable [59].

In this study, binary logistic regression model was used to investigate the effect of quantitative, demographic and attitude variables on WSCM adoption. In the section of interpretation and analysis of the results of the Logit model, the two concepts of weighted aggregate elasticity and the marginal effect were used. Elasticity can be thought of as a measure of how sensitive a variable is to another variable. In economics, the interpretation of elasticity is that if the first variable increases by 1%, the second variable will increase by what percentage [35].

The marginal effect tells the researcher on how changing a particular explanatory variable, changes the dependent variable. In other words, if the independent variable is increased by 1 unit, by how many units will the dependent variable increase [114].

Based on the results obtained from the Logit model estimate, the model used in this study is statistically significant [Likelihood Ratio (LR) = 685.452, P-value < 0.000, df = 14] and can be considered as a suitable model for analyzing research data. The percentage of right prediction of the model was 98.5%, which means that 98.5% of the changes in the dependent variable are explained by the explanatory variables.

RESULTS AND DISCUSSIONS

In this study, we examined the factors influencing the adoption of WSCM by paddy farmers in Lasht-e-Nesha district, located in northern Iran. Using logistics binary regression model, the effectiveness of 14 different variables - including quantitative, demographic and behavioral attitudinal - was tested. Table 3 shows the descriptive statistics of the variables used in the study.

The results of estimating the Logit regression model are shown in Table 4.

The variable level of education of the paddy farmer had a negative effect on the adoption of WSCM, which was also statistically insignificant (β= -0.3, and t-value= -1.14). Similar results can be found in the studies of Eleni [40], Anim [10], Chomba [34], Foltz [45], Jara-Rojas et al. [52], Nkegbe et al. [84], Mutuku et al. [82] and Abdul-Hanan [2]. It also contradicts the results of studies by Moges and Taye [79], Tenge et al. [107], Sinore et al. [103], Sileshi et al. [102], Nurie et al. [85], Asfaw and Neka [14], Ashoori et al. [15], Anley et al. [11], Illukpitiya and Gopalakrishnan [50], Mengstie [77], Kessler [62], Lapar and Pandey [66], Pender and Kerr [89], Rezvanfar et al. [94], Kerse [61] and Long [69].

The next variable that had a negative effect on WSCM adoption was the number of household members and it was significant at 10% level (β= -0.5, and t-value= -1.69). This finding is in line with the studies of Ouedraogo and Tiganadaba [87], Sileshi et al. [102], Bekele and Drake [25], Ashoori et al. [15], Bakhsh et al. [20], Mengstie [77], Gebremichael [48] and Abdul-Hanan [2]. On the other hand, there are a number of studies that show that the more the members of a family are, the higher is the rate of adoption of WSCM by the head of the household [40], [42], [106], [79], [103], [36], [3], [52], [84], [61], [12], [16].

Farmer's experience in rice cultivation (which was based on the number of years) was another variable that negatively affected WSCM adoption. This variable was statistically significant at 10% (β= -0.05, and t-value= -1.64). Darkwah et al. [36] and Ashoori et al. [15] also found the effect of the variable experience as negative.

Farm size was another variable whose effect on WSCM adoption was negative and it was statistically significant at 5% (β= -0.0001, and t-value= -2.46). The results obtained in the studies of Shortle and Miranowski [101], Ouedraogo and Tiganadaba [87], Sileshi et al. [102], Ashoori et al. [15], Gebremedhin and Swinton [47], Mutuku et al. [82] and Asfaw and Neka [14] confirm the finding of our study about the negative effect of farm size. However, there were studies whose results differed from this study in the case of farm size variable [9], [79], [103], [36], [8], [3], [106], [40], [37], [26], [61], [2]. No significant relationship between field size and WSCM adoption was found in the studies of Agbamu [5] and Uri [110].

The number of plots of land available to the farmer was another variable that had a negative effect on WSCM adoption, which was also significant at the statistical level of 5% (β= -0.4498, and t-value= -2.50). Also Ashoori et al. [15] and Beshir [26] concluded that the number of agricultural land plots and the adoption of WSCM have a negative relationship and correlation. On the other hand, Ashoori et al. [16] found a positive relationship between the number of agricultural plots and the adoption of WSCM.

