Predicting and Understanding Farmers' Soil Conservation Behavior in Mazandaran Province, Iran

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ABSTRACT

Iran is considered as a vulnerable country in terms of erosion and degradation of soil resources. One of the solutions that have been proposed in recent years to solve this crisis is to pay special attention to the behavioral, cognitive, and social dimensions of soil conservation behavior in agricultural development programs in addition to the technical aspects. In this regard, a study with a descriptive-correlational and causal-relational method was conducted to identify the most important factors influencing the soil conservation behavior among the Iranian farmers and agricultural community. To this end, a sample of 120 farmers in Mazandaran Province was selected using stratified random sampling with appropriate assignment. The results showed that environmental consciousness, environmental values, and social pressures have significant impacts on soil conservation behavior of farmers. Finally, using the results and insights gained from this study, six practical suggestions have been proposed to managers and policy-makers towards the better management of agricultural soil resources. Application of each of these suggestions can act as a turning point in the improvement of the status of Iran's agricultural sector in general and soil resources in particular.

Keywords: Environmental consciousness, Environmental values, Pro-environmental behavior model, Value-Belief-Norm (VBN) Theory.

INTRODUCTION

Based on the statistics provided by Soil Science Society of Iran (SSSI), the rate of soil erosion of Iran in 2013 was three times higher than the average rate in Asia (Soil Science Society of Iran, 2015). Indeed, Iran has the first rank in soil erosion among the developing countries and throughout the world (FAO, 2011; Kahrom, 2012; Azizi Khalkheili *et al*., 2012). High levels of soil erosion and degradation have introduced Iran as a vulnerable country in terms of soil resources.

Evaluation of the reasons for high levels of soil erosion and the consequent land degradation shows that this challenge emanates from various and complex determinants that can be classified in these categories: (1) Climate causes, such as rainfalls and drought, (2) Bio-geophisical causes, such as soil slope and type, and (3) Managerial and human related causes, such as training, experience, and farmers' access to extension services (Jara-Rojas *et al*., 2013). Many countries have placed the focus of their developmental policies on the utilization of economic and technical tools

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in order to reduce soil vulnerability and enhance soil conservation behavior. However, application of conservation activities has been very low among farmers (especially in Iran) and even the use of these strategies in some cases has led to more degradation of natural resources, such as soil, vegetation, and forests (Vignola *et al*., 2010; Azizi Khalkheili et al., 2012; Valizadeh *et al*., 2018a). These statements suggest that the mere technical and economic strategies cannot motivate farmers towards soil conservation behaviors alone (Ives and Kendal, 2014). Here, the economic strategies need to use other strategies to complement the existing strategies (economic and technical) in order to make the intended changes (Yazdanpanah *et al*., 2015; Valizadeh *et al*., 2018b).

One of the methods that can be effective in providing reasonable insights for the more successful design of soil conservation programs is "the analysis of behavioral and cognitive dimensions of soil conservation behavior" (Lalani *et al*., 2016). In this regard, soil conservation programs and policies should make use of such complementary tools in order to institutionalize soil conservation behaviors and practices (Vignola *et al*., 2010). Despite the growing importance of such issues, few studies (see Noorollah-noorivandi *et al.,* 2009 Azizi Khalkheili *et al*., 2012; Salehi and Imam Gholi, 2012) have been done on this domain in Iran to date.

This study aimed to better understand the soil conservation behaviors among Iranian farmers and to identify some of the most important factors that affect soil conservation behaviors of farmers. Additionally, the aim was to propose proper management inputs and suggestions to the policy-makers of soil conservation programs and executive interventionists in agricultural communities so that soil conservation programs can be properly designed based on the analysis of behavioral and psychological variables.

Theoretical and Emperical Background

The main purpose of this study was to identify the independent variables affecting soil conservation behavior and to evaluate their interconnections. In this regard, the model of pro-environmental behavior (Kollmuss and Agyeman, 2002) and Value-Belief-Norm Theory (Stern, 2000) were used to identify and conceptualize the variables that influence soil conservation behavior. Of course, it should also be noted that there are other behavioral theories like Planned Behavior Theory (Ajzen, 1991), Theory of Reasoned Action (Ajzen and Fishbein, 1980), and Norm Activation Theory (Schwartz, 1977) that can be applied to analyze farmers' soil conservation behavior. For example, Menozzi *et al.* (2015) used Planned Behavior Theory to evaluate the wheat farmers' intention to implement sustainable practices. The results of this study revealed that farmers' attitude and past behavior positively affected intentions to implement the Ecological Focus Area (EFA), while perceived behavioral control and attitudes predicted intentions to adopt the private sustainability scheme.

Planned Behavior Theory is the most used theory in soil conservation studies (see Lalani *et al*., 2016; Wauters *et al*., 2010). However, it is also worth mentioning that each of above mentioned theories have some limitations and strengths. For example, Planned Behavior and Reasoned Action Theories consider the behavior as a rational decision-making situation and ignore moral drivers of behavior. On the other hand, Norm Activation and Value-Belief-Norm Theories assume that the behavior is a moral decision-making situation and thus do not consider the rationality of human beings. Considering that the model of pro-environmental behavior covers the limitations of these theories, it was used as a base to analyze farmers' soil conservation behavior.

