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ATTITUDES OF BULGARIAN FARMERS FOR ADOPTING ECO-INNOVATIONS

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Abstract

With the growing needs of society for food safety and quality, as well as habitat protection, soil and water quality improvement, the role of eco-innovations in agriculture can be considered to provide ecosystem services and environmental protection. The attention paid by institutions to food safety and quality encourages innovative solutions. The aim of this paper is to present the attitudes of farmers to implement eco-innovative solutions such as organic farming and agri-environmental practices. A survey was conducted among 64 organic farmers dealing with perennial crops, pastures, and beekeeping in Bulgaria. The data from the survey was used to build logistic regression to analyze the factors affecting the decisions to implement eco-innovative solutions. The results reveal that three most important factors affect willingness to adopt eco-innovations are: positive perception of the impact of eco-innovation on environment quality, positive change in income as a result of organic farming, and adequate state policy and regulation of the agricultural sector.

Key words**:** *eco-innovation, organic farming, ecosystem services*

INTRODUCTION

Eco-innovations in agriculture are processes, products, services, methods (biological), practices (agri-environmental) that are new to agriculture and through which the environment is protected, and a more responsible and efficient use of resources is achieved. The introduction of eco-innovation is a way to promote the provision of agro-ecosystem services (Fig.1). The introduction of eco-innovation on farms poses many theoretical and practical questions, including: (1) what are the factors that form farmers' attitudes for implementing eco-innovations, (2) how eco-innovations affects the development of their farm (including changes in the value of land, change in production costs, total income, etc.), and (3) how and in what way these changes affect the ecosystem services provision.

Increasing social and political pressures to tackle climate change and protect the environment also affect the "greening" of agriculture, including the promotion of agri-environmental practices and organic farming as transition to sustainable agriculture, diversification and multifunctionality of farms.

Agroecology is one of the most successful ways of transitioning to sustainable agriculture [3, 4, 14, 10]. The term agri-environmental innovation is increasingly being used in the scientific literature [13].

The application of agri-environmental practices is considered by some authors even as a socially responsible innovation, not just eco-innovation [8], as it addresses issues related to food security, rural poverty, climate change and their impact on supply for food.

On the other hand, the valuation of public goods and the provision of a market for their realization can be achieved by increasing the share of organic farming. Some studies show that even if the size of tangible agro-ecosystem services in terms of yields is lower in organic farming compared to conventional farming, the balance of all ecosystem services is better in organically managed agro-ecosystems [15]. Therefore, in addition to agri-environmental practices and schemes, organic production is one of the ways to provide agro-ecosystem services.

Innovation in agriculture may depend on a wide range of determinants related to the

characteristics of innovation (attributes), the structure of the farm and the attitude of the farmer.

Increasing consumer concerns about food safety and environmental impact lead to agricultural innovation being linked to greener production technologies.

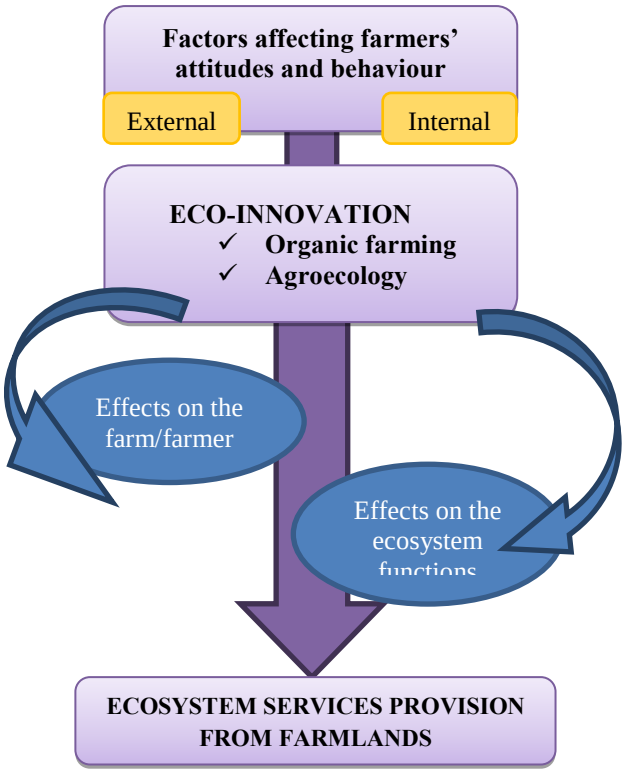

Fig.1. The connection between adoption of eco-innovation and provision of ecosystem services
Source: Own representations.

Economic variables have traditionally been considered in studies on the implementation of agri-environmental practices, revealing flexibility in investment management and the ability to expand and diversify activities [2]. However, the strong individual heterogeneity of farmers suggests that individual attitudes and preferences also play an important role, although they are less likely to be included in empirical research.