Doing other agricultural activities, along with rice cultivation, is another dummy variable that had a negative effect on WSCM adoption, which is significant at 5% level (β= -2.5249, and t-value= -2.33).

Employment in off-farm activities was another examined variable whose effect on the adoption of WSCM was positive but statistically insignificant (β= 1.4209, and t-value= 1.31). Demelash and Stahr [38] found that the farmer's employment outside the farm generated additional income and encouraged him/her to adopt and implement WSCM on farm. Tiwari et al. [109] also concluded that income from off-farm activities is a reliable source for investing in conservation measures and considered it an influential and decisive factor. Darkwah et al. [36] found that off-farm activity variable was positive but insignificant. Meanwhile, Abdul-Hanan [2] considered the off-farm income variable to be negative and insignificant. Eneyew et al. [41] also concluded that household access to off-farm income is more likely to have an effect on water and soil conservation measures implemented by farmers. On the other hand, other studies have concluded that off-farm activities and income from them have a negative effect on WSCM adoption [14], [9], [61], [32], [107], [40], [89], [75], [47], [102].

When the variable of employment in off-farm activities increases by 1%, the probability of WSCM being adopted by farmers also increases by 0.014%. Also, with an increase of 1 unit in this variable, it can be said with certainty that WSCM adoption by farmers will increase by 0.293 units.

Another quantitative variable used in this study was the total amount of rice production, which was calculated in kilograms. According to the results obtained by the Logit regression model, the effect of this variable on the adoption of WSCM is positive and statistically significant at the level of 5% (β= 0.00105, and t-value= 2.29). In the studies of Ouedraogo and Tiganadaba [87] and Ashoori et al. [16], the effect of the variable "total amount of production" was positive but statistically insignificant. When total rice production increases by one percent, we will see a 0.057 percent increase in WSCM adoption rates in the Lasht-e-Nesha district. Also, if this variable increases by 1 unit, the adoption rate increases by 0.0002 units.

The cooperation and participation of farmers with each other and membership in producer organizations was considered in the regression model of this article and its effect was considered positive, which should be noted that it was also significant at the statistical level of 10% (β= 0.77688, and t-value= 1.88). These results are consistent with studies conducted by Mango et al. [73], Abdul-Hanan et al. [3], Mutuku et al. [82] and Nkegbe et al. [84]. It also contradicts the results of the studies by Bayard et al. [24] and Abdul-Hanan [2].

If the variable of cooperation among farmers increases by one percent, there is a 0.036 increase in the likelihood of WSCM adoption. Also, if this variable increases by one unit, the probability will increase by 0.192 units.

The last dummy variable to be included in the regression model of this paper was the farmer's participation and access in development-extension and training courses whose relationship with and effect on WSCM adoption were positive and statistically significant at 5% (β= 1.2574, and t-value= 2.08). This variable has been analyzed in many studies and its effect on WSCM has been recognized as positive [79], [83], [103], [21], [102], [82], [61], [55], [2], [14], [109], [40], [16], [17], [25]. There are also other studies that have assessed negatively the effect of this variable on WSCM adoption [36], [5], [47], [9].

If the variable of farmer participation and access to development-extension and training courses increases by one percent, the variable of WSCM adoption increases by 0.13 percent, and if this variable of increases by1 unit, the adoption of increase by 0.311 units.

However, in addition to quantitative, demographic and dummy variables, attitudinal and behavioral variables have been included in this study, which is a kind of innovation in the study of factors affecting WSCM adoption.

The first attitudinal variable introduced in the Logit regression model of this paper was the behavioral intention variable (BI) in WSCM adoption. According to the results (Table 3), the relationship between BI and the adoption was positive and statistically significant at the level of 1% (β= 0.70252, and t-value= 3.88). In the study of Faridi et al. [43], the BI coefficient was 0.353 and was statistically significant at the level of 1%. Various articles such as Chauhan and Jaiswal [33], Suki and Suki [105]), Brom et al. [30], Hoque and Sorwar [49], Venkatesh et al. [112] and Oliveira et al. [85], highlighted a positive effect of BI on the adoption variable. If the BI variable increases by one percent, the WSCM adoption variable increase 0.32 percent, and if it increases by 1 unit, the adoption rate increases by 0.173 units.