In their model, Kollmuss and Ageman (2002) have conceptualized the most important factors influencing pro-environmental behavior in terms of internal factors (such as values, attitudes, feelings, etc.) and external

factors (such as social, economic, etc.). In this theory, special attention has been assigned to the internal factors that form behavior. The "values" that people own are among the most important and foremost internal factors that play a preeminent role in the formation of people's behavior. Values are the driving forces for shaping many of our inner motives. However, the nature of formation of these values is itself uncertain (Kollmuss and Agyeman, 2002). In this regard, Fuhrer *et al.* (1995) argue that individuals' values are mosly under the influence of the microsystems that include the immediate social networks, such as family, neighbors, and peer groups. Moreover, values are likely to be also influenced by macrosystems, such as the cultural background that one lives in.

Research in the field of psychology and other interdisciplinary domains have revealed a range of values for people, including farmers, and these values have acted as a guide to these people's judgment about the world around them (Schwartz, 1992; Ives and Kendal, 2014; Valizadeh *et al.,* 2019). Different types of values have been conceptualized based on this key point, i.e. people's judgment. The environmental values used in this study to evaluate soil conservation behavior include biospheric values (nature-centered), altruistic values (human-centered), and egoistic values (self-centered). In terms of soil conservation behavior, the farmers with egoistic values attend to different dimensions of soil conservation based on how it affects them personally. In this regard, if the costs of soil conservation are perceived to be too much by farmers, they will not show that much interest in soil conservation and may even oppose it.

Altruistic values are also available to the farmers who attend the dimensions of soil conservation behavior based on the costs and benefits it brings to the society, fellow human beings, and mankind. However, the farmers with biospheric values assign credit to soil conservation with regard to the costs and benefits it brings to the environment and ecosystem. In this context, some experts (Stern and Dietz, 1994; Stern, 2000) argue that the

individuals who assign great importance to the ecosystem and other species are more likely to be aware of the negative impacts of their own behavior on soil resources. In this regard, the farmers who assign value to other people are concerned about the consequences of their own soil conservation behaviors towards other farmers.

Environmental consciousness is another internal variable that has been assigned credit in Kollmuss and Agyeman's model of pro-environmental behavior and is treated as a key concept and variable. In the present study, this variable consists of two main components, namely, "environmental attitudes" and "environmental concerns" in the field of soil conservation behavior. Attitudes are defined as the positive or negative enduring feelings that people may hold towards a person or a subject (Kollmuss and Agyeman, 2002) although there is controversy in some studies between attitudes and behaviors. However, it should be noted that attitudes have an important role in farmers' soil conservation behavior (Kollmuss and Agyeman, 2002; Baron and Kenny, 1986). In this regard, attitude towards soil conservation (in the form of environmental consciousness) has been considered as one of the predictor variables of soil conservation behavior.

Attitude towards soil conservation has also been one of the most significant predictors of soil conservation practices in previous studies. For instance, the results of a study conducted by Noorollah-noorivandi *et al.* (2009) among farmers of Iran revealed that understanding the attitudes and practices of farmers is one of the most important ways of integrating wheat cultivation to rural development. Rezvanfar *et al.* (2009) also investigated the factors affecting application of soil conservation practices by Iranian farmers. The results of this study demonstrated that attitude toward soil conservation practices, number of participants in extension-education courses, and size of farming land account for 56.2 percent of dependent variable variances among farmers in the study area. Environmental concern was another component that was applied in the framework of environmental consciousness. In

this study, the variable of environmental concern has been defined as "the level of farmers' sensitivity to and preoccupation with soil conservation".

In addition to some internal predictors, farmers' soil conservation behavior may be also affected by the environment in which they live (Kollmuss and Agyeman, 2002; Shiri *et al.,* 2011; Sabzali Parikhani *et al.,* 2018; Raeisi *et al.,* 2018). In other words, soil conservation behavior in many cases is contingent upon the attitudes and values dominant in the society where farmers live (Willy and Holm-Müller, 2013). In this study, it was attempted to conceptualize the influences that the farmers' social environment (family, religious leaders, relatives, etc.) have had on soil conservation behavior by using the variable of "perceived social pressure".

Review of literature and theoretical perspectives show that not many studies have been done in the field of soil conservation behavior while the importance of the social dimensions of soil conservation behavior is not concealed to anybody. Hence, the aim of this study was to predict Iranian farmers' soil conservation behavior. To this end, a mixture of the variables of the model of pro-environmental behavior (Kollmuss and Agyeman, 2002) and the triple values in the Value-Belief-Norm Theory (Stern, 2000) was used (Figure 1).

