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FINANCIAL EFFICIENCY AND WILLINGNESS TO CONVERT TO ORGANIC RICE FARMING MODELS IN DONG THAP PROVINCE, MEKONG RIVER DELTA, VIETNAM

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Abstract

The study was conducted to compare the financial efficiency of the traditional and organic rice farming models in two districts of Dong Thap province, Mekong River Delta, Vietnam. Research data was collected from 252 farming households in Thanh Binh and Tam Nong districts, Dong Thap for 2021 crops. Financial indicators, the Cobb-Douglas production function, and the Logit binary model are used to evaluate and compare financial performance, understanding the factors influencing the farmers' willingness to convert to organic farming models. Research results show that production cost of the organic model is higher than that of the traditional model; in term of revenue, organic model is significantly greater than traditional model. Also, participation in the organic farming helps farmers to sell rice at a higher price than the traditional production. However, due to higher unit production costs of the organic model, profit in each hectare of this model is lower. Logit analysis also shows that around 45% of farmers in the traditional models are willing to convert to organic models. Small area holder farmers are more probably switching to organic model while households with large area are more reluctant. Based on the research results, some solutions and policy implications are proposed to improve the efficiency of rice production and create an incentive to convert to organic rice farming models in Dong Thap province.

Keywords: Cobb-Douglas production function, organic model, rice farming, Vietnam, willingness to convert

1. INTRODUCTION

Currently, organic rice cultivation has become a dominant trend in world agriculture in the context of climate change, food security and increasing consumer awareness of the environment and food safety (Surekha, 2013; .Adamtey et al., 2016; Tashi and Wangchuck, 2016). Organic rice production is a process associated with the use of clean water, organic fertilizers and pesticides, and a strict farming techniques in order to create rice products with high nutrient content and harmful substances minimization. Organic rice production focuses on product quality and value, thereby providing high economic efficiency, contributing to environmental protection (Karki, 2011; Scialabba, 2013; Nguyen Tuan Kiet 2017, Setiyadi et al., 2017)

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In Vietnam, Dong Thap province is located in the Mekong River Delta, the biggest rice production area in the country. This province has an interlaced system of rivers, streams, canals, and many large ponds and lakes. The Tien River (a tributary of the Mekong River) flows through the province with a length of 132km. along the two banks of the Tien River is a complex system of canals. The inter-provincial road is convenient, with more than 300km of roads and a transportation network of rivers and canals (Nguyen Mai Phan et al., 2019).

As an agricultural province, Dong Thap produces much food and various agricultural and aquatic products with high export value (Dong Thap People Committee, 2021). The land of Dong Thap is fertile with alluvium provided by the Tien and Hau rivers every year. The villages throughout Dong Thap are rich in soil and covered in green plant systems. Therefore, Dong Thap is known as a rice granary of the whole country. In Dong Thap province, there is a floating rice variety, a species of rice that grows naturally from April, May to October, harvested without needing to fertilize. Dong Thap province is also a promising area for short-term industrial crops such as sugarcane, cotton, tobacco, soybeans, and fruit trees such as Cao Lanh mango, Chau Thanh longan, Lai Vung tangerine, Phong Hoa pomelo, rambutan, custard apple, custard apple all year round (Huy Duc Dan 2020, Dong Thap People Committee, 2021).

In recent years, climate change has become more and more complicated, negatively impacting and directly affecting the rice farming system of many farm households, such as saline intrusion and severe drought in Mekong River region. Climate change also creates much pressure on the natural environment, such as water, waste, and air pollution (Ngo Minh Hai et al., 2017). In addtion, environmental degradation is becoming more and more serious due to unsustainable crop growth models. According to Vietnam Institute of Agricultural Science, in 2019, Vietnam has nearly 20,000 types of fertilizers licensed for circulation. On average, each year, Vietnam consumes over 2 million tons of urea fertilizer, and about 50% of fertilizer is wasted, mainly absorbed into water and air bed. This leads to concerns when the rate of farmers who have cancer in rural areas is very high, accounting for more than 65% (Nguyen Van Bang et al., 2019). Therefore, the need to develop efficient use of resources and minimize pollution risks in agriculture is essential (Nguyen Mai Phan et al., 2019; Huy Duc Dan, 2020).

