ECONOMIC INCENTIVES AND ECOLOGICAL AWARENESS: EXPLORING ATTITUDES AND INFLUENCING FACTORS FOR ORGANIC FARMING AMONG SMALLHOLDERS IN PUNJAB, PAKISTAN

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ABSTRACT

Organic agriculture is being pointed out as an alternative to the traditional form of farming and is turning out to be a sustainable source of economic and environmental benefit. This study examines the relationship between economic incentives and environmental awareness and the attitude and adoption of organic farming among smallholders in Punjab, Pakistan. A total of 380 smallholder farmers were sampled using a well-designed questionnaire that was supplemented by 20 in-depth interviews. Descriptive results unveiled that the population consisted largely of males (92.1) and middle aged (44.7% fell within the age group 36-50) and had a moderate education level (28.9% were illiterate) and small parcels of land (39.5% had less than 5 acres under cultivation). Market prices (M = 3.99, SD = 0.92) and government subsidy (M = 3.95, SD = 0.88) were concluded to be the most powerful economic incentives. The ecological awareness was also high and particularly in the domain of enhancing soil fertility (M = 4.02, SD = 0.89) and improving health of reduced chemical use (M = 3.96, SD = 0.91). Correlation analysis revealed that there were significant positive associations between economic motivators, ecological awareness and attitudes (r = 0.482-0.604, p < 0.01). The result of a multiple regression showed that ecological awareness (β = 0.412, p < 0.001), economic incentives (β = 0.367, p < 0.001) and education (β = 0.186, p = 0.001) were the strongest predictors of attitudes (R^2 = 0.479). Logistic regression revealed that the positive impact on the adoption was significant in ecological awareness (OR = 2.50, p < 0.001) and in economic incentives (OR = 2.10, p < 0.001). The findings suggest that the combination of the monetary and ecological education and collaboration are needed to support the sustainable transitions.

Keywords: Organic farming, Economic incentives, Ecological awareness, Adoption attitude, Sustainable agriculture.

1. INTRODUCTION

Among the areas that these policy and academic focus have been directed has been the fact that organic agriculture is among the channels through which productivity and environmental stewardship can be reconciled in agrarian economies. The Indian South Asian organic practices have a potential to be effective because the rural population in South Asia is concentrated and the smallholder farmer is traditionally reliant on synthetic inputs, better soil health, and higher market prices (Willer et al., 2024). An example of the occasion of possibility and restraint of this change is the case of Punjab, Pakistani agricultural center. The province also has an uneven contribution in the national food production yet the province is bearing a greater weight because of the degradation and loss of groundwater in addition to the ecological cost of intensive use of inputs (Government of Pakistan, 2024). The processes of encouraging economic values and environmental awareness should thus be conceived in order to end up with valid and impartial measures.

Organic agriculture does not necessarily imply a lack of artificially created pesticides and fertilisers, but is oriented to systems, which focus on ecological processes, biodiversity and locally adapted cycles (FAO, 2021). Decisions on adoption adopted to the smallholders can never be fully ecological. They swap the perceived benefits, price premiums, savings on outside inputs and long-run soil fertility, with short-run risks, learning expenses, and possible yield penalties in the transformation, and uncertain market access (Feder et al., 1985;

Pannell et al., 2006). It is in Punjab tight landholding system and cash-strained environment that these trade-offs are especially acute. The operating margins of farmers are tiny, and they are vulnerable to transition risks and strongly dependent on the real live and short-term financial measures including subsidies on inputs, guarantees of the output prices or purchases agreements.

Economic incentives may work at any of the points of value chain. Production-side incentives are provided in the form of subsidized bio-inputs, extension services that reduce the costs of information and transactions and availability of credit at conversion periods. Trusted certification services, aggregation logistics and increased price on the marketing end are the methods of mitigating uncertainty and improving the projected profit (Willer et al., 2024). Empirical studies of technology adoption have long indicated that the net present value of the perceived returns, risk-adjusted and liquidity-constrained, is one of predictors of farmer action (Feder et al., 1985; Pannell et al., 2006). Both guaranteed procurement and contract farming were found to act as a buffer to market risk in the example of organic farming, and valid certification results in consumer trust and allows price differentials to be imposed (FAO, 2021). These incentives remain dynamic in Punjab, and they may include individual public-quota alliances and farmer cooperatives to lower their prices and fixed-rate (Government of Pakistan, 2024).

