



## Article

# Getting Young People to Farm: How Effective Is Thailand's Young Smart Farmer Programme?

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**Abstract:** In 2014, the Thai government initiated the Young Smart Farmer (YSF) programme to counter the decline in the number of young people involved in farming. The YSF programme has three desired outcomes: first, to increase participants' financial independence; second, to enhance the adoption of innovative farming methods; and third, to retain participants in the long-run by satisfying them. This study aimed to evaluate if these outcomes have been achieved. A Propensity Score Matching (PSM) method was applied to analyse the data collected from programme participants (61 responses) and non-participants (115 responses) through a survey in the Prachin Buri province in Thailand. Participation was determined by education, farmland size, farming experience, and challenges to farming. Most participants (~79%) stated that they were satisfied with the programme; however, the programme did not increase financial independence and the adoption of innovative farming methods. As such, the programme might not be very effective in motivating young people to continue, return to, or enter farming. We recommend that the programme can be improved by adjusting training and field trips to meet the needs of participants in different production systems. The programme should also be expanded beyond providing knowledge and information, and it could offer additional monetary and non-monetary support to participants, such as loans for technology investments needed for farm expansion and competitive advantages.

**Keywords:** financial independence; innovative farming methods; farming exodus; food security; impact evaluation; participants' satisfaction



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## 1. Introduction

Thailand is facing an ageing farming population, with fewer young people continuing, returning to, or entering farming [1]. This is a common demographic structural change, also found in many other countries [2]. In Thailand, the share of farmers younger than 45 years decreased from ~30% in 2008 to ~19% in 2018, while the share of those 60 years and older increased from ~26% to ~33% [3,4]. This is partly because of the economic development disparity between the agricultural sector and others, resulting in people with a farming career earning less than those with other occupations [5,6]. Farming also faces many risks, such as the volatility of the agricultural markets and product prices, increasing product costs, labour shortage, deterioration of soil quality, climate change and natural disasters, and fraud by intermediaries [5,7]. Farm work is also physically and mentally exhausting, with an augmented chance of work-related accidents, while medical and pension benefits are usually poor [8]. These factors make farming an unattractive career path for young people. Young people are also reaching higher levels of education, which leads to changes in their lifestyle and employment aspirations, with increasing opportunity to find off-farm employment [9,10]. Particularly the well-educated young people out-migrate to urban areas, contributing to the global problem of a rural and farming exodus [11,12]. Between 2015 and 2019, the average net immigration into the capital, Bangkok, was a surplus (32,920 people per year), while the average net immigration into other regions was a deficient (−222,500 people per year) [13].

However, the agricultural sector in Thailand is still an important source of livelihood, income, and raw material, and thus, it is essential to the national food supply. In 2019, of the total 37 million employed people, ~32% worked in the agricultural sector [14]. Thailand is also a major food product exporting country [15], meaning that Thailand currently has a food production surplus, and food security is not an issue in most regions. However, if the number of young farmers continues to decline, leaving only older farmers to deal with increased farming workloads and risks, the agricultural sector competitiveness, sustainability, and national food security are likely to become a challenge in the future. This is because older farmers are generally less motivated than their younger colleagues to develop their farms, less open to new ideas and efficient methods, less daring regarding on-farm investments, and less productive as their health might deteriorate [9,16].

To address this decline in the number of young farmers, the Thai government and governments of other Asian and African countries initiated capacity-building programmes for young farmers. The scope of such programmes is large, with differences in how they are implemented and their governance and incentive strategies. Some programmes follow a top-down approach [7,17–23], while others are bottom-up [7,18,24–26]. Most programmes focus on collective incentives and developments, with fewer focusing on incentives for and developments of individuals [22]. Programmes either offer mainly monetary support and incentives, such as subsidy [7,17,20,23,26], or mainly non-monetary support and incentives, such as knowledge and information [18,19,21,22,24,25]. An example for the latter strategy has been introduced in Thailand in 2014, under the umbrella of the Young Smart Farmer (YSF) programme, which has been the focus of our study [27]; the next section provides some conclusions about these programmes.

