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Factors Affecting the Adoption of Organic Farming in Peshawar-Pakistan

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Abstract

This study was conducted to investigate the factors affecting the adoption of organic farming in Peshawar-Pakistan. A total of 100 respondents were randomly selected from the four different cultivated areas of Peshawar, namely Palosi, Regi, Ternab and Pushtakhara. Binary logistic regression was used in this study to categorize the organic farming into adoption and non-adoption. The purpose of this model was to check the event probability for a categorical response variable with two outcomes. The results of the binary logistic show that factors affecting adoption of organic farming have a significant effect on the farmer productivity. Moreover, cost, productivity, profitability, compatibility and efficiency have a positive and significant effect. Thus, it is obvious that adopting organic farming not only to increase the farmer income but also to protect environmental pollution by avoiding the toxic chemical and fertilizer. Finally, we suggest that government agencies, extension and research institution should play a vital role to strengthen the awareness and advantages of organic farming.

Keywords

Binary Logistic Regression, Logit and Probit, Organic Farming

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1. Introduction

In agriculture, one of the methods is organic farming which protects environment, quality of the food, animal health, natural resources on sustainable bases and is helpful for the social welfare purpose. These objectives support the market and compensate for the internalization of externalities [1]. To ensure the environmental sustainability, organic agriculture is one of the best practices. Basically these practices are very harmless for human health, because they retain the fertility of soils and sustain the ecosystems. It depends upon natural biodiversity and locally adapted improved ecological processes or cycles, rather than genetically altered resources and the use of synthetic inputs [2].

Since the mid-1980s, policy-makers, environmentalists, consumers and farmers have paid significant attention to organic farming and actively involved for the regulation and support of organic sector. To achieve the major goals in organic farming and agricultural policy, a diverse and complex range of policy approaches have been formed and implemented to support this sector. Conversely, there are many particular challenges for policy making and implementation of the policy. These challenges are to maintain the balance between societal and consumer/market goals and to keep the balance between institutional and private stakeholder interests in the organic sector [3]. Today at least in 141 countries produce organic food commercially. Organic agriculture emerged rapidly and was estimated in 2007, and organic food is produced in about 32.2 million hectares globally, managed by more than 1.2 million producers, including smallholders [4].

The countries with the most organic agricultural land are Australia (12 million hectares), Argentina (3.8 million hectares), and the United States (1.9 million hectares). Currently 0.9 percent of the agricultural land of the countries covered by the survey is organic. By region, the highest shares of the total agricultural land are in Oceania (2.9 percent) and in Europe (2.2 percent). In the European Union, 5.4 percent of the farmland is organic. However, some countries reach far higher shares: Falkland Islands: 35.9 percent; Liechtenstein: 27.3 percent; Austria 19.7 percent. In ten countries, more than ten percent of the agricultural land is organic. There has been an increase of the organic agricultural land in Asia, Europe, North America and Oceania. For Asia, after a major drop of organic land in 2010, 0.9 million more hectares were reported. There was also strong growth in Europe, where the area increased by 0.6 million hectares (6 percent). In Latin America the organic land decreased, mainly due to a decrease of organic grazing areas in Argentina. Apart from agricultural land, there are further organic areas, most of these being areas for wild collection. Other areas include aquaculture, forests, and grazing areas on non-agricultural land. They constitute 32.5 million hectares. In total, 69.7 million hectares (agricultural and non-agricultural areas) are organic. There were 1.8 million producers in 2011. Thirty-four percent of the world's organic producers are in Asia, followed by Africa (30%), and Europe (16%). The countries with the most producers are India (547591), Uganda (188625) and Mexico (169570) [5].

Over the past four decades not only incorporation of modern agricultural farming practices, but also the usage of excess amount of chemical inputs have caused losses for the natural habitat balance and soil fertility. Examples of these losses are soil salinization, soil erosion, pollution due to fertilizers and pesticides, decreased groundwater level, genetic erosion. These hazards have initiated ill effects on environment, degrade the food quality, enhance the cost of production, and badly affect the farmer life [6].

Several studies have suggested that the determinants of the adoption of organic production systems should be explained. Various research approaches have been used for this purpose: factors influencing the adoption of organic and inorganic fertilizers in maize and kales by using the logit and probit regression analysis [7]; Factors affecting smallholder farmers' adoption of soil and water conservation practices using the logit and probit model [8]; Adoption and extent of organic vegetable farming using the model of the Logistic Regression [9]; Modeling the adoption of organic horticultural technology by using duration analysis [10]; Factors influencing the adoption of organic farming by the farmers using the correlation [11]; Factors affecting the Adoption of Organic Pepper Farming [12].

The adoption approach which usually relies upon cross-sectional data which is analyzed by means of probability models to assess the likelihood that conversion occurs [13]-[17] have found out the comparison approach that compares organic and conventional farming in various management aspects such as input use, efficiency, productivity, as well as economic results, using basic statistics or profit maximization models, among other methods [18]-[21].

On the basis of in-depth research literature [22]-[26] study in hand have identified the factors associated with the adoption and non-adoption of organic farming.