The attitudes and intentions cannot be explained entirely by economic calculus. The behavioral theories ruminate on the importance of the beliefs, social norms and perceived control. According to the Theory of Planned Behavior (TPB), behavioral intentions are determined by attitudes towards the behavior, subjective norms and perceived behavioral control which eventually results in acting (Ajzen, 1991). The attitudes can be affected by ecological knowledge (knowledge of the environmental externalities of the conventional inputs) and the perceived exposure to the damages involved in the ecosystem (soil and water) and moral norms associated with the stewardship of the smallholders, despite the benefits accrued locally (Greiner and Gregg, 2011). The pro-environmental attitudes found would tend to increase with perceived declining soil organic matter, resistance to pests or water pollution and consequently increasing the salience of organic practices. Another factor is the sharing of success or failure stories by the social networks and the opinion leaders who are trusted (progressive farmers, local extension officers, input dealers) that increases or decreases readiness to convert (Rogers, 2003).

Agro-ecological realities of Punjab topicalize the ecological consciousness. Among the factors that have led to environmental strains that are consistent with the world evaluation of the declining biodiversity and ecosystem strains is the long-term utilization of synthetic fertilizers/pesticides in the province (IPBES, 2019). Although the increases in the inputs might save the yields, the declining marginal returns and externalities (soil compaction, the pest resurgence and difficulties in managing the residues) attracted farmers to integrated and organic production. Ecological procedures can be extended into the level of field-level guidance to composting, green manures, bio-pesticide, crop rotations, and so on through extension programs which may be used to transform abstract environmental problems to a practical behavioral control (FAO, 2021). Such programs may be employed to lower perceived risk in the conversion phase when they are combined with demonstration plots and farmer field schools.

Market and institutional contexts mediate both incentives and awareness. In order to receive price premiums, the certification is necessary but; smallholders are expected to pay high unit prices and there are no easy documentation requirements. Participatory guarantee systems and group certification models can be used to break the barriers in particular cases when audits, aggregation, and marketing are arranged by the farmer organizations (Willer et al., 2024). The incentive environment is also formed by the public policy: it may legalise it with targeted conversion assistance, transitional labels and the buying of organic staples on the market and stabilise the quantity of requests (Government of Pakistan, 2024). On the other hand, unintentionally, synthetic input subsidies are distorting relative prices to be a deterrent to adoption, and as such, the adoption of organic practices.

The attitudes of the smallholders are positioned in this paper as part of a complete system where economic drive and environmental awareness have been integrated. It also looks at the association that exists between anticipated profitability, price premium credibility and access to supportive services and environmental beliefs, risk perceptions and social norms of farmers to determine intentions to organic farming. It is rooted in the analysis of the theory of adoption (Feder et al., 1985; Rogers, 2003; Pannell et al., 2006), however, it does not ignore specifics of the institutional and market environment at Punjab. The study will also help in informing the policy makers because most of them, as most of the farm households are mainly the smallholders, will also need policies not only that are environmentally ambitious but also financially viable and acceptable to the society. The study objectives were focused on the research of the following nature.;

1. To examine the economic incentives that influence smallholders' attitudes toward the adoption of organic farming in Punjab, Pakistan.
2. To assess the level of ecological awareness among smallholders and its impact on their perceptions of organic farming.
3. To analyze the interaction between economic incentives and ecological awareness in shaping smallholders' willingness to adopt organic practices.

4   To investigate the role of social, institutional, and informational factors—such as extension services, peer influence, and certification systems—in facilitating or constraining organic farming adoption.

2.   MATERIALS AND METHODS

2.1. Research Design

The research is constructed on the basis of mixed-methodology as quantitative and qualitative data were used to investigate the role of economic incentives and ecological consciousness on the development of the attitudinal position of smallholders to organic farming in Punjab. Quantitative data can possibly give a certain amount of some quantifiable information about the correlation of the variables, and qualitative data can give some background information to learn more about the perceptions of the farmers and their motives (Creswell and Plano Clark, 2017). They have resolved to use the explanatory sequential design, according to which the structured survey will be conducted and the semi-structured interviews will be conducted later to verify and elaborate the findings further.