MATERIALS AND METHODS

This study was based on a cross-sectional survey. The statistical population of this study consisted of 9,621 farmers in Sari, Mazandaran Province, Iran. The region under study included four rural districts, namely Esfivard-e Shurab, Mazkureh, Kolijan Rostaq-e Sofla, and Miandorud. Sari is located in the north of Iran, between the northern slopes of the Alborz Mountains and the southern coast of the Caspian Sea. It is the largest and most populous city in Mazandaran Province with a population of 504,298. The economy of study area is based on food production such as milled rice, dairy products, canned meat and cookies. This region is a major citrus fruits producer, especially oranges, tangerines and lemons. Other sources of the economy include, but are not limited to, paper, wood, fabrics and construction materials. Sari has a humid subtropical climate, with a Mediterranean climate influence. Winters are cool and rainy whilst summers are hot and humid. In terms of general topography, this area is located at the altitudinal level of 0 to 100 m ams and its slope is from north to south and mild. The region's mixture of soil is mainly clay and clay-loam (Jihad-e Agriculture Organization of Mazandaran
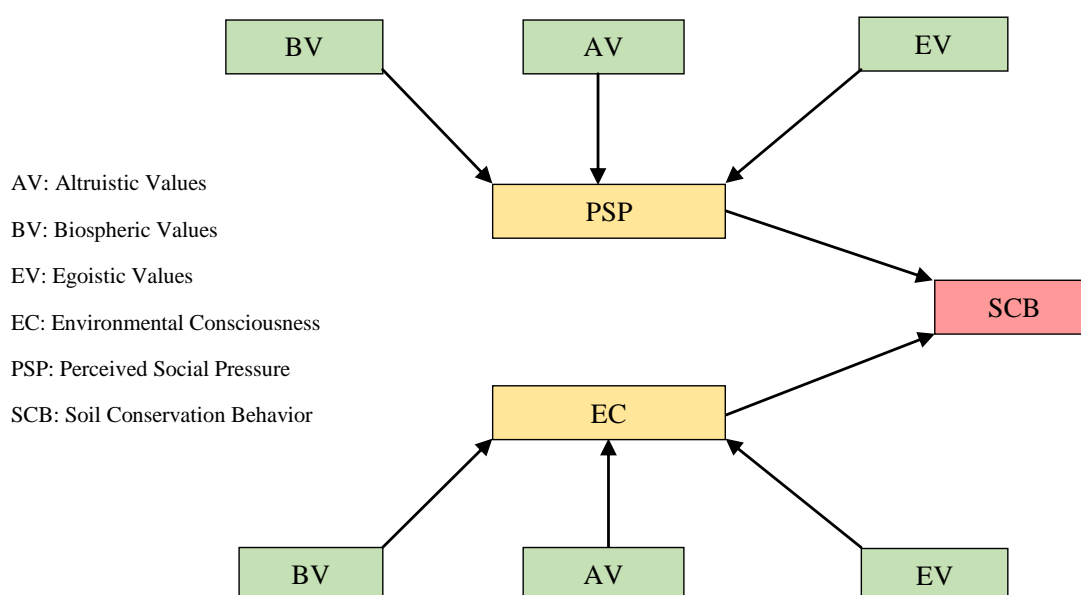

AV: Altruistic Values

BV: Biospheric Values

EV: Egoistic Values

EC: Environmental Consciousness

PSP: Perceived Social Pressure

SCB: Soil Conservation Behavior

Figure 1. Research theoretical framework.

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Province, 2014).

The reason for choosing this region as the research area was that, first, the soil erosion statistics of Iran show that this region has top rank in soil resources' degradation and erosion. Another reason was that the second author was native of this region and he was completely familiar with the situation of soil resources in this area. Thus, he confirmed that the soil erosion is an invaluable issue in study area that can be addressed. The third and final justification that attracted the authors' interest was that this topic was one of the research priorities of Jihad-e Agriculture Organization of Mazandaran Province and thus its results were really important for this organization. The sample size was estimated equal to the number of 120 farmers based on Cochran's formula. The word "farmer" in this study refers to all individuals in the study area who owned/rented a plot of land for farming. This could be a young and/or an old man/woman that had the main responsibility of farm management in a household.

The sampling was fulfilled via stratified random sampling with appropriate assignment. In the pilot study and primary evaluations of the study site and population, the research team recognized that farmers' soil conservation behaviors were variant in different geographical areas (in four regions). In other words, there was a homogeneity in each region/geographical area in terms of water conservation behaviors; on the other hand, there was also heterogeneity between the regions in terms of water conservation behaviors. In addition, considering that the distribution and density of population were so variant in different geographic areas, we tried to categorize the general study population to different strata with respect to the density of population and water conservation behaviors. Afterwards, the sample was stratified in direct proportion to the size of the stratum/sub counties as compared to the population. At the end, the farmers were selected randomly from each strata (Table 1).

For the design of the research instrument, at the first stage, it was attempted to review the research in the field of social dimensions of soil conservation behavior that had been done in Iran and some parts of the world. This stage was prerequisite to the next stage of the research or the development of the research instrument. It is noteworthy that the measurement instrument in this study was a researcher-administrated questionnaire whose items (questions) were responded in a close-ended mode. The validity of this scale was approved *via* expert opinion. After that, a pilot study was carried out and then the reliability of the variables was evaluated using Cronbach's Alpha coefficients. The results suggested the acceptability of the obtained reliability of the study for doing research (Table 2). The data analysis was performed using $SPSS_{24}$.

The required data in this study were obtained using face-to-face interviews with farmers and completion of questionnaires. Because the research population had different local languages and customs, a special data collecting team was initially formed whose members were completely familiar with the languages, customs, and traditions of the research population.

Table 1. Rice farmers in central district of Sari and selected samples.