Latterly, the Mekong Delta region, in general and Dong Thap, in particular, have many standards and regulations for sustainable agricultural development, such as VietGap, GlobalGap, and organic farming models (Huy Duc Dan, 2020). The primary purpose of these models is to reduce the risk of pollution and increase the quality of products to meet the needs of consumers. Therefore, the authorities in many localities are currently directing people to participate in organic rice production models. These models have advantages: using new varieties, limiting the use of fertilizers and chemical drugs, and plant protection products. These models have the potential of many outstanding advantages compared to the traditional production models, such as higher selling price of rice, high output consumption, limiting environmental pollution caused by chemical

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fertilizers, and thus protecting people's health (Rozman, 2015; Gorman, 2019). Besides, the model's effectiveness also helps farmers to change their awareness and more sustainable farming practices (Maitah et al., 2020). However, the organic model still has some limitations, such as high labor, farmers have not mastered farming techniques and low rice yield. In addition, this is a new model that farmers are hesitant to convert to be (Minh Ngo Hai et al., 2013, Huy Duc Dan 2020). Therefore, it is in need to compare the financial efficiency of the traditional and new models and understand the factors affecting the willingness of farmers to convert to a new, organic model, which helps to provide scientific arguments to support policymakers to propose and manage more effectively in Dong Thap province and Vietnam.

2. METHODOLOGY AND DATA

2.1 Model specification

In this study, we adapt the cost benefit analysis approaches by Tashi and Wangchuk (2016), Adamtey et al. (2016), Boardman et al. (2018) and use the following economic models to estimate costs, benefits and assess financial efficiency of organic rice production compared to conventional rice production in the study area.

Total revenue represents the total income farming households receive from selling rice per season which is determined by the formula:

$$TR_T = P_T \times Q_T$$

TR_T: total revenue (thousand VND/hectare/year) of rice produced by technology T (T=0: traditional farming, T=1: organic farming)

P_T: market price of rice (thousand VND/kg/year) grown by technology T

Q_T: yield of rice grown by technology T (kg/hectare/year)

1. Total cost of rice production is determined by the formula:

$$\textit{Total cost} = \textit{Fixed cost} + \textit{Variable cost}$$

Variable costs are costs incurred along with rice production including: seed costs, labor (including family labor), fertilizers, harvesting costs, land preparation costs (and other costs).

Fixed costs are costs that do not depend on production output but create a premise for production including: land tax and depreciation of fixed assets (plows, tillers).

With

$$TVC_T = \sum_{n}^{i=1} P_{X_i} X_{iT}$$

TVCT: total variable cost (thousands of VND/hectare/year) for rice grown by technology T

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PX_i: cost of input i for rice production (thousands of VND/unit)

X_{iT}: The ith input amount (over 1 hectare/year) for rice production by technology T

2. Gross profit of rice production is determined by:

$$GP_T = TR_T - TVC_T$$

GP_T: gross profit (thousand VND/hectare/year) for rice grown by technology T

3. Net profit of rice production is calculated as followed:

$$NP_T = TR_T - TC_T$$

NP: Net profit (thousand VND/hectare/year) for crop according to technology T, with

$$TC_T = TVC_T + TFC_T$$

TFC_T: total fixed costs (thousands of VND/hectare/year) for rice cultivation by technology T

4. Benefit–cost ratio (BCR) is the final indicator for comparing the economic efficiency of organic and traditional rice farming. BCR/hectare was calculated by dividing the total revenue for the total variable cost of rice production.

$$BCR_T = (TR_T / TVC)_T$$

BCR_T: benefit/cost ratio per hectare for rice produced by technology T.

In addition, descriptive statistics were used to analyze the current status of rice production in the study area. The comparative method is utilized to compare relevant financial indicators such as revenue, cost, income, profit, and other comparative indicators (La Nguyen Thuy Dung and Mai Van Nam, 2015; Nguyen Tuan Kiet, 2017; Nguyen Mai et al., 2019) between traditional and organic production models.

The Cobb-Douglas production function was set up to determine the factors affecting the standardized profitability of the household with the following form:

$$\mathrm{Ln}\pi_i = \beta_0 + \beta_1 \ln P_{x1} + \beta_2 \ln P_{x2} + \beta_3 \ln P_{x3} + \beta_4 \ln P_{x4} + \beta_5 \ln P_{x5} + \beta_6 \ln P_{x6} + \beta_7 \ln P_{x7} + + e_i$$

In which, π_i is the standardized profit (or unit output price (UOP) of the ith farmer, calculated as total revenue minus variable costs such as fertilizers, agro-pharmaceuticals, and seeds, then divided by the price of rice; β_0 is the free coefficient (slope of Cobb-Douglas production function), which is the ith correlation coefficient corresponding to independent variables such as P_{xi} (i=1, 2,…,n). The values represent the influence of the inputs on the profit. They also measure the profit elasticity in terms of the number of inputs because they show how much a 1% increase in the inputs causes the profit to change (%) (positively or negatively depending on the sign of the variable value); P_{xi} is the normalized price of the inputs (average price of ith input item

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divided by output price) and other fixed factors; ε_i is the mixed error of the model. Based on the theoretical framework of production (Debertin, 2012; Yu et al., 2014; Rozman et al., 2015) and related empirical studies, the variables included in the research model are explained in Table 1.