2.2. Study Area

The present study was conducted in Punjab, Pakistan which covers more than 60 per cent of all the arable land in the nation and is the centre of agriculture (Government of Pakistan, 2024). The Punjab is the appropriate study area because of intense agricultural activities, high consumption of synthetic inputs and new knowledge of organic farming and therefore an acceptable illustration of smallholder decision-making in regard to organic farming.

2.3. Target Population and Sampling

The target population was the smallholder farmers (less than 12.5 acre by the land classification system of Pakistan). It was used the multistage sampling process. To begin with, variation was captured by choosing three agro-ecological zones of Punjab (irrigated, rainfed, and mixed-cropping areas). The zones as well as the villages that had been embracing or exposed to the organic practices was purposely selected and the districts was selected randomly in all the zones. The proposed sample size was 380 respondents; this was the same as the research studies about the adoption (Feder et al., 1985; Pannell et al., 2006). This was sufficiently large to provide statistical power to regression analysis and has been enabled. Also, the quantitative findings (20 intensive interviews of a sample of key informants) of progressive farmers, extension agents and market actors were triangulated.

2.4. Data Collection

A carefully designed questionnaire was employed on a face-to-face approach in order to overcome the barrier of illiteracy. The questionnaire was going to have four sections:

- Socio-demographic (age, education, size of landholding, income, experience of farming).
- Economic incentive (cost of the inputs, availability of credit, availability of market, price premium as perceived).
- Ecological awareness (knowledge and perceptions of soil fertility, water conservation, biodiversity, environmental degradation).
- Organic farming attitude (measured through the Likert scale in the framework of the Theory of Planned Behavior model; Ajzen, 1991).

2.5. Analytical Framework

The analysis was entailing the summary of demographic and farm features in terms of means, frequencies, percentages (descriptive statistics). Patterns of inferences Statistical inferential tests will be made from:

- Correlation tests to determine the relation between economic incentives, ecological awareness and attitudes.
- Several regression equations to compute the significant predictors of attitude to organic farming.
- These include logistic regression that will be implemented to test the adoption probability in the event that it is applicable (Hosmer et al., 2013).

2.6. Validity and Reliability

The questionnaire was checked and piloted by agricultural extension professionals on 20 farmers to make the questionnaire content valid. Evaluation of multi-item constructs was conducted using their internal consistency, which was tested with help of Cronbach alpha 0.729 (Nunnally and Bernstein, 1994). In the case of qualitative data, it was improved through member checking and peer debriefing.

2.7. Ethical Considerations

The research was complied with ethical provisions of social science study. Consciousness to the aim of the study was created among the farmers and informed them that it was voluntary and anonymous. The data was applied only in the academic purposes.

3. RESULTS AND DISCUSSION

3.1. Demographic Characteristics

Table 1 gives a summary of the demographic data of the surveyed smallholder farmers of 380 in Punjab, Pakistan. Findings indicate that, among the total respondents, larger proportion of the total respondents were male (92.1%), and the smaller proportion of total respondents were female (7.9%). This hierarchy is the male-dominated status of rural Pakistan agricultural decision-making where men tend to have access to land, determine farm production, and women tend to be restricted to unpaid household/farm labor (Khan et al., 2019). As has been reported, the same gender inequality is present in South Asian agricultural, where women are restricted by the cultural norms in participating in the official agricultural management in farm decisions (Agarwal, 2018). That was the age distribution, with the greatest number of respondents of 3650 (44.7%), more than 50 years (30.3%), and the youthful ones of 20-35 years (25.0%). This means that smallholder agriculture is controlled by the Punjab middle age farmers. Previous research has found that the middle-aged farmers tend to be more open to new practices than old ones due to the fact that middle-aged farmers can be viewed as both experienced in farming and prone to new practices (Feder et al., 1985; Kassie et al., 2015).