No	Rural District	Rice farmers	
		Population	Sample
1	Esfivard-e Shurab	3378	42
2	Mazkureh	2194	27
3	Kolijan Rostaq-e Sofra	432	6
4	Mian Doroud-e Kouchak	3617	45
Total	9621	120	

$$n = \frac{N(t.s)^2}{Nd^2 + (t.s)^2}$$

$$n = \frac{9621(2*0.93)^2}{9621*0.17^2 + (2*0.93)^2} \Rightarrow n \approx 120$$

Table 2. Survey items and Cronbach's Alpha coefficients.

Var		Items	*Mean*	*SD*	Ref
Environmental values		BV: Biospheric Values (α= 0.74)			
	1	Human survival is interconnected with the existence of healthy natural resources; thus, its conservation is required prior to any action.	5.30	1.05	1
	2	Environmental protection and reclamation has priority to agriculture.	4.97	1.15	1
	3	We should not contaminate the environment and natural resources, such as soil, by excessive use of chemical fertilizers.	4.54	1.55	2
	4	Farmers should not embark on environmental degradation for the sake of an increase in products and crops.	4.32	1.90	1
		AV: Altruistic Values (α= 0.71)			
	1	All the people are involved in the environment and natural resources, so, we should not ruin it by our behavior.	5.29	1.31	1
	2	We should not allow pollution to spread from our farms to other farms so that other farmers will not face difficulty.	4.81	1.73	2
	3	Since human beings are superior to other creatures, attention to humans is more important than the maintenance of other animals and plant species.	4.27	1.76	1
	4	Increasing agricultural activities to supply food for human is more important than my personal interests and maintenance of the environment.	3.30	1.66	2
		EV: Egoistic Values (α= 0.77)			
	1	Natural Resources Department is solely responsible for solving my problem and achieving my benefits and interests.	3.69	1.76	1
	2	In today's economic conditions, I cannot think of the environment or collective benefits.	2.90	1.56	1
	3	The increase of my income and product is more important than the environment and other people.	2.72	1.65	1
	4	Farmers must pay attention to their own farms and the other farms are not of their concern.	2.53	1.62	2
Soil conservation behavior		SCB: Soil Conservation Behavior (α= 0.67)			
	1	I use pesticides just as instructed to combat diseases and pests.	5.03	1.05	2
	2	Given the need for crop cultivation, I try to plow my land with proper depth and at the right time.	4.74	1.17	2
	3	I prefer the use of organic and green fertilizers to chemical fertilizers.	3.64	1.64	3
	4	If the farmland is steep, I use conservation tillage.	3.54	1.68	3
	5	I use biological control to prevent pests.	3.39	1.81	2
	6	After harvest, I do not burn the crop residues (straw) that have been left on the farm.	3.17	1.69	3
	7	I use soil test to determine the crops fertilizer requirement	2.88	1.64	2
	8	I refuse cultivation of root and tuber crops (such as potatoes, carrots, etc.) as the second crop on the farm.	3.22	1.85	2
	9	I collect the empty containers of pesticides after usage and deliver them to recycling operators.	3.13	1.87	4
	10	After the harvest, I cultivate dicotyledonous (pea, bean, broad bean, etc.).	2.43	1.55	2
	11	I do not throw away my household waste on the farm or in the surrounding.	3.09	2.18	2
	12	I do not use wastewater drainage for irrigation.	2.66	1.88	2
Environmental consciousness		Attitude towards soil conservation (α= 0.90)			
	1	Nature must be protected because it is the symbol of the existence of God.	5.71	0.50	2
	2	Future generations have the right to enjoy the environment; thus, it must be protected.	5.57	0.75	2
	3	Human is part of the environment, so, its protection leads to human survival.	5.57	0.62	2
	4	Farmers should pay attention to the conservation of natural resources, such as water and soil in their fields while using them.	5.48	0.67	2
	5	All creatures such as animals and plants have the right to live.	5.33	0.92	2
		Soil conservation concern (α= 0.90)			
	1	Littering around the farms always makes me concerned about my family's health.	5.23	1	2
	2	Excessive tillage operations for crop cultivation and loss of soil fertility are highly worrisome to me.	4.85	1.08	2
	3	In most cases, I ask about the permissible level of pesticides use before using them in order not to pollute the environment.	5.09	1.23	2
	4	In most cases, the burning of crop residue by farmers makes me concerned about the environment and people's health.	4.89	1.26	2
	5	I am concerned that the use of chemical fertilizers in my agricultural field will lead to the salinity of the soil.	5.22	1.52	2
Perceived social pressure		Perceived social pressure towards soil conservation (α= 0.90)			
	1	Religious leaders recommend environmental protection as a divine matter.	4.68	1.53	2
	2	Majority of the villagers show sensitivity to the farmers' maintenance of the health of the farms around the village.	4.16	1.44	2
	3	If I dispose of the pesticides containers around the farm, I will be criticized by other farmers.	3.97	1.65	2
	4	Agricultural experts always recommend using organic and green fertilizers.	3.52	1.59	2
	5	According to my wife and children, I do not burn the crop residue after harvest.	3.67	1.70	2

References: 1. Bijani and Hayati (2013); 2. Researcher administrated; 3. Azizi Khalkheili *et al*. (2012); 4. Salehi and Imam Gholi (2012)

During the questionnaire design, a six-point Likert scale was employed for designing of the items pertaining to the dependent variable (soil conservation behavior) and a number of independent variables [never (1), very low (2), low (3), medium (4), high (5), and very high (6)]. Farmers' soil conservation behavior was defined as "the behaviors that farmers demonstrate consciously to reduce the negative impacts of their actions on soil". A number of the items of this variable were obtained from the studies carried out by Salehi and Imam Gholi (2012) and Azizi Khalkheili *et al*. (2012); however, some modifications were made in them to comply with the current study. Some of the items were also self-developed (researcher-administered) and were designed by the research team (Table 2).