Table 1: Description of independent variables in the model of factors affecting profitability

Variables	Symbol	Description	Expected value	References
lnPnpk	P_{x1}	The standardized price of NPK fertilizer, as the price of 1 kg of NPK fertilizer divided by the price of 1 kg of rice sold	-	Debertin, 2012; Coelli et al., 2005
lnPdap	P_{x2}	The standardized price of DAP fertilizer, as the price of 1 kg of DAP fertilizer divided by the price of 1 kg of rice sold	-	Debertin, 2012; Coelli et al., 2005
lnPure	P_{x3}	The standardized price of URE fertilizer, as the price of 1 kg of URE fertilizer divided by the price of 1 kg of rice sold	-	Debertin, 2012; Coelli et al., 2005
lnPpotassium	P_{x4}	The standardized price of POTASH fertilizer, as the price of 1 kg of POTASH fertilizer divided by the price of 1 kg of rice sold	-	Debertin, 2012; Coelli et al., 2005
lnPppp	P_{x5}	The standardized price of PLANT PROTECTION PRODUCTS (PPP), as the price of 1 kg of PPP divided by the price of 1 kg of rice sold	-	Debertin, 2012; Coelli et al., 2005
lnPseed	P_{x6}	The standardized price of 1 kg of seeds, as the price of 1 kg of seeds divided by the price of 1 kg of rice sold	-	Debertin, 2012; Coelli et al., 2005
Lnarea	P_{x7}	The total area of household rice farming (1.000 m2)	+	Nguyen Tuan Kiet, 2017; Debertin, 2012

Source: Results from literature review and preliminary research (2022)

Note: The sign "+" represents a positive relationship with the dependent variable; the sign "-" shows a negative relationship with the dependent variable

In order to build a basis for proposing solutions to motivate farming households to participate in the organic model, a binary Logit function is used to analyze the factors affecting the decision of farmers' willingness to convert to organic farming from the traditional production model, that is set up as follows (Debertin, 2012):

$$\mathrm{Ln}\left[\frac{P(Y=1)}{P(Y=0)}\right] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

In which, P(Y=1) is the probability of the event occurring in this study, which is the probability that farmers are willing to convert to the organic rice model. P(Y=0) is the

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probability that the event does not occur, which is the probability that the farmer is unwilling to convert to the organic rice model. β_0 is the free coefficient, β_1, β_2,... β_5 is the coefficient of X_1, X_2,... X_5, which are the independent variables included in the model.

The head of the household is an essential factor in determining which production model is used (Karki, 2011; Heryadi et al., 2018). In addition, human resources are also one of the critical factors in agricultural production (Debertin, 2012; Scialabba and Nadia, 2013). Therefore, the variables included in the model will include age, the education level of the household head, and the number of laborers engaged in production. In addition, the expansion of the area helps to increase the efficiency of the organic model (Ngo Minh Hai et al., 2014), so the area variable is also included in the research model (Table 2). Preliminary research results of variables in the model are consistent with previous studies; no new variables. ε_i is the model error; ln is the log of the base e (e=2.714), with the coefficients of Odds as follows:

$$O_o = \frac{P_0}{1 - P_0}$$

$$\text{Odds} = \frac{P_0}{1 - P_0} = \frac{\text{P(probability of willingess to convert)}}{\text{P (probability of unwillingess to convert)}}$$

The Logit function can be rewritten as:

$$\text{Ln(Odds)} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

The regression coefficients will be estimated by the method of maximum likelihood estimation.