Some authors see the process of adoption of a practice as a process based on complex theoretical models [5]. Research on the introduction of agricultural practices is referred to the Rogers' theory of diffusion of innovation. Some authors report [6, 9], that measures aimed at environmental protection are far too different than those for commercial goals. The reason for that is the fact that environmental measures bring benefits to society, making them public goods in the most general sense, and putting the benefits to the individual at a second place. Moreover, environmental practices have long-term societal benefits, as opposed to short-term goals for maximization of the benefits for the individual farmer.

Some researchers have focused on examining attitudes toward implementing a measure in terms of farmers' individual utility, while others have found [11, 1, 13], that maximizing benefits may not be the only factor and that other factors might be relevant.

Using only economic factors for explaining farmers' motivation to adopt eco-innovations fail to explain the heterogeneity of farmers' preferences. Thus, several other factors can influence the decision to implement an eco-innovative practice.

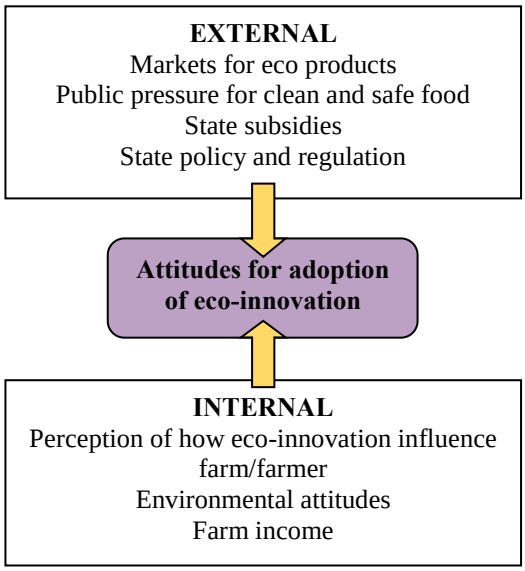

Fig. 2. External and internal factors on attitudes for eco-innovations
Source: Own representations.

Based on the theoretical overview, several characteristics and factors can be grouped that affect the attitude of farmers for implementing eco-innovations (Fig. 2).

MATERIALS AND METHODS

The method of structured interview was chosen to gather the information needed to analyze the attitudes of farmers to implement

eco-innovation to provide agro-ecosystem services. For the purposes of the present study, the focus is put on organic farmers. A questionnaire with 23 questions was prepared. The survey was conducted in September-November 2020. The main objective is to assess how the implementation of an eco-innovation (such as organic farming) affects the farm, as well as to assess the barriers or drivers that encourage or dissuade the farmer from this activity. To cover the various agro-ecosystem services, three main areas have been selected: perennial lands, apiaries, and pastures. The survey was conducted with 64 farmers.

The connection between change in income from biological activity as an eco-innovation and the attitudes toward the environment was assessed using Chi square with one factor variable - change in income from organic farming. Then, logistic regression was used to assess the factors affecting farmers' willingness to adopt eco-innovative practices such as agroecology and organic farming. For analyzing the factors affecting implementation of eco-innovative practices, participation equals 1, non-participation equals 0. Correlation analysis was also performed to check if the independent variables have poor correlation with each other [7]. The performance of the correlation matrix and analysis will provide a statistical stability of the model. After that, a forward regression is used, where the independent variables with the highest significant impact are included in the model. All calculations are performed in the statistical program SPSS.

RESULTS AND DISCUSSIONS

Connection between income and environmental attitudes

The attitude towards the environment is a subjective factor that can influence the future behavior of the farmer. It is assumed that the positive economic result of involvement in eco-innovative activities such as organic farming or agroecology would create a positive attitude of farmers towards environmental protection.

As farmers are driven mostly by the economic performance of new practices/production methods, one of the factors to influence the adoption of environmental activities is to secure a positive change in farmers' income. Although, studies have shown examples where farmers behaved as environmental stewards of the land rather than striving for higher economic results, it is believed that examples like these are rather the exception not the rule.

To test this assumption, the strength of the relationship between the attitudes towards the protection of environment on one hand, and the positive change in the income from organic farming on the other, are analyzed. To analyze this relationship, Chi square analysis was used with one factor variable – positive change in income from organic farming (Table 1).

Table 1. Relationship results between change in income and environmental attitudes

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	48.301[a]	1	.000		
Continuity Correction[b]	44.661	1	.000		
Likelihood Ratio	55.944	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	47.546	1	.000		
N of Valid Cases	64				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.98.
b. Computed only for a 2x2 table

	Value	Approx. Sig.
Phi	.869	.000
Cramer's V	.869	.000
Contingency Coefficient	.656	.000
Pearson's R	.869	.000[c]
Spearman Correlation	.869	.000[c]
N of Valid Cases	64	

Source: Own calculations.

Cramer's V coefficient is the most suitable for measuring the relationship.