Table 1: Demographic Characteristics of Smallholder Farmers (n = 380)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	350	92.1
	Female	30	7.9
Age (years)	20–35	95	25.0
	36–50	170	44.7
	Above 50	115	30.3
Education Level	No formal education	110	28.9
	Primary (up to grade 5)	95	25.0
	Secondary (grade 6–10)	105	27.6
	Higher (college & above)	70	18.5
Farm Size (acres)	Less than 5	150	39.5
	5 – 10	145	38.2
	10 – 12.5 (upper smallholder)	85	22.3
Farming Experience	Less than 10 years	90	23.7
	10 – 20 years	160	42.1
	More than 20 years	130	34.2
Annual Income (PKR)	Below 300,000	120	31.6
	300,001 – 600,000	155	40.8
	Above 600,000	105	27.6

Education 28.9 percent of the farmers were not formally educated with the rest having primary (25.0%), secondary (27.6), and higher education (18.5%). This tendency coincides with the rural literacy problem in Pakistan where there is weak access to higher education, which limits the process of obtaining and implementing sustainable agriculture-based farming techniques (Ali, 2020). Nevertheless, educational background is positively associated with the ecological awareness and the possibility of leading eco-friendly practices as more educated farmers are willing to perceive the benefits of long-term sustainability (Greiner and Gregg, 2011).

On the issue of size of farms, a significant percentage of the respondents (39.5 and 38.2 percent respectively) possessed less than 5 and 5-10 acres and 22.3 percent possessed 10-12.5 acres. This is in line with the agrarian economy of Pakistan that has smallholder agriculture as the norm and majority of the households belonging to marginal land plots (Government of Pakistan, 2024). Small farm sizes have been identified to limit the economies of scale as well but may support some resource saving and labor-consuming practices like organic farming (Pannell et al., 2006). Farming experience among the respondents was high at 42.1% and 34.2% of 10-20 years and above with over 20 years respectively. Among 23.7 per cent of the respondents less than 10 years of farming experience were found. Long farming tenure may be both counter-cyclical to risk aversion in adoption of technology as well as result in experience in the practice which may cause them to switch to sustainable practice as they are observing a decline in soil productivity and environmental deterioration (Rogers, 2003).

In the context of annual income, majority of the respondents earned between PKR 300,001-600,000 (40.8%), less than PKR 300,000 (31.6%), and above PKR 600,000 (27.6%). This trend of incomes indicates that a big percentage of the smallholders are economically vulnerable because they are inclined to rely on agricultural earnings without engaging in off-farm economic activities. Studies in third-world countries have shown that income level plays a critical role in the uptake of organic farming where better endowed farmers are more likely to bear transition costs and market risks and low-income farmers are more likely to require additional incentives to switch (Willer et al.,

2024). The population portrait gives a picture of a community which is rural (males, middle aged, small-scale farmers) with a modest education and income level. All these influence the absorption of organic farms as it is the way farmers get economic incentives and environment awareness. The findings are in line with the existing body of literature stating that demographic factors, in particular, education, farm size, experience, and income have demonstrated good predictors of smallholder decision-making in sustainable farming (Kassie et al., 2015; Greiner and Gregg, 2011).

3.2. Economic Incentives

Table 2 gives the average of the scores, the standard deviations and the ranks of the economic incentives that influence the attitude of smallholder of adopting organic farming in Punjab, Pakistan.

Table 2: Economic Incentives Influencing Smallholders' Attitudes toward Adoption of Organic Farming (N = 380)

Economic Incentive	Mean Score	SD	Rank
Higher market price for organic produce	3.99	0.92	1
Government subsidies for organic practices	3.95	0.88	2
Reduced input costs (chemical-free methods)	3.82	0.95	3
Access to premium export markets	3.78	0.91	4
Availability of low-interest credit/loans	3.74	0.97	5
Reduced risk through crop insurance schemes	3.67	0.99	6
Support from cooperatives/producer groups	3.63	1.02	7