The independent variables in this study included the triple environmental values (biospheric, altruistic, egoistic values), perceived social pressure in the field of soil conservation behavior, and environmental consciousness. The guidelines mentioned in Kollmuss and Agyeman's study (2002) were used to design the items of the variable of social pressures on soil conservation behavior and environmental consciousness; however, the final design of the items was performed by the research team. Environmental consciousness in this study consisted of two parts or components, namely, attitude towards soil conservation and concerns about soil conservation. Ajzen (1991) has defined the variable of attitude as "the extent to which an individual assesses a behavior to be favorable or unfavorable". Accordingly, the present study defines the variable of attitude towards soil conservation as "the extent to which farmers find soil conservation favorable or unfavorable". This definition has been inspired by the definition proposed by Ajzen. The variable of social concern was defined as "the level of farmers' sensitivity to and preoccupation with soil conservation". Furthermore, the variable of social pressure was defined as "the extent to which farmers behaviors in the field of soil conservation are influenced by the people around them". This definition was also inspired by the explanation provided by Kollmuss and Agyeman (2002).

The variables of triple values were extracted from Value-Belief-Norm (VBN) Theory (Stern, 2000). The value-based statements and arguments mentioned in Bijani and Hayati's study (2013) were used for designing or operationalizing the items. Some items were also researcher-constructed (Table 2).

RESULTS AND DISCUSSION

The descriptive analysis of the data showed that the respondents' age ranged between 19 and 86 years, with a mean age of 46.59 years (SD= 11.95). From among the 120 respondents, 108 individuals (90%) were men and 12 participants (10%) were women. The distribution of farmers in terms of agricultural working experience showed that this variable ranged from the minimum of two years to the maximum of 65 years, with a mean of 21.76 years (SD= 10.50). Farmers' "education level" was another demographic variable examined in this study. The pertaining results indicated that high school education degree had the highest frequency among respondents. Moreover, the farmers were also evaluated in terms of their attendance or absence in extension education classes related to soil conservation practices. These findings showed that 90 farmers (75%) did not have the experience of participation in extension classes pertaining to soil conservation behavior and only 29 farmers (24.2%) had participated in such classes.

Relationships between the Variables

Pearson correlation coefficients were used to investigate the relations between the variables (Table 3). Relevant previous studies (Stern and Dietz, 1994; Stern, 2000; Ives and Kendal, 2014) had placed emphasis

on the indirect effect of pro-environmental values on people's behavior. Accordingly, this study indirectly correlated pro-environmental values with soil conservation behavior through environmental consciousness and perceived social pressure (Figure 1). As it was expected, egoistic values had a significant negative correlation with the farmers' environmental consciousness (r= -0.394; P< 0.01). This finding is supported by other studies conducted by researchers, such as Rokeach (1973) and Ives and Kendal (2014). Data analysis also revealed the existence of a significant positive correlation between biospheric values and environmental consciousness at the level of one percent error (r= 0.358; P< 0.01). In the same way, altruistic values also had a significant positive correlation with environmental consciousness (r= 0.493; P< 0.01).

Moreover, it was assumed that pro-environmental values would also influence farmers' soil conservation behavior with the mediating role of another variable called "perceived social pressure". Accordingly, in the second stage of the analysis, the correlations between values and perceived social pressure were assessed. The results showed that biospheric and altruistic values had significant positive correlations with soil conservation behavior (r= 0.337; P< 0.01; r= 0.352; P< 0.01). However, egoistic values did not show any significant positive correlation with perceived social pressure in terms of soil conservation behavior (r= 0.168, non-significant). Among the independent variables that directly and

indirectly affected farmers' soil conservation behavior, environmental consciousness had the highest correlation value (r= 0.526; P< 0.01). In addition, perceived social pressure had also a significant positive correlation with soil conservation behavior (r= 0.442; P< 0.01).

The two variables of environmental consciousness and perceived social pressure were positively correlated with soil conservation behavior. This is so while the theoretical framework of the research had led one to assume that the two above-mentioned variables directly affect farmers' soil conservation behavior. This result indicates that farmers' soil conservation behavior will be enhanced and become more desirable with the increase of environmental consciousness and perceived social pressure and vice versa. The correlation between perceived social pressure and soil conservation behavior is supported by other research findings (Kollmuss and Agyeman, 2002).

Causal Analysis

The results of ENTER regression analysis showed that the causal model of the research accounted for 38.6% of the variance of soil conservation behavior, 38.1% of the variance of environmental consciousness, and 18.7% of the variance of perceived social pressure (Table 4 and Figure 2). In order to simplify the process of path analysis, the theoretical framework of the research was first divided into three distinct

Table 3. Correlation matrix of the theoretical framework variables.