The second attitudinal variable influencing WSCM adoption is facilitating conditions (FC). According to the results of the Logit regression model, FC has a positive and significant correlation at the level of 5% with WSCM adoption (β= 1.1207, and t-value= 2.44). Faridi et al. [43] obtained similar results in their study (path coefficient equal to 0.185 and statistically significant at the level of 1%). Numerous studies have concluded that FC has a positive and significant effect on the adoption [54], [85], [92], [96]. With a 1% increase in FC, the probability of adopting WSCM increases by 0.18%, and with an increase of 1 unit of this variable, 0.277 units will be added to the probability of adopting WSCM.

However, the latest attitude variable introduced in this regression model is the initial confidence (IT) variable, which according to the results (Table 3) has a clearly positive and significant effect at the statistical level of 1% (β= 2.3313, and t-value= 4.74). The study by Faridi et al. [43] confirms the positive and significant effect of IT on adoption. With a 1% increase in IT, there is a 0.63% increase in WSCM adoption, and with an increase of 1 unit in this variable, the adoption rate increases by 0.577 units.

Table 3. Descriptive statistics of variables (N=538)

Variable	Mean	ST. DEV.	Min	Max
Farmer's level of education	3.550	1.762	1	8
Number of household members	3.403	1.363	1	10
Farmer's experience in rice cultivation (in years)	35.1	15.579	3	70
Farm size (m^2)	10,207	11,456	400	0.15
Number of paddy plots	2.977	2.513	1	30
Use of family labour in rice cultivation	0.763	0.425	0	1
Doing other agricultural activities (besides rice)	0.589	0.492	0	1
Off-farm employment	0.472	0.499	0	1
Total amount of rice production (Kg)	1,883.9	1,728.6	100	1,200
Cooperation with other farmers	2.284	1.321	1	5
Participation in development-extension and training courses	4.753	0.760	1	5
Behavioural intention	18.359	6.563	5	25
Facilitating conditions	7.152	2.474	3	15
Initial trust	11.820	2.445	5	15
Adoption	0.571	0.495	0	1

Sources: Field survey data, 2019.

Table 4. Binary logistic regression model results for factors affecting the adoption of WSCM by farmers

Variable	Coefficient	t-ratio	Elasticity	Marginal Effect
Farmer's level of education	-0.303	-1.14	-0.027	-0.075
Number of household members	-0.524	-1.69	-0.047	-0.129
Farmer's experience in rice cultivation	-0.054	-1.64	-0.042	-0.013
Farm size	-0.0001	-2.46	-0.039	-0.000
Number of paddy plots	-0.449	-2.50	-0.037	-0.111
Use of family labour in rice cultivation	1.469	1.16	0.028	0.128
Doing other agricultural activities	-2.524	-2.33	-0.039	-0.551
Off-farm employment	1.420	1.31	0.014	0.293
Total amount of rice production	0.001	2.29	0.057	0.0002
Cooperation with other farmers	0.776	1.88	0.036	0.192
Participation in development-extension and training courses	1.257	2.08	0.13	0.311
Behavioural intention	0.702	3.88	0.32	0.173
Facilitating conditions	1.120	2.44	0.18	0.277
Initial trust	2.331	4.74	0.63	0.577
Adoption	-51.282	-4.56	-1.17	-

Sources: Field survey data, 2019.

CONCLUSIONS

In this study, we evaluated various quantitative, demographic and attitudinal variables that were thought to be effective on WSCM adoption by Lasht-e-Nesha farmers. In the following paragraphs, we discuss policy proposals commensurate with the results of this study.

In this study, the effect of the number of household members on WSCM adoption was negative. This means that families with fewer members in Lasht-e-Nesha were more likely to adopt WSCM. It can be interpreted that households living in rural areas have low financial means and the more are the family members, the more financial problems they have and practically no budget will be allocated to WSCM. Therefore, governments should take more measures to solve the economic problems of rural households, and also rural development specialists should redouble their efforts to develop rural areas. The Ministry of Agriculture can also encourage low-income households to adopt WSCMs by providing low-interest loans and facilities.