Table 2: Description of independent variables and the expected sign affecting the model

Variables	Symbol	Description	Expected sign
Area	X_1	The total area of household rice farming (1,000 m2)	+/-
Age	X_2	Age of household head	+/-
Training	X_3	Dummy variable: 1 participated, 0 did not participate	+
Lnincome	X_4	The income in the traditional model obtained in the Spring crop (VND/1.000 m^2)	-
Employee	X_5	Number of employees engaged in agricultural production	+

Source: Results from literature review and preliminary research (2022)

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2.2 Data collection

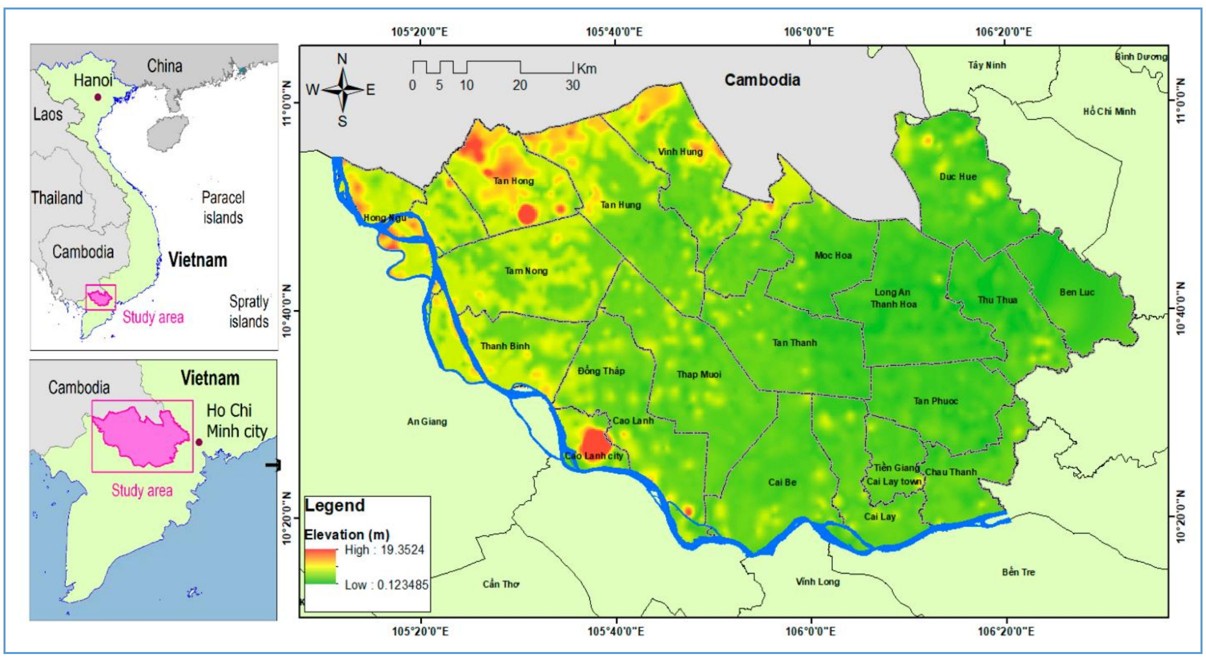
Primary data for the study were collected by directly interviewing 252 farmers in Thanh Binh and Tam Nong districts of Dong Thap province by systematic random sampling from March to April, 2022. Production data was collected for 2021 crops. The respondent is the head or the leading producer of the household.

Sample size was determined according to the ratio estimation formula as follows:

$$n = p(1-p)\left(\frac{Z_{\frac{\alpha}{2}}}{MOE}\right)^2$$

In which, p is the rate of occurrence of factors in the sampling unit exactly as the sampling target; in the most unfavorable case, the data variability p (1-p) is at the maximum, inferring p=0.5. Choose 90% confidence and allow error with a small sample size MOE is 10%, deduce n=101 observations (Willer et al., 2014; Tandon et al., 2020).

Figure 1. Study area- Dong Thap Province in Mekong River Delta of Vietnam



Based on the local organic farming model and consultation with the Provincial Department of Agriculture and Rural Development officials, this study randomly selected 105 households with organic model and 147 households with traditional crop model in 2 selected districts. In addition, these two areas were chosen due to their relatively similar production scale, natural conditions, and soil characteristics. Hoa Binh commune, Tam

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Nong district, is one of the first organic pilot model areas, so the analysis information will be significant for areas that want to replicate organic models in Dong Thap province.

3. RESULTS AND DISCUSSIONS

3.1. Socio- economic background

The actual survey includes 147 farmers using the traditional rice models and 105 farmers using the organic rice model in Thanh Binh and Tam Nong districts (the number of surveys in the organic model is smaller than the traditional model because this is still a pilot model, the number of participating households is limited). Some information on the production characteristics of farming households is shown in Table 3.