It is assumed that if it is less than 0.3 the relationship is weak; if it is between 0.3 and 0.7 - the relationship is average; if it is above 0.7 the relationship is strong. It is interpreted only if it is statistically significant - the level of significance is <0.05.

A statistically significant relationship was found with the factor variable. All necessary requirements are met including that there should be no theoretical frequencies less than 1 in the cross-table (the minimum theoretical frequency is 8.98> 1). The sample size should be at least 50 respondents (in this study it is 64).

The coefficient is 0.869, which makes the relationship between the positive attitude towards the environment and the positive change in the income from organic farming statistically significant and strong in degree.

Logistic regression: Organic farming and agroecology

To test the factors affecting adoption behavior of farmers for two eco-innovative activities (organic farming & agroecology) logistic regression was performed.

Based on the theoretical assumptions for different factors, as well as following the steps for performing logistic regression, the variables that remain in the regression equation are:

(A) Organic farming:

-Positive perception of the impact of eco-innovation on environmental quality (X1);

-Positive change in income as a result of organic farming (X2);

-State policy and regulation of organic sector (X3).

(B) Agroecology:

-Positive perception of the impact of eco-innovation on environmental quality (X1);

-Positive change in income as a result of agroecology (X2).

The regression equation for both organic farming and agroecology is:

$$Logit(\pi)=Ln(\pi/(1-\pi)) = \beta0+\beta1X1+ \beta2X2\ldots+ \beta nXn$$

where: X1, X2,.....Xn are independent variables, Bo, B1, ...Bn are the parameters of the model.

The data from Table 2 shows that all independent variables are statistically significant.

The value of the exponent of the regression coefficient Exp (B) shows the increase in the chance of adopting organic farming as eco-innovation.

Table 2. Logistic regression organic farming

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
X1	3.317	1.485	4.990	1	.025	27.570
X3	3.379	1.721	3.854	1	.046	29.349
X2	3.047	1.484	4.213	1	.040	21.043
Constant	-14.113	4.141	11.613	1	.001	.000

Source: Own calculations.

If the farmer believes that the effect of eco-innovation on the environment is positive, there is a 27.57 chance to adopt organic farming. Similarly, a positive assessment of government policy on the organic sector increases the chance of implementing organic farming by 29.34, and a positive change in income increases the chance by 21.04.

If the income from organic farming has changed positively (increased), if eco-innovation has a positive impact on the environment, and if the respondent believes that the state policy promotes organic farming, the chance that the farmer has the motivation to engage in organic farming increases significantly. The results for all three independent variables confirm the initial assumptions about their influence on the resultant variable.

Table 3. Logistic regression agroecology

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
X1	2.179	.862	6.395	1	.011	8.840
X2	1.719	.724	5.633	1	.018	5.579
Constant	-4.606	1.318	12.211	1	.000	.010

Source: Own calculations.

Calculations show that all independent variables are statistically significant (Table 3) regarding agroecology regression model. The value of the exponent of the regression coefficient Exp (B) shows that if the farmer

believes that the there is a positive impact of eco-innovative practices such as agroecology on farm income then there is 5.58 chance to implement agri-environmental practices. Similarly, if the effect of eco-innovation on the environment is positive, then the chance of implementing agri-environmental practices is 8.84. The interpretation of the variables gives us reason to say that if eco-innovation has had a positive impact on the environment and income, then the chance that the owner will be motivated to engage in the implementation of agri-environmental practices increases significantly

CONCLUSIONS

The goal of this report was to present the factors affecting farmers' willingness to implement eco-innovations like organic farming and agroecology. For this purpose, two types of analysis were performed. First, the connection between the positive change in income from organic farming and the environmental attitudes was tested. It was assumed that farmers who have experienced positive economic result from organic farming would be more inclined to have a positive attitude towards environmental protection overall. The result of the Chi square analysis showed strong relationship between these two variables.

The logistic regressions for both organic farming and agroecology showed that farmers' perception about the positive effect of eco-innovations on income and environment are factors that will increase their willingness to adopt such activities. For organic farming a third factor in the regression equation was the state policy and regulation of the organic sector. One of the main factors that are a barrier to eco-innovation is the constantly changing regulatory requirements and uncertainty in state support for organic production in Bulgaria. Therefore, it is not a surprise to see this factor here. The state support is still a key factor in promoting eco-innovation in agriculture, including organic farming. Unlike agri-environmental practices, organic farming as an agricultural model combines the economic benefits for the farmer with the environmental and social benefits. Organic farming is a sector that in Bulgaria is still heavily dependent on state support, due to less developed markets for organic products and the specifics of the purchasing power of Bulgarian citizens. Overall, increasing societal concerns about environmental pressures from agricultural activity together with increasing support from state agencies (financial, technical, expert consultations, etc.) can lead to increasing interest within farmers to adopt eco-innovations.

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