Despite the given variety in programmes aiming to retain young people in farming employment, studies of the programmes have unambiguously concluded that they are only successful when they provide young people with a clear vision of the economic benefits of farming. This can be achieved through following these key programme implementation principles: (1) providing support that is flexible and consistent between the agricultural sector development goals of the countries and the specific needs of young farmers [7,17,20,22,23,25,26]; (2) focusing on developing the entrepreneurial skills and the adoption of innovative information and communication technologies by young farmers [18,24]; and (3) facilitating informal and formal cooperative networks amongst young farmers and also other stakeholders [7,17,19–21,23,26].

Although previous studies have explored how these principles can lead to the success of a programme, most of the studies used qualitative data and did not provide an empirical evaluation of the impact of the programmes in terms of economic viability of the participants. No consensus has been reached among the few existing quantitative studies, with some studies finding that the programmes are ineffective [21], while some found that they are effective [19,25].

To fill this gap, our study, therefore, aimed to evaluate if (1) young farmers participating in the YSF programme could make enough money from farming to be financially independent, (2) if the YSF programme has contributed to the adoption of innovative farming methods, and (3) how satisfied participants are with the YSF programme. Addressing these aims aligns with the desired outcomes of the YSF programme, and they can indicate whether the YSF programme is likely to achieve its ultimate aim of increasing the number of young farmers across Thailand. We conducted a systematic impact evaluation using the Propensity Score Matching (PSM) method and used self-reported satisfaction measures from household data collected from 176 farmers (61 participants and 115 non-participants) in the Prachin Buri province in Thailand. The study results, discussion, and recommendations may contribute to directing the next phase of the programme implementation by policymakers, which will be the extension to more participants and increased effectiveness. This study may also contribute as a guideline for future evaluations of similar programmes in Thailand and other countries facing the same problem of declining numbers of young farmers.

## 2. The Young Smart Farmer Programme Background and Evaluation Framework

### 2.1. The Young Smart Farmer Programme

According to the Farmer Development Division [27], the YSF programme has been designed to develop the farming business capabilities of young farmers. The development approach of the programme is based on the principle that farmers are the centre of the development (bottom-up approach) and relies on the process of knowledge sharing and network building among farmers as a development means. The programme has been implemented annually in every province of the country by the Department of Agricultural Extension (DOAE) since 2014.

There are three long-term aims of the programme:

- (1) to increase the number of young farmers by motivating young people to continue, return to, or enter farming to replace older farmers;
- (2) to help young farmers to become agricultural leaders in their communities; and
- (3) to create collaborative networks among relevant stakeholders for the development of the agricultural sector of the country.

It is expected that these aims will be achieved through the completion of two short- or medium-term outcomes of the programme:

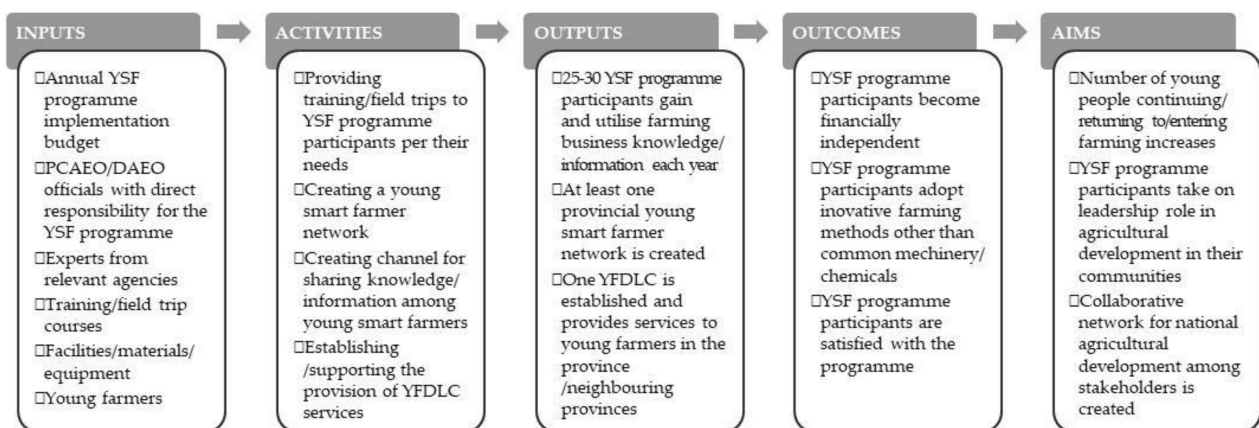
- (1) to make young farmers become financially independent with their own farming businesses and
- (2) to enhance the adoption of innovative farming methods by young farmers.