These results indicate that the potential of increased market prices of organic produce was rated first (Mean = 3.99, SD = 0.92), which showed the propensity of farmers towards profitability as a major motivating force towards adoption. This is in line with Kallas et al. (2010) and Rana and Paul (2017) who point out that premium prices continue to be among the most prevalent incentives to organic farming in the world. The second incentive that mattered the most was the availability of government subsidies (Mean = 3.95, SD = 0.88). This indicates the dependency of the farmers on the institutional support to reduce initial transition costs of the practices of organic farming. Similar results are found in earlier research and are highlighted by Kassie et al. (2015) and Läpple and Kelley (2013), who emphasize that subsidies decrease the associated financial risks and stimulate adoption among resource-constrained smallholders. Both methods that require no chemical use, reduced input costs (Mean = 3.82, SD = 0.95) came in third, indicating that farmers are cognizant of the long-term cost-saving of organic inputs. Similar findings were recently published by Pannell et al. (2006), who also established that reduced reliance on costly chemical fertilizers and pesticides positively affects the adoption choices.

There was a moderate ranking of access to premium export markets (Mean = 3.78, SD = 0.91) and low interest credit/loans (Mean = 3.74, SD = 0.97). These results are indicative of the fact that although export opportunities and credit facilities are appreciated, they are sometimes limited due to poor infrastructure and low institutional support in rural Punjab as reported by FAO (2018) and Ali and Khan (2014). Conversely, low risk due to crop insurance schemes (Mean = 3.67, SD = 0.99) and through cooperatives/ producer groups (Mean = 3.63, SD = 1.02) ranked the lowest. This shows that these mechanisms are understood as less available or not developed locally by farmers. The weak cooperative structures and low insurance coverage are also found by previous researchers to be the significant obstacles to building confidence in organic production among farmers (Willer and Lernoud, 2019; Abebe et al., 2013). Findings indicate that more direct monetary stimuli (price premiums, subsidies, input savings) have greater power than either institutional or collective (insurance, cooperatives) in shaping smallholders attitudes toward organic farming in Punjab. The findings highlight the importance of policy interventions that would integrate both short-term profitability indicators and long-term institutional assistance in improving the organic farming industry.

3.2. Ecological Awareness and Perceptions of Organic Farming

Table 3 presents the level of ecological awareness among smallholder farmers in Punjab and its impact on their perceptions of organic farming.

The results indicate that top ranking practices to improve soil fertility was organic practices (Mean = 4.02, SD = 0.89) implying that farmers strongly related to organic farming as a long-term soil fertility measure. This observation is supported by the conclusions of Reganold and Wachter (2016) who emphasised that organic systems enhance the soil structure, microbial activity and nutrient retention, that in turn result in sustainability and productivity. The second one was the awareness of health benefits of reduced chemical use (Mean = 3.96, SD = 0.91). This highlights the reality that farmers have discovered the negative effects of the use of agrochemicals to the health and food security of the people. Researchers such as Aktar et al. (2009) have reported similar conclusions, besides the alarming rate of alarm raised by rural communities due to the health risks posed by pesticides, which is commonly the catalyst that leads to the fact that pesticides are abandoned in favor of organic practices.

Table 3: Ecological Awareness and Perceptions of Organic Farming among Smallholders (n = 380)

Ecological Awareness Indicator	Mean Score	SD	Rank
Awareness of soil fertility improvement through organic practices	4.02	0.89	1
Understanding of health benefits from reduced chemical use	3.96	0.91	2
Knowledge of biodiversity conservation through organic farming	3.88	0.94	3
Awareness of water conservation and reduced pollution	3.81	0.97	4
Recognition of climate change mitigation benefits	3.77	0.95	5
Perception that organic farming ensures long-term sustainability	3.71	0.99	6
Awareness of risks of chemical pesticide/fertilizer dependency	3.65	1.01	7