	SCB	BV	AV	EV	PSP	EC
SCB	1					
BV	0.255[**]	1				
AV	0.248[**]	0.177	1			
EV	-0.196[*]	-0.190[*]	-0.126	1		
PSP	0.442[**]	0.337[**]	0.352[**]	-0.168	1	
EC	0.526[**]	0.358[**]	0.493[**]	-0.394[**]	0.218[**]	1

AV: Altruistic Values	EC: Environmental Consciousness	[*] Sig level: 0.05 error
BV: Biospheric Values	PSP: Perceived Social Pressure	[**] Sig level: 0.01 error
EV: Egoistic Values	SCB: Soil Conservation Behavior	

parts. In the next stage, regression analysis (ENTER method) was used to carry out the causal analysis. In the first stage of the causal analysis, the environmental effects of triple values on environmental consciousness were evaluated. The findings of this stage indicated that biospheric (β= 0.226; P< 0.005), altruistic (β= 0.419; P< 0.001), and egoistic values (β= -0.272; P<

0.001) had significant effects on environmental consciousness. In the meantime, the effect of egoistic values on environmental consciousness was negative.

In the second stage of the causal analysis, the effects of triple values on perceived social pressure were evaluated. The results of this stage were to some extent similar to those of the first stage, because the two variables of biospheric

Table 4. Calculation of direct effects on soil conservation behavior, environmental consciousness, and social pressure.

	Independent variables	B	Beta (β)	t	Sig t	Std Error
Direct effects on the *PSP*	Constant	10.19	---	3.26	0.001	3.12
	BV	0.365	0.280	3.10	0.002	0.118
	AV	0.375	0.301	3.37	0.001	0.111
	EV	-0.062	-0.045	-0.50	0.618	0.124
	Sig F= 0.001	F= 9.21	R^2_{Adj}= 0.187	R^2= 0.210	R= 0.458	
Direct effects on the *EC*	Constant	22.84	---	5.37	0.001	4.61
	BV	0.490	0.226	2.83	0.005	0.173
	AV	0.874	0.419	5.32	0.001	0.164
	EV	0.629	-0.272	-3.43	0.001	0.183
	Sig F= 0.001	F= 22.50	R^2_{Adj}= 0.381	R^2= 0.398	R= 0.631	
Direct effects on the *SCB*	Constant	12.65	---	3.59	0.001	3.52
	EC	0.456	0.449	5.77	0.001	0.079
	SCB	0.615	0.356	4.58	0.001	0.134
	Sig F= 0.001	F= 34.62	R^2_{Adj}= 0.386	R^2= 0.397	R= 0.630	

AV: Altruistic Values   *EC*: Environmental Consciousness
BV: Biospheric Values   *PSP*: Perceived Social Pressure
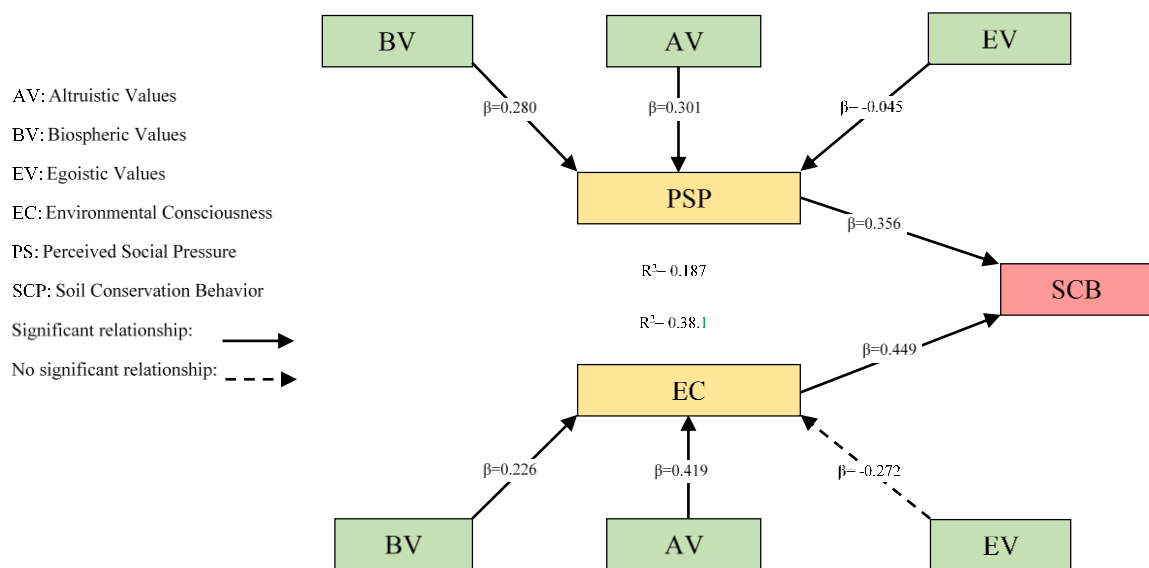*EV*: Egoistic Values   *SCB*: Soil Conservation Behavior

AV: Altruistic Values
BV: Biospheric Values
EV: Egoistic Values
EC: Environmental Consciousness
PS: Perceived Social Pressure
SCP: Soil Conservation Behavior
Significant relationship: →
No significant relationship: ⇢

Figure 2. Causal analysis model derived from the path analysis.