Table 3: General information on farm households in two models

	Traditional model			Organic model			Std. Deviation
Variables	**Minimum**	**Maximum**	**Average**	**Minimum**	**Maximum**	**Average**	
Age (years)	27	69.5	48.86	41	75	53.29	-3.01
Education level (level)	0	1	0.18	0	3	1.98	0.80
Household members (person)	2	7	5.32	1	7	4.85	0.089
Labors involved in farming (person)	1	4	2.39	1	3	1.98	0.55
Farming experience (years)	2	51	30.67	1	5	2.9	24.02

Source: Data collected and processed (2022)

The results of descriptive statistics show that the difference between the two groups currently focuses on education level, the number of people involved in the production, and years of experience. The educational level of the organic model group is higher than that of the traditional model group (1.98 vs. 0.18, respectively). The traditional model group has 0.41 more people engaged in productive labor than the organic group (2.39 compared to 1.98). In particular, the production experience of the organic model group is about three years (2.9 years), while the traditional model group is about 31 years (30.67 years). Thus, the organic model will have a limitation in that farmers do not have much experience participating in producing while requiring more care and techniques to apply. The remaining two characteristics include age and number of family members, with the difference not statistically significant. The socio-economic characteristics of the two groups of households clearly show the difference and the relationship between the behavior of choosing a production model and the household characteristics. This is also one of the points to note for policymakers when proposing solutions to expand the organic model in the near future.

3.2. Rice farming techniques and trading

The survey results show that reasons for choosing to grow organic rice, besides reasons such as wanting to switch to a new model, the majority of organic rice growing households choose this model because they are supported with capital when needed, and original varieties (13.2%) and some follow the local organic production planning (7.08%). This result can support when proposing solutions to expand the organic model in localities in the near future. In the traditional model, most households rely on existing experience, and their access to new technical information is minimal. Therefore, when converting to a new production model, one of the essential points is to strengthen technical training and provide more information to farmers.

The survey data also shows that organic farming households have a 100% participation rate in cooperatives to receive technical support in the production process and to pay off the output. In contrast, in the traditional model, farmers do not want to join cooperatives even though there are cooperatives in the locality because they think it is time-consuming, complicated, and less flexible. In addition, according to statistics, up to 92.3% of households in the traditional model only receive information from radio and television, and 30.1% receive market information from relatives and neighbors. Thus, farmers in the traditional model are still passive in the consumption of their products because the actual market prices are very different from the information they receive. For example, according to the information they receive through television and radio, the price of rice tends to increase, but when they sell, the price is low because the price is often forced through the rice storks. Particularly for the organic production model, 100% of households receive market information from the cooperative so that the price will be more precise and accurate, and farmers can feel more secure when producing.

Besides, most of the traditional model farmers sell rice in the form of selling fresh rice in the field and purchased by traders in the field, this form of sale is prevalent, and farmers do not have to make an effort to transport it back home or warehouse, then it saves time to dry rice. However, this is inconvenient in the summer crop because this crop often rains a lot, so the rice quality is deficient, so the rice price is easy to fall; traders rely on that to pressure prices. Farmers can consume their output in the organic model to feel more secure and minimize relying on traders.

3.3. Financial performance comparison between traditional and organic models

3.3.1. Productivity and costs

According to Sub-Department of Cultivation and Plant Protection (2022), organic production in the early stages has a 26.5% lower output than traditional farming in Dong Thap. This study also showed similar results. Specifically, in the Spring crop, the average yield of the traditional model is 801.32 kg/1.000 m2 (the lowest is 521.34 kg/1.000 m2, the highest is 978.01 kg/1.000 m2), while the average yield of the organic model is only reached 641.56 kg/1.000 m2, which is 159.76 kg/1.000 m2 lower than the traditional model. This difference is statistically significant at 1%.

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Table 4. Productivity comparisons of two crops in two models (kg/1.000 m2)

Crop	Model	Average	Standard deviation	Minimum	Maximum	Deviation
Spring	Traditional	801.32	79,21	521.34	978.01	159.76***
	Organic	641.56	112.89	310.47	1001.25	
Summer	Traditional	512.79	73.29	224.83	705.19	-91.1***
	Organic	603.89	115.96	365.49	1012.08	

Source: Data collected and processed (2022)

Note: *** is statistical significance at 1%

However, in the summer crop, the average yield of the traditional model was only 512.79 kg/1.000 m2, lower than the organic model's 91.1 kg/1.000 m2 with a statistical significance of 1%. Thus, there is a good sign that the yield of the organic model is more stable, while that of the traditional model is lower in the summer crop.

Production cost is one of the critical factors determining farmers' profitability in the production process, as shown in Table 5.