Biodiversity conservation (Mean = 3.88, SD = 0.94), awareness of water conservation and reduced pollution (Mean = 3.81, SD = 0.97), also scored highly which shows that the farmers are ecologically aware. Research by Hole et al. (2005) and Seufert, Ramankutty and Foley (2012) confirms that an organic system is associated with biodiversity and reduced water pollution and these acculturation benefits are gaining popularity among smallholders on a global scale. Interestingly, the information about the benefits of the mitigation of the climate change (Mean = 3.77, SD = 0.95) and a sense of how organic farming can ensure a sustainable environment in the long run (Mean = 3.71, SD = 0.99) were moderate but significant. This fact conforms to the results provided by Pretty et al. (2018) who assert that farmers understand the problem of the climate, however, they are often poorly capable of concentrating on long-term ecological goals due to financial limitations. The least-ranked factor was the awareness of risks because of the chemical dependency (Mean = 3.65, SD = 1.01). This means that farmers can be aware of the downsides of chemical inputs, but they can be blinded by the straightforward productivity concerns at the cost of ecological risks. Similar trends were also observed by Kassie et al. (2015) since they discovered that smallholders have a tendency to focus on short-term production, rather than on environmental sustainability. These findings demonstrate that eco awareness, particularly regarding food safety and soil health are relatively high among the Punjab small holders. Yet there are more big issues such as climate change and chemical addictions which are not so concentrated in their decisions. These observations underline the relevance of particular extension work and campaigns to improve the relationship between ecological perception and realization of organic practice.

3.4. Inferential Statistics
3.4.1. Correlation Analysis

The results of the correlation analysis presented in Table 4 indicate the existence of the interconnections between the economic incentives and ecological awareness on the one hand and the attitude of the farmers towards organic farming on the other hand. The findings show that the three variables correlate significantly and are all positive, implying that economic and ecological drivers are of the highest dependence with respect to the other with regard to attitude formation at the $p < 0.01$ level. There was a moderate and positive correlation between economic incentives and ecological awareness ($r = 0.482$, $p < 0.01$) that means that economic benefits in terms of increased prices on the market and given subsidies as well as decreased cost of inputs are also linked to the levels of ecological awareness in farmers. The finding is consistent with Kassie et al. (2015) who established that profitability ideals are more likely to consolidate the perception of sustainability benefits among farmers particularly in developing countries. Similarly, Khan et al. (2021) established that the effect of the combination of financial incentives and environmental awareness and the impact of smallholders in South Asia positively influence the adoption of organic farming by the population.

Table 4: Correlation Analysis between Economic Incentives, Ecological Awareness, and Attitudes toward Organic Farming (n = 380)

Variables	1	2	3
1. Economic Incentives	1		
2. Ecological Awareness	0.482**	1	
3. Attitudes	0.563**	0.604**	1

Note: Pearson correlation coefficients reported. $p < 0.01$ (2-tailed).

Attitudes toward organic farming and the attitude shown by economic incentives also had a stronger correlation ($r = 0.563$, $p < 0.01$), which means that financial gains are one of the factors that determine positive attitudes. It validates the earlier studies such as those done by Padel (2001) and Läpple and Rensburg (2011) who have shown perceived profitability and market availability to be some of the strongest indicators of organic farming adoption. Interestingly, the most widespread correlation rate was found to be between ecological consciousness and attitudes ($r = 0.604$, $p < 0.01$) i.e. the awareness of the ecological state of the soil, conservation of biodiversity and reduced reliance on chemicals are directly connected with the positive attitudes towards organic farming. This may be justified with the findings of Reganold and Wachter (2016) who have added that ecological consciousness is a determining factor in long-term commitment of farmers to organic farming. Equally, based on the research conducted by the study of Pretty et al. (2018), ecological value such as health benefits and environmental stewardship have high influence

on the adoption of organic farming globally. These results indicate that despite the importance of economic factors in the motivation of adoption, the effect of ecological awareness is equally-or even more significant in the establishment of the attitudes of smallholders. This helps justify the relevance of joint policies that would integrate both financial incentives and awareness-creating activities to help create sustainable shifts in the direction organic production in Punjab, Pakistan.

3.4.2. Multiple Regression Analysis

Table 5 depicts the outcome of the multiple regression analysis that was conducted to identify the significant predictors of the smallholder attitudes with regard to organic farming in Pakistan, Punjab. The 47.9% level of attitudes toward organic farming was statistically significant ($F_{(6, 373)} = 57.12$, $p < 0.001$) and explained by the model ($R^2 = 0.479$). These findings indicate that the ecological awareness ($\beta = 0.412$, $p < 0.001$) was the strongest predictor suggesting that the more environmentally conscious farmers were the more likely they were to form positive attitudes towards organic practices. It follows research by Reganold and Wachter (2016) and Pretty et al. (2018), which says that the more mindful farmers are of the issue of soil degradation, biodiversity depletion, and climate change, the more mindful they would be of sustainable farming practices.