(β= 0.280; P< 0.002) and altruistic values (β= 0.301; P< 0.001) had significant positive effects on perceived social pressure with regard to soil conservation behavior. The only difference of this stage with the previous stage of the causal analysis was that the effect of egoistic values on perceived social pressure was not significant (r= -0.045; P> 0.05). The results of this section suggested that the standardized effect of altruistic values was higher than the other two values.

The third stage of causal analysis included the analysis of the effects of environmental consciousness and perceived social pressure on soil conservation behavior. The results of this stage showed that environmental consciousness (β= 0.449; P< 0.001) and perceived social pressure (β= 0.356; P< 0.001) positively and significantly influenced farmers' soil conservation behavior. Looking at the path coefficients (β) reveals that environmental consciousness benefits from a higher ability in explaining the variance of soil conservation behavior.

Analysis of Direct, Indirect, Causal, Non-Causal Effects on Soil Conservation Behavior

It was also attempted to explain the results of analyzing direct, indirect, causal, non-causal effects of independent variables on soil conservation behavior in order to better understand the causal relationships of variables (Table 5). This helps to understand the relation between correlational coefficients and regression coefficients. At this stage, the correlation coefficients were used to calculate non-causal effects. It should be noted that the sum of causal (total)

and non-causal effects of an independent variable on dependent variable is equal to the correlation value of these variables. Considering that the calculation of the non-causal effects using the software programs was impossible, correlation coefficients and total effects (obtained from the software programs and reported in Tables 3 and 4) applied to calculate the non-causal effects. To calculate indirect effects, the path coefficients were multiplied by each other. Total (causal) effects were the sum of indirect and direct effects.

Evaluation of the indirect effects of the variables showed that biospheric values [(0.226×0.449) + (0.280×0.356)= 0.20], altruistic values [(0.419×0.449) + (0.301×0.356)= 0.295], and egoistic values [(-0.272×0.449) + (-0.045×0.356) = -0.138] had significant indirect effects on farmers' soil conservation behavior. Additionally, the effects of biospheric and altruistic values on soil conservation behavior were positive, while the indirect effects of the egoistic values on soil conservation behavior were negative.

The results of this stage of the analysis showed that environmental consciousness (0.449) and perceived social pressure (0.356) had the highest share in total effects towards soil conservation behavior.

The final stage of the correlation analyses within the research framework pertained to the calculation of non-causal effects. The results of this stage indicated that the variables of perceived social pressure (0.442-0.356= 0.086) and perceived environmental consciousness (0.526-0.449= 0.077) had the highest value of non-causal

Table 5. Analysis of direct, indirect, causal, and non-causal effects of the variables on Soil Conservation Behavior (SCB).

No	Variables	Direct effects	Indirect effects	Total effects	Total non-causal effects	*P*-values
1	BV	---	0.200	0.200	0.055	0.006
2	AV	---	0.295	0.295	-.0.047	0.002
3	EV	---	-0.138	-0.138	-0.058	0.01
4	PSP	0.356	---	0.356	0.086	0.001
5	EC	0.449	---	0.449	0.077	0.001

AV: Altruistic Values   EV: Egoistic Values   PSP: Perceived Social Pressure
BV: Biospheric Values   EC: Environmental Consciousness   SCB: Soil Conservation Behavior

effects. The high level of these effects suggests that some variables may have a mediating role in the relationship between these two variables (Mansourfar, 2013; Ebrahimi Sarcheshmeh *et al.,* 2018).

Policy Implications

Present study provides the following managerial recommendations and policies in the field of psychosocial behaviors and dimensions of farmers' soil conservation behavior based on the findings and logics derived from the data and results: The results of this study showed that environmental consciousness had the highest impact (standardized effect) on farmers' soil conservation behavior. Accordingly, it is recommended that farmers' concerns about the consequences of degradation of soil resources and their attitudes towards soil conservation be improved by soil conservation planners. In order to increase farmers' environmental consciousness, soil conservation planners can implement educational courses on soil conservation strategies. The results showed that perceived social pressure by farmers had a significant impact on their soil conservation behavior. This result means that farmers' soil conservation behaviors are contingent upon their atmosphere and (or) social environment as well as the behavior and attitudes of the individuals around them. From this perspective, it is necessary to reinforce and strengthen the policies of interventionist organizations with respect to the practice of those strategies that value the importance of establishing and maintaining farmers' social environments. The Agricultural Extension is one of the interventionist organizations that can direct social learning processes in the farmers' social environments in order to conserve natural resources such as soil and water. This will be feasible through execution of a range of activities and efforts. The results of the causal analysis and correlation analysis revealed that the triple values (biospheric, altruistic, and egoistic)