2. Materials and Methods

2.1. Selection of the Study Area and Sample Size

This study is based on the factors affecting adoption of organic farming in District Peshawar, Pakistan. Four different agricultural areas namely Palosi, Regi, Ternab and Pushtakhara were selected for the purpose that a large number of farmers were involved in these areas. Due to financial and budget constraint the study was restricted to limited number of sample size. A total of 100 respondents were randomly selected by using proportional sampling allocation technique. A well-developed pretested structured questionnaire was formed to collect the primary data from the farmers in the study area. The empirical data was analyzed by using Statistical tools for Social science (SPSS) Version 20. The main of objectives of the paper was to find the fertilizer used adoption or non-adoption of organic farming.

2.2. Modeling Design and Specification

The categorization of firms into "adopters" and "non-adopters" is based on the dichotomous outcome of the adoption decision, which characterizes the dependent variable (Y). Thus, a firm is defined as an "adopter" where Yi = 1 or as a "non-adopter" where Yi = 0 [27]. For this purpose probit and logit analysis are well established approach.

Probit model deals with a choice between two alternatives [28] Thus, the dependent variables in the following Binary logistic model are the adoption of organic = 0 and non-adoption = 1.

2.3. Estimated Model of the Binary Logistic Regression

Binary logistic regression analysis were used in this study to categorize the Organic Farming into adoption and non-adoption. Binary logistic regression is most useful in cases where we want to model the event probability for a categorical response variable with two outcomes. The logistic regression model is a type of generalized linear model that extends the linear regression model by linking the range of real numbers to the range 0 - 1.

$$\pi_i = \frac{1}{1+\mathrm{e}^{-z_i}} \tag{1}$$

where: p_i is the probability that the i^{th} case will adopt an Organic farming and z_i is the value of the unobserved continuous variable for this i^{th} case. The model also assumes that Z is linearly related to the predictors.

Thus,

$$z_i = \alpha + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_n x_n + e_i \tag{2}$$

The term z_i is the i^{th} value of the dependent variable and X_i is i^{th} value of the independent variable. The term e_i is known as the "error" and contains the variability of the dependent variable not explained by the independent variable. Where n is the number of independent variables.

The regression coefficients are estimated through an iterative maximum likelihood method.

2.4. Empirical Model of the Binary Logistic Regression

The following model was used to assess the adoption of organic farming in the study area. Description of the model variables are explained in the **Table 1**.

$$\begin{aligned} Logit(\pi) = {} & \alpha + \beta_1 \mathrm{AGE} + \beta_2 \mathrm{EDU} + \beta_3 \mathrm{EXP} + \beta_4 \mathrm{LTS} + \beta_5 \mathrm{IA} + \beta_6 \mathrm{TCHF} + \beta_7 \mathrm{AEF} \\ & + \beta_8 \mathrm{TV} + \beta_9 \mathrm{COST} + \beta_{10} \mathrm{PRD} + \beta_{11} \mathrm{PRF} + \beta_{12} \mathrm{CPT} + \beta_{13} \mathrm{EFC} + e_i \end{aligned} \tag{3}$$

3. Results and Discussion

3.1. Descriptive Statistics of the Variables Included in the Analysis

After detailed interview from the respondents in the study area results of the descriptive statistics were presented in tabular form (**Table 2**) which showed that age of the respondent mean was computed 2.7 and its Standard Deviation was 0.937 and education mean was 0.37 while Standard Deviation was 0.446. Furthermore, experience of the farmers mean was calculated 1.69 and its Standard Deviation 0.8127 was figures out. Similarly,

Table 1. Description of the model variables.

Dependent Variable		Categories
TFU	Type of Fertilizer used	Organic = 0 Inorganic = 1
	Independent Variables	
AGE	Age of the respondent	Less than 30 years = 1 30 - 40 years = 2 40 - 50 years = 3 50 - 60 years = 4 60 - Above years = 5
EDU	Education od the respondent	Literate = 0 illiterate = 1
EXP	Experience of the farmers	0 - 10 years = 1 10 - 20 years = 2 20 - 30 years = 3 30 - 40 years = 4 40-above = 5
LTS	Land Tenure status of the Farmers	Owner = 1 OwnerCum status = 2 tenants = 3
IA	Irrigation Availability	Whole year = 1 seasonal availability = 2 Rain fed = 3
TCHF	Type of Cheaper/Healthy Fertilizer	Organic = 0 Inorganic = 1
AEF	Adverse effect of fertilizer	Organic = 0 Inorganic = 1
TV	Training or Visit attend by the Respondents	0 - 10 = 1 10 - 20 = 2 20-Above = 3
COST	Cost	High Cost = 1 Equal = 2 Low Cost = 3
PRD	Productivity	Less Productive = 1 Equal = 2 More Productive = 3
PRF	Profitability	Less profitable = 1 Equal = 2 More Profitable = 3
CPT	Compatibility	Incompatible = 1 Equal = 2 More Compatible = 3
EFC	Efficiency	Less efficient = 1 Equal = 2 More Efficient = 3

Table 2. Socio-economic characteristics of respondents.