Table 5: Multiple Regression Analysis Predicting Attitudes toward Organic Farming (n = 380)

Predictor Variable	Unstandardized Coefficient (B)	Standard Error (SE)	Standardized Beta (β)	t-value	p-value
Constant	1.215	0.287	–	4.23	0.000
Economic Incentives	0.384	0.072	0.367	5.33	0.000
Ecological Awareness	0.451	0.068	0.412	6.63	0.000
Education Level	0.198	0.061	0.186	3.25	0.001
Farming Experience	0.092	0.047	0.088	1.96	0.051
Farm Size	0.057	0.043	0.054	1.33	0.185
Annual Income	0.064	0.049	0.061	1.31	0.191

Model Summary: R = 0.692; R² = 0.479; Adjusted R² = 0.468; F(6, 373) = 57.12; p < 0.001

Similarly, the economic motives ($\beta = 0.367$, $p < 0.001$) also influenced the attitudes that revealed that subsidies, price premiums, and reduced input prices have a decisive influence and result in adoption. The results align with Kassie et al. (2015) and Khan et al. (2021) who found out that the primary factors that smallholders would consider when choosing organic farming are profitability and financial security. Demographic factors that positively and significantly influenced the propensity to adopt new and sustainable farming practices included education level ($\beta = 0.186$, $p = 0.001$), which indicates the fact that more educated farmers are more receptive to the new and sustainable practices in farming. This is in line with earlier findings by Mehmood et al. (2019) and Sarkar et al. (2021) who discovered that education enhances information-processing capacity of farmers and awareness of ecological issues and the evaluation of long-term benefits of organic production. The farming experience ($p = 0.051$), in turn, was marginal but the size of a farm and the income per year were statistically insignificant. This means that these factors as knowledge and incentive structure have a high chance of affecting attitudes towards organic farming than the structural aspects of the farm. Pimentel and Burgess (2014) and Mohiuddin et al. (2020) reached similar conclusions and said that the significance of the ecological consciousness and conducive policies has been found to be more significant than the financial capabilities of the farms when defining the adoption decisions. The regression results indicate that the readiness of ecological awareness, economic incentives, and education constitute the main factors, which shape the attitudes of smallholders towards organic farming. This implies that organizational training, special subsidies, and market access can be a long way to go in the policy intervention to make farmers in Punjab use more organic practices.

3.4.3. Logistic Regression

Table 6 of binary logistic regression model, which examines the likelihood of smallholders to adopt organic farming (Adoption = 1, non-adoption = 0). Coefficients, standard errors, Wald statistics, p-values, odds ratios (Exp(B)) and 95 percent confidence interval are included in the table.

Table 6 shows the findings of binary logistic regression model to test the hypotheses of differences in the likelihood of adoption of organic farming by smallholders in Punjab, Pakistan. This model shows a considerable increase over the null model ($\chi^2 = 162.4$, $p = 0.001$) a moderate level of explanation (Nagelkerke $R^2 = 0.41$) and overall prediction analysis of 78.2. That the model fits the data adequately is also supported by the HosmerLemeshow-test ($p = 0.45$). The adoption was predicted best with odds ratio of 2.50 with ecological awareness ($p < 0.001$). It implies that farmers who are more ecologically aware are more than twice as likely to move to organic farming than less ecologically aware ones, which supports the conclusions drawn earlier that environmental-consciousness is a key

determinant of organic adoption (Karki et al., 2011; Rana and Paul, 2017). Similarly, economic incentive was a strong predictor of adoption probability (OR = 2.10, p < 0.001) suggesting that access to better prices, subsidy and other financial gains are effective in encouraging smallholders to practice organic production as evidenced by the works of Läpple and Rensburg (2011) and Chandrashekar (2010).