had a good ability to predict environmental consciousness and had considerable effects on farmers' soil conservation behavior. Accordingly, paying attention and identifying "diversity of values" among farmers can be one of the future policies of the governmental bodies (like Ministry of Agriculture Jihad and Department of Environment) in the study area. Considering and identifying these values can be very useful in taking managerial decisions and planning for the management of agricultural ecosystems (soil is also an integral part of it). Implementing this recommendation can be a turning point for the attraction of the authorities' attention to the values and ideas existing in the agricultural community. The managers of agricultural ecosystems and natural resources (especially soil) should attend to the values of different stakeholders of agricultural ecosystems in addition to the environmental values of the agricultural community. The awareness of the values of these stakeholders can help managers to increase their own prediction and conflict management power. For instance, in some cases, it is necessary to eliminate some organisms in the soil of a region to maintain the health of agricultural ecosystems. On the other hand, it is possible that people with biospheric values strongly react to this happening. In this case, the awareness of values of different stakeholders (such as farmers or the groups who disagree with it and hold opposite values) will empower agricultural ecosystem managers to build trust and make necessary clarifications before entering the operational phase. In this way, the possible conflicts among stakeholders will disappear. The findings obtained from the analysis of indirect effects on soil conservation behavior showed that altruistic and biospheric values had the strongest effect on soil conservation behavior among the triple values. This suggests that the managers and organizations responsible for the conservation of natural resources in the research region should make higher investment in institutionalization and promotion of altruistic and biospheric

values. These values firstly lead to the production of more favorable soil conservation behaviors on part of farmers and, secondly, lay the groundwork for the participation of farmers in soil conservation programs and activities unlike the egoistic values. The findings revealed that farmers' social environment (perceived social pressure) had significant impact on their soil conservation behavior. Institutions such as Agricultural Extension can lay the groundwork for strengthening soil conservation behaviors practices by using the planned interventions in farmers' organizations and by establishing appropriate social environments. Considering the finding derived from the effects of altruistic and biospheric values on perceived social pressure and soil conservation behavior, decision-makers, planners, and executive officers of agricultural extension should attempt to spread and develop altruistic and biospheric values in farmers' social environments and organizations.

CONCLUSIONS

One of the original contributions of this study was that the framework used in this study led to the development and growth of the understanding about the complex interactions existing between the cognitive-behavioral variables of soil conservation behavior. Furthermore, special attention should be paid to the behavioral and socio-cognitive dimensions of soil conservation behavior in addition to technical aspects. In this regard, the social and psychological model of this research can be helpful and useful and can act as a guide for managers in this field. Based on the results and discussions, increasing social pressures of soil conservation, environmental consciousness, and altruistic/egoistic values by means of educational and intervention programs is one of the best strategies to increase farmers' soil conservation practices

that can be considered by managers and decision-makers of soil conservation projects.

This study had also some limitations. The first limitation is that there was no definitive claim about the effect of the variables used in this research in all fields and agricultural environments. Therefore, future research can evaluate the other psychological and social variables in parallel with the circumstances and features of specific areas. The second limitation concerned the relatively small sample size and the generalizability of the results. Thus, replicating this study with larger sample size could give higher power of generalizability to this study. The third limitation of this study was related to the variables included in the analysis. This study just used a mixture of the variables of Kollmuss and Agyeman's Pro-Environmental Behavior Model and the triple values in Stern's Value-Belief-Norm Theory to analyze farmers' soil conservation behavior. However, future studies definitely can apply other independent variables and/or theories to analyze soil conservation behavior. The fourth limitation of this study was that multiple regression analysis using SPSS software was applied to analyze the effects of independent variables on soil conservation behavior. However, it seems that Structural Equation Modeling (SEM) using LISREL and AMOS programs can generate more plausible results about the interconnections of the variables. Therefore, this issue can be addressed in future studies. Finally, it should be noted that unavailability of a set of reference data about the main socio-demographics of population was another limitation of this study.

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پیش‌بینی و درک رفتار حفاظت خاک کشاورزان در استان مازندران، ایران

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چکیده

ایران به عنوان یک کشور آسیب‌پذیر از نظر فرسایش و تخریب منابع خاکی محسوب شود. یکی از راه‌حل‌هایی که در سال‌های اخیر برای حل این بحران مطرح گردیده، این است که در برنامه‌های توسعه کشاورزی باید علاوه بر ابعاد فنی، به زمینه‌های رفتاری، شناختی و اجتماعی حفاظت خاک نیز توجه ویژه‌ای مبذول شود. در این راستا، پژوهشی با روش توصیفی ـ همبستگی و علّی ـ رابطه‌ای انجام شد تا مهم‌ترین متغیرهای اثرگذار بر رفتار حفاظت خاک کشاورزان و جامعه کشاورزی ایران شناسایی شود. برای این منظور، یک نمونه ۱۲۰ نفری از کشاورزان استان مازندران در ایران با استفاده از روش نمونه‌گیری تصادفی طبقه‌ای با انتساب متناسب انتخاب گردید. یافته‌ها نشان داد که متغیرهای هوشیاری محیط‌زیستی، ارزش‌های محیط‌زیستی و

فشارهای اجتماعی در زمینه حفاظت خاک تأثیر قابل‌توجهی در پیش‌بینی رفتار حفاظت خاک کشاورزان دارند. در نهایت با بهره‌گیری از نتایج و بینش‌های حاصل‌شده از این پژوهش، شش پیشنهاد کاربردی در راستای مدیریت بهتر منابع خاک کشاورزی برای مدیران و سیاست‌گذاران ارائه شده است که بکارگیری هر کدام از آنها می‌تواند نقطه عطفی در بهبود وضعیت کشاورزی ایران به صورت عام و منابع خاک به صورت خاص باشد.