The three primary activities of the programme are, first, to provide training, workshops, seminars, and field trips to participants, as per their needs; second, to create 77 provincial, nine regional, and one national young smart farmer networks and channels for sharing knowledge among participants; and third, to establish and support the services of 27 young farmer development learning centres.

Young farmers who can participate in the programme must have the following qualifications. First, they must be between 17 and 45 years old and have just started their own farming. Second, they must be determined to improve their farming capability and quality of life. Third, they must volunteer to participate in the programme and join all activities throughout the programme period. Fourth, they must be registered as farmers with the DOAE. Each year, 25 to 30 young farmers are recruited to participate in the programme in each province. Between 2014 and 2018, 12,569 participants nationwide were recruited [28].

### 2.2. Evaluation Framework

We outlined the theory of change for the YSF programme, as implemented in the Prachin Buri province in Thailand between 2014 and 2018, using a result chain to clearly demonstrate the link between inputs, activities, outputs, outcomes, and aims of the programme (Figure 1). This is an important first step in any programme impact evaluation, as it helps to define a clear evaluation question, in which the answer clearly benefits future policy and an understanding of why a programme might succeed or fail its desired outcomes [29]. We focused on the measurable desired outcomes of the programme from our collected data, that is, to evaluate whether they have been achieved or not. We measured the outcome on increased financial independence by net farm income and the enhanced innovative methods adoption by examining whether participants adopted innovative methods other than common machinery and chemicals. As per Nordin and Lovén [2], this enabled us to indicate the probability of the programme's achievement regarding its final aim (in particular, the increase in the number of young people continuing, returning to, or entering farming), although we did not directly focus on this aim. Two hypotheses could, therefore, be formulated:



**Figure 1.** A result chain for the Young Smart Farmer programme implemented in the Prachin Buri province in Thailand between 2014 and 2018. **Notes.** YSF = Young Smart Farmer, PCAEO = Prachin Buri Provincial Agricultural Extension Office, DAEO = District Agricultural Extension Office, YFDLC = Young Farmer Development Learning Centre.