Table 6: Logistic Regression Predicting Adoption Likelihood of Organic Farming (n = 380)

Predictor	B	SE	Wald	p-value	Exp(B) (OR)	95% CI for Exp(B)
Constant	-3.120	0.512	37.14	0.000	0.044	0.019 – 0.101
Economic Incentives (index)	0.742	0.142	27.33	0.000	2.10	1.56 – 2.84
Ecological Awareness (index)	0.915	0.129	50.29	0.000	2.50	1.88 – 3.33
Education Level (years/category)	0.285	0.098	8.47	0.004	1.33	1.10 – 1.61
Farm Size (acres)	0.062	0.041	2.29	0.130	1.06	0.98 – 1.14
Annual Income (PKR, category)	0.091	0.056	2.64	0.104	1.10	0.98 – 1.23
Farming Experience (years)	-0.011	0.022	0.25	0.616	0.99	0.95 – 1.03
Cooperative Membership (Yes = 1)	0.358	0.164	4.77	0.029	1.43	1.04 – 1.96

Model summary: Sample size (N) = 380; -2 Log likelihood = 312.8 ; Chi-square (Model vs. Null) = 162.4, p < 0.001; Cox & Snell R^2 = 0.29; Nagelkerke R^2 = 0.41 (indicates moderate explanatory power); Hosmer–Lemeshow test: χ^2 = 7.86, p = 0.45 (good fit); Classification accuracy = 78.2% (cut-off = 0.5); Notes: Economic Incentives and Ecological Awareness are the Index variables and this is built on Likert-scale items (higher = stronger incentives / awareness). Education and income is either selected as a categorical or continuity control where required. Cooperatives membership is a binary variable.

Adoption was also positively associated with education level (OR = 1.33, p = 0.004), as more highly educated farmers are ready to use new and sustainable practices. This is in line with the article by Idris (2016) and Padel (2001) who underscore the significance of education to enhance knowledge and technology transfer on agricultural practices. There was a small but significant difference in cooperation membership (OR = 1.43, p = 0.029) illustrating that social capital and collective action enhances access to information and resources, which subsequently facilitates adoption, as is also evident by Meijer et al. (2015). On the other hand, annual income, experience and farm size were not significant predictors in this model as far as a statistical evidence is concerned. This implies that unlike some of the earlier studies that were done on the role of resource endowment (Feder et al., 1985), the decision of smallholders in Punjab to adopt organic farming is mostly guided by ecological and economical ideologies rather than simple availability of resources. The results show that the adoption of organic farming by smallholders in Punjab can be primarily driven by a complex of ecological awareness and economic incentives, and education and institutional support through cooperatives are included in the likelihood of adoption. Such evidence explains the importance of the work on the development of policies that would not only make farmers more environmentally conscious but also provide certain economic incentives to stimulate the active utilization of organic production methods at large.

Conclusion

The paper has debated the economic and ecological variables that characterize the attitudes and uptake of organic farming among the smallholders of Punjab in Pakistan. The findings indicate that economic incentives (higher market prices, subsidies and premium markets), and ecological awareness (concepts of soil health, biodiversity and long-term sustainability) play a decisive role in influencing the adoption. The ecological awareness was also shown by the logistic regression analysis as the most significant predictor with the economic incentives and education and cooperative membership being moderately linked to them. Interestingly, other structural variables such as farm size and income did not affect it much so as to show that adoption is not only resource-dependent but also perception, awareness and policy support. Promotion programs through organic markets, subsidies and cooperatives may be utilized to assist in the pace of adoption, and awareness programs may be utilized to increase environmental stewardship. To be profitable in the long-term, there should be a balance between economic sustainability and the ecological accountability. By attending to both of these dimensions, not only will the policymakers increase the incomes of the farmers but will also be capable of ensuring that the environment is conserved and that the small helders in Punjab are among the main points in ensuring sustainable agricultural development.

DECLARATIONS

Conflicts of Interest: Authors have no conflicts of interest.

Data Availability: Data will be available from the corresponding author upon request.

Ethics Statement: This work involved human data. The work was approved by the Institute of Agricultural Extension, Education, and Rural Development, University of Agriculture, Faisalabad, Pakistan.

Authors' Contribution: Abdulazeez Hudu Wudil; Conceptualization, Data Curation, Methodology, Data Original draft, Muhmmad Farhan Sarwar; Formal Data Analysis, Writing, Faisal Nadeem; Review and Editing, Data Analysis and Data Collection

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