Table 5. Production cost comparisons of two crops in two models (VND/1.000 m2)

Variables	Spring crop		Deviation	Summer crop		Deviation
	Traditional	Organic		Traditional	Organic	
Tillage cost	35.102	172.379	137.277***	91.045	170.857	-79.812***
Seed cost	182.012	175.903	6.109ns	185.029	175.080	9.949 ns
Fertilizer cost	373.121	794.654	421.533***	387.23	833.028	-445.789***
PPP cost	352.908	78.351	274.557***	324.097	182.698	141.399***
Labor hiring costs	28.045	-	-	29.011	-	-
Harvesting cost	202.673	231.856	-29.183***	213.89	250.490	-36.6***

Source: Data collected and processed (2022)

Note: *** is statistical significance at 1%

In both models, fertilizer accounts for the highest proportion of the entire cost structure of both spring and summer crops. In both crops, the organic model has a higher fertilizer cost than the traditional model of 421.533 VND/1.000 m2 (in the spring crop) and 445.789 VND/1.000 m2 (in the summer crop) and is statistically significant at 1%. In contrast, the cost of pesticides, PPP in the traditional model was higher than in the organic model in both crops, at 274.557 VND/1.000 m2 (in the spring crop), and 141.399 VND/1.000m2 (in the summer crop), with a statistical significance of 1%, this is a good signal, but it is also worth noting. The highlight of organic farming is that it helps to radically reduce the amount of chemicals used, which is good for the environment and farmers' health in the long run. However, the current price of organic fertilizer is relatively high, making fertilizer costs in the new model high. It is necessary for the intervention of relevant agencies to help stabilize and support the cost of organic

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fertilizers in the early stages. In addition, the seed cost in the two models has no difference. The cost of tillage and harvesting in the organic model is still higher than in the traditional model. This is because the organic model is still new, and farmers must spend more labor on land preparation, tillage, fertilizing, and harvesting per the signed contract. A remarkable point in the organic model that is different from the traditional one is that it does not hire outside workers but only uses family labor to ensure the model's correct technique and strict care requirements.

3.3.2. Revenue, income and profit

A remarkable point in the comparison results of the two models is that the factors on revenue, income and profit of the organic model are higher in both crops. Only the profit in the spring crop is lower than the traditional model due to the higher cost of organic fertilizer and more care in this crop. Specifically, Table 6 shows that the revenue and income of farmers in the organic model are higher than in the traditional model in both crops. For example, the revenue in the spring crop of the organic model is higher than that of the traditional model at 422.234 VND with statistical significance at 5%, and in the summer crop, the difference is about 2.152.022 VND and is statistically significant at 1% (Table 6). Although the organic model's spring crop yield is lower than that of the traditional model, the average selling price of organic model rice is 7.500 VND/1.000 m2, higher than the traditional model's average price of 5.012 VND/1.000 m2, then the revenue of organic model is still higher.

Table 6. Revenue, income and profit comparisons of two crops in two models (VND/1.000 m2)

Spring crop

Variables	Model	Average	Standard deviation	Minimum	Maximum	Deviation
Revenue	Traditional	3.925.467	464.180	2.333.550	5.106.554	-422.234**
	Organic	4.347.702	949.424	2.073.384	7.315.920	
Income	Traditional	2.678.501	479.785	1.192.364	3.841.639	-11.035ns
	Organic	2.689.536	915.267	596.694	5.484.005	
Profit	Traditional	2.469.602	480.725	978.486	3.633.209	823.879***
	Organic	1.645.723	803.654	894	3.451.805	

Summer crop

Variables	Model	Average	Standard deviation	Minimum	Maximum	Deviation
Revenue	Traditional	2.239.174	372.847	870.785	3.334.892	-2.152.022***
	Organic	4.391.196	984.427	2.287.872	7.641.072	
Income	Traditional	1.004.570	368.893	-291.024	1.776.959	-1.577.788***
	Organic	2.582.358	973.213	685.170	5.691.854	
Profit	Traditional	795.495	372.466	-535.455	1.569.745	-627.998***
	Organic	1.423.493	925.013	19.364	4.337.054	

Source: Data collected and processed (2022) Note: *** is statistical significance at 1%

Although the profit in the spring crop is higher than in the traditional model, it is mainly due to the care labor because the difference in income is insignificant and not statistically significant. In the traditional model, the summer crop in most districts of Dong Thap province, farmers face unfavorable weather conditions, causing pests and diseases to develop. Therefore, this group of farmers has to use more fertilizers, leading to increased production costs, while the productivity of the summer crop is low. Thereby, farmers' income in the traditional model is lower than that of the organic model.