Variables	Mean	Min.	Max.	Std. Dev.
AGE	2.7	1	5	0.937
EDU	0.73	0	1	0.446
EXP	1.69	1	4	0.8127
LTS	1.75	1	3	0.8333
IA	1.14	1	2	0.3487
TFU	0.73	0	1	0.446
TCHF	0.65	0	0	0.479
AEF	0.46	0	1	0.501
TV	1.68	1	4	0.815
COST	1.97	1	3	0.936
PRD	1.92	1	3	0.849
PRF	1.87	1	3	0.848
CPT	1.9	1	3	0.870
EFC	1.83	1	3	0.853

Source: Field survey-2010.

mean and Standard Deviation land tenure status of the farmers and irrigation availability was 1.75, 0.8333 and 1.14, 0.3487 respectively.

During survey in the research area it was found that type of fertilizer used by farmers mean was 0.73 which shows that large number of farmers have adopted the organic farming. Moreover, Type of Cheaper/Healthy Fertilizer and Adverse effect of fertilizer mean and Standard Deviation was calculated 0.65, 0.479 and 0.46, 0.501 respectively. In addition, training or visit attended by the respondents mean was1.68, and Standard Deviation was estimated 0.815.

The sole objective of the producer is productivity. Mean and Standard Deviation for productivity was calculated 1.92 and 0.849. At last, mean and Standard Deviation for compatibility was figured out 1.9 and 0.870. Besides, mean and Standard Deviation for efficiency was valued 1.83 and 0.853.

3.2. Binary Logistic Regression Analysis of Organic Farming Adoption

Table 3 presents the results of the binary logistic model and describes the main objective of the study to find the important variables that influences farmers' decisions to adopt organic farming. In this model log likelihood ratio was obtained −42.510 and the chi-square statistic for the goodness of fit of the model is 169.01, significant at 1% level. The pseudo R^2 value of the model is 0.45. Thus, the overall model is significant and good fit. The explanatory variables used in the model are collectively explaining the decision of the respondents to adopt Organic farming in the study area.

Table 3 shows that, it was observed that age, education and land tenure status positively affect farmers' valuation regarding adoption of organic farming. Other attributes like land tenure status and irrigation availability also exhibits a positive sign, an indication that for every unit increase of any of the variables, the probability that farmers' valuation towards organic farming also increases by the corresponding estimate.

Table 3. Results of the binary logistic regression.

Variables	Coefficient	Std. Error	Z	Significance
Intercept	−5.911	1.956	−3.02198	0.998
AGE	0.051	1.13	0.045133	0.964
EDU	0.068	0.487	0.13963	0.889
EXP	−0.523	0.338	−1.54734	0.939
LTS	1.253	0.721	1.737864	0.082
IA	−1.06	0.678	−1.56342	0.941
TCHF	1.346	0.885	1.520904	0.128
AEF	0.843	0.43	1.960465	0.049
TV	−0.547	0.216	−2.53241	0.994
COST	1.258	1.387	0.906994	0.364
PRD	1.367	1.374	0.994905	0.749
PRF	−0.234	0.124	−1.8871	0.970
CPT	1.91	1.451	1.316334	0.188
EFC	1.569	1.325	1.184151	0.236
Pseudo R2	0.45			
Log likelihood	−42.510			
Correct Predictions	87.2%			
Observations	100			

Source: Field survey-2010.

Results in **Table 3** shows that farmers' awareness of organic farming has very positive and significant effect. Therefore, it is logical to expect that if a farmer adopt this perception not only have a chance to increase his income also have a chance to protect environmental pollution caused by agro-chemicals. Another study identified four factors like development of knowledge and awareness regarding environmental issues, creation of health awareness, and simplicity of the organic farming technologies (OFTs) and availability of basic production factors as the major influential factors which can increase the extent of practice of OFTs by the farmers [29].

Other important factors on decision of adoption of organic farming that were positively significant included water accessibility, farm-gate price and attitude to conventional production problems. This implies that the early organic adopter may have better access to water, the ability to seek and find higher prices, and have stronger attitudes toward conventional farming problems [30]. Organic farming requires more manual labors than conventional farming; consequently, households with a larger number of family labors are more likely to adopt organic farming. This hypothesis is supported by the findings of [31] and reported that large number of family members able to join on-farm activities enable farmers to adopt a labor intensive technology. Conversely, households with larger numbers of dependent members are more vulnerable to food insecurity; consequently, the number of dependent members shows a negative relation with organic farming adoption.

4. Conclusion

Farmers' perception about the adoption of organic farming plays an influential role in adopting or non-adopting organic farming. Concluding the results, the adoption of organic farming has a positive and significant impact on the farmer life *i.e*. cost, productivity, profitability compatibility and efficiency. Hence, the farmers should motivate and be aware of the advantages of organic farming through extension and research intuitions not only to increase income but also to change their behavior and perception about new technique of the farming. Finally, it is suggested that the adoption of organic farming is essential for famers, and for this purpose comprehensive policy and strategies should be made to aware the farmers from the benefits of organic farming.

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