The number of years of experience in agriculture was another variable that had a negative effect on WSCM adoption. In other words, inexperienced farmers living in Lasht-e-Nesha district were more inclined to adopt WSCM. Unfortunately, more experienced farmers are distrustful of modern methods of conserving natural resources and still use traditional and inefficient methods. Social groups as well as influential individuals in rural areas should gain this trust and develop and promote WSCM in rural areas. For example, rural development specialists can rent a small farm to demonstrate WSCM. By doing so, experienced farmers will see the end result more closely and it will be more believable for them.

The effect of farm size variable was also negative. That is, farmers with smaller plots were more likely to adopt WSCM. The prices of agricultural inputs as well as WSCM are high, especially in developing countries such as Iran. So, of course, farmers with large plots of land are less interested in implementing WSCM due to financial problems as well as the large area of land at their disposal. It is proposed to make it easier for large-scale farmers to adopt WSCM by supporting their investments in this field.

Carrying out agricultural activities along with rice cultivation is another variable with a negative effect on WSCM adoption. Due to low incomes, rural farmers are forced to do more agricultural activities for a living. This means that the farmer's small capital is distributed among several agricultural activities and a small share remains for conservation measures. Therefore, if a farmer is engaged in several agricultural activities, then these activities must be done optimally and efficiently so that both his/her resources are not wasted and his/her income increases, which paves the way for the adoption of WSCM. It is suggested that experts in all fields of agriculture (e.g. animal and poultry, gardening, soil, water, agronomy and plant breeding, botany, etc.) come together in rural areas and monitor the activities of farmers to guide activities in the right direction and optimize them. The total amount of farmer's rice crop had a positive and significant relationship with the adoption of WSCM. That is, by implementing conservation measures on agricultural land, in addition to protecting water and soil resources from the risk of contamination or loss, they also maximize the crop yield. In this case, it is again recommended that the Ministry of Agriculture and the government facilitate the adoption of WSCM by farmers so that they can increase their rice production and, consequently, improve the level of economic development of rural areas.

Cooperation and interaction with other farmers also had a positive effect on WSCM adoption. Rural communities, because they have a smaller population, interact more with each other and farmers influence more each other. Therefore, if a farmer achieves a favorable result from the implementation of a protection measure, he/she shares this result with others and promotes it in some way. Therefore, meetings can be held inside the rural areas and WSCM adopters can be invited to share their experience with others, while explaining in detail the benefits of WSCM. This action will surely bring positive results.

Participation in development-extension and training courses also positively increases WSCM adoption. As expected, these training courses have a significant impact on the development and promotion of conservation measures. Therefore, these courses should be held regularly by the ministry of agriculture in all rural areas of the country and be free of charge for farmers to increase their participation. Also, these training sessions should be properly advertised in the rural areas so that the farmers know the exact time and place of the events.

But the part that distinguished this study from previous studies on the factors affecting

WSCM adoption by using the logit regression approach was the inclusion of attitudinal variables in the model. Of course, it should be noted that the strongest identified effect in this model was for attitude variables.

Our first attitude variable was behavioral intention in adopting WSCM, which showed a positive and significant effect. When the farmer has in mind a great desire to implement conservation measures on his/her land in next year or in the near future, they will surely do so. The Ministry of Agriculture, as well as rural development experts, should change the farmer's attitude towards conservation measures by demonstrating the benefits of these conservation measures.

The second attitude variable was the facilitating conditions, which had a positive and significant effect on the adoption of WSCM. Thus, the easier are the conditions for adopting and implementing WSCM, the more inclined are the farmers to adopt them. Therefore, the conditions for the implementation of the WSCM should be made more favorable by the relevant bodies, such as the Ministry of Agriculture, the rural cooperatives, the local agricultural service centers. For example, credits with low-interest for adopters should be considered. Long-term and low-interest loans from banks, especially agricultural banks, can also be useful.

Finally, the strongest variable used in this study is initial trust, which proved to have a positive and significant effect on WSCM adoption. It can be concluded that until an initial trust in the efficiency and effectiveness of WSCM is formed in the farmer's mind, practically no adoption is possible. It is highly recommended that agricultural professionals, especially agricultural promoters and rural development experts, meet with farmers in person and provide them with WSCM information honestly and in full transparency so that they can gain their trust. Also, as mentioned earlier, the demonstration farms in villages can result instrumental in building trust and encouraging farmers to adopt WSCM.

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