3.3.3. Financial indicators

The analysis results show that although the organic model is not as effective as the traditional model in the spring crop, in the summer crop, it is more effective than the traditional model. However, the difference in the profit ratio Profit/cost is not statistically significant. The summer crop often has unfavorable planting conditions, requiring more fertilizers and pesticides due to diseases. Thus, in the long term, the organic model is a perfect alternative and is the right development direction for the sustainable rice production model. Specifically, in the Spring crop, the revenue/cost ratio in the traditional model is 3.31, meaning that when a farmer spends 1 VND in investment costs, they will earn 3.31 VND in revenue, while in the organic model, this figure is 2.71, meaning that when spending 1 VND of cost, the farmer will get 2.71 VND of revenue, the difference is 0.59 and it is statistically significant at 1%. In the summer crop, this data has a difference of -0.62 and is statistically significant at 1%. The income/cost in the spring crop of the traditional model is 2.28, which means that the farmer in the traditional model spends 1 VND of investment costs, excluding family labor, and the household will earn 2.28 VND. This figure in the organic model is 1.68, meaning that when farmers in the organic model spend 1 VND in production costs, they will get 1.68 VND in income; the difference is 0.59 and statistically significant at the 1% level. Profit-related indicators are interpreted similarly (Table 7).

Table 7. Financial indicators comparisons of two crops in two models

Variables	Spring crop			Summer crop		
	Traditional	Organic	Deviation	Traditional	Organic	Deviation
Household labor (day/1.000m2)	0.96	6.39	-5.43***	0.96	7.17	-6.21***
Revenue/cost (times)	3.31	2.71	0.59***	1.91	2.53	-0.62***
Income/cost (times)	2.28	1.68	0.59***	0.88	1.49	-0.61***
Profit/cost (times)	2.10	1.03	1.07***	0.69	0.82	-0.13^{ns}

Source: Data collected and processed (2022)

Note: *** is statistical significance at 1%

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3.3.4. Factors affecting profitability of willingness to convert to organic models

Currently, farmers participating in the organic model use an amount of organic fertilizers, seeds, and farming techniques according to the training and guidance of the cooperative. The quantity and cost of inputs are almost the same. Therefore, when analyzing the factors affecting profit, this study only focuses on analyzing the group of traditional farmers as a basis for proposing solutions to change the model. The model estimation results are shown in Table 8.

Table 8. Estimation results of the production function of the traditional model

Variables	Spring crop		Summer crop	
	Coefficient	**Standard Deviation**	**Coefficient**	**Standard Deviation**
lnPnpk	0.008ns	0.039	-0.134^{ns}	0.249
lnPdap	-0,023ns	0,041	-0,498*	0.284
lnPure	-0.089ns	0.081	-0.592^{ns}	0.599
lnPpotassium	0,149**	0.071	0.801**	0.423
lnPppp	-0.111***	0.439	-0.128^{ns}	0.121
lnPseed	-0.201ns	0.290	-0.162^{ns}	0.296
Lnarea	0.009ns	0.017	0.317**	0.136
Constant	7.694***	0.605	4.709**	1.904
Log-likelihood	39.24		55.009	
Prob>chi2	0		0	
sigma	0.159		0.801	

Source: Data collected and processed (2022)

Note: *, **, and *** are statistical significance at 10%, 5%, and 1%, respectively; ns is not statistically significant

The analysis results show a linear relationship between the normalized profit in the traditional model and at least one of the factors is the independent variable included in the model. The independent variables selected in the model have a high ability to explain the change in the profitability of traditional model farmers (Prob>chi2=0.0000 <1%). The model results show that two variables positively affect profitability, including the standardized price of potash fertilizers (in both crops) and area (in the summer crop), and are statistically significant at the 5% level, meaning that increases farmers' profits. Besides, the summer crop requires a reduction in the amount of DAP fertilizer used, which is entirely consistent with the organic model that requires a reduction in the amount of fertilizer used. The organic model also requires appropriate adjustments and a more reasonable balance of inputs. An interesting finding in this study is that the household's use of inputs in the traditional model is not stable over two crops, explaining widespread, irregular, non-standard use of PPP dosage in the current traditional model. Thus, in general, the farmers in the traditional model still use inputs that are not reasonable and are not technically correct, thereby affecting the

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households' profits. Thus, the conversion to the organic model is expected to help farmers use a reasonable amount of seeds, fertilizers, and agro-pharmaceuticals, PPP increasing profits for farmers, reducing health risks and environmental pollution in the long run.

Factors affecting farmers' willingness to convert to organic model

In the actual survey results of 147 farmers in the traditional model, 66 respondents are willing to convert to the organic rice model, accounting for 44.8%. In addition, 81/146 households do not intend to participate in the new model, accounting for 55.2%. As such, it is essential to understand the influencing factors to make their decision to switch as a basis for proposing solutions and creating an incentive to switch to the new model. This study uses the Logit model to analyze these factors. The results are shown in Table 9.

Logit analysis results with Prob> chi^2=0.313 show the model has statistical significance at 1%. The study shows three factors affecting the decision to convert organic models: area, age, and revenue. However, while training increases the probability of a household's decision to change the model (with a marginal effect of 0.021), the area and revenue of the traditional model reduce the probability of the farmer's decision to convert (with a marginal effect of -0.009 and -1.188, respectively). This result is a suitable signal for the transition to the new model. The older the householders are, the more they want to switch to the new model. This can be explained by the fact that the older they are, their relevant knowledge are more accumulated, recognizing the importance of the organic model. Households with a large area are more afraid to convert because this is a new model; the larger area is, the higher risk of ineffective. Therefore, policymakers need to take many measures to create an incentive for conversion and solutions, mainly to clearly show the long-term benefits of the organic model to help people boldly change the model.

Table 9. Factors affecting the willingness to convert to the organic model

Variables	Coefficient	dy/dx	Standard Error
Area	-0,052	-0,009*	0,0074
Age	0,087	0,021**	0,0105
Training	1,709	0,201ns	0,2269
Lnrevenue	-5,594	-1,188*	0,8180
Number of employees	0,720	0,149ns	0,1389
Number of observations		252	
LR chi^2		13.67	
Prob> chi^2		0.0313	
Pseudo R^2		0.5903	

Source: Data collected and processed (2022)

Note: *, **, and *** are statistical significance at 10%, 5%, and 1%, respectively; ns is not statistically significant

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4. CONCLUSIONS AND RECOMMENDATIONS

Several remarkable conclusions have been pointed out from the analysis and comparison of the production and financial efficiency of traditional and organic rice growing models. First, the production cost of the organic model is higher than that of the traditional model, but when compared to revenue, the households in the organic model have higher revenue than those in the traditional model. Also, participation in the organic model helps farmers to sell rice at a higher price than the traditional model. Besides, farmers also protect their health and reduce environmental pollution. However, the production cost of the organic model is relatively high and higher than that of the traditional model, so the farmers' profit in this model is lower. Logit analysis results show that smallholder farmers are willing to switch to the new model, while the older the household head is, the more they want to switch to the new model. In the traditional model, the amount of seed used is unstable and negatively impacts standardized profits. Therefore, receiving technical training and guidance on rational resource use when participating in the organic model is considered a complete and essential solution to help increase income for farmers.

The results of this study show the differences in financial performance between the organic and traditional models. Hence, policymakers should pay attention to the following solutions:

1. It is necessary to propagate and mobilize people to switch to the new production model that helps to optimize input resources used by using more correct techniques, especially helping farmers to use fertilizers more efficiently because when participating in the model, farmers must produce according to strict procedures in terms of dosage and usage, participating in the organic model has many long-term benefits such as reducing environmental pollution, protecting farmers' health;
2. It is also critical to integrate the contents of organic farming in the training sessions on agricultural production knowledge and sustainable agricultural production;
3. There are many preferential policies to encourage businesses to increase household consumption of agricultural products. In order to do this, the role of cooperative groups is necessary for connecting agricultural products. In addition, the enterprise also has safe and sustainable raw material areas available, ensuring the availability of products to supply to customers. In addition, businesses can also build a closed process, sell more relevant organic products to farmers, such as organic fertilizers and provide seeds, and diversify revenue sources for businesses;
4. Local authorities should establish a new type of cooperative to guide and advise, for example, the organic model mentioned in this study, for farmers to participate. Participation in cooperatives will help farmers to take the initiative. For example, the

output might be consumed and sold at a high price, and purchasing inputs have also remained at good quality and a reasonable price. In summary, after more than 30 years of innovation and development, Vietnam's agricultural economy has achieved remarkable achievements, eliminating underdevelopment. However, with the current situation, it is facing many difficulties. With many challenges and still a long development gap from other countries in the region, Vietnam needs to transform its agricultural model from a small, boldly, and low-quality to high quality and efficient model to increase its competitiveness for domestic products, reducing environmental pollution, bringing agriculture to a fast and sustainable development.

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CONTRIBUTION

All authors have participated in conception, design, analysis and interpretation of the data; drafting the article, revising it critically for important icontent; and approval of the final version.

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