**Hypothesis 1 (H1).** *Participation in the YSF programme increases the financial independence of the participants.*

**Hypothesis 2 (H2).** *Participation in the YSF programme helps to adopt innovative farming methods.*

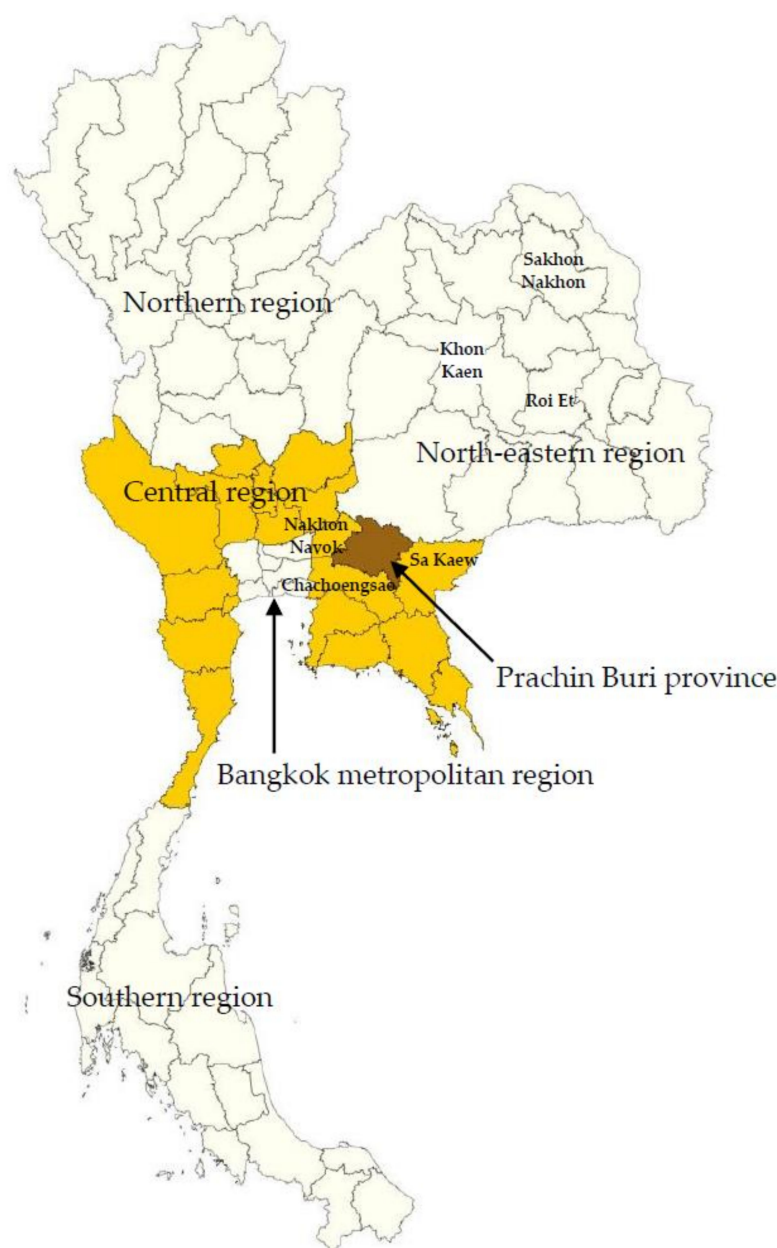
Satisfaction is an important proxy for the success or failure of a development programme's outcome [30], as it can show whether a programme's support has fulfilled participants' expectations and improved them in a desired outcome [30,31]. Participating farmers who are satisfied with an agricultural extension programme and their situation are more likely to continue farming [32]. We, therefore, also focused on evaluating participants' levels of satisfaction with the programme. A third hypothesis could, therefore, be formulated:

**Hypothesis 3 (H3).** *Participants in the YSE programme are satisfied with the programme.*

### 3. Data and Methods

#### 3.1. Research Area

The study was conducted in the Prachin Buri province in central Thailand (Figure 2) because of its importance as a large agricultural production area in the central region undergoing structural change (decreasing income from agriculture and a decline in the share of people employed in the agricultural sector). The province spans 2.98 million rai which equals 4762.36 km<sup>2</sup> (1 rai = 0.0016 km<sup>2</sup>) and is located ~136 km east of Bangkok. Most of the Prachin Buri province is used for agriculture (52.6%), especially rice (21.2%), perennial and fruit trees (16.2%), and field crops (10.8%) [33]. The agricultural sector contributes 2.2% to the Gross Provincial Product (GPP), where the service sector contributes 19.1% and the strongest industrial sector, comprising 965 large factories, contributes 78.7% [34]. The proportion of the population below 45 years accounts for 62.1% of the province's total population, while the population 60 years and older accounts for 16% [35]. Most people work in the service (47.3%) or industrial sectors (34.3%), with 18.4% working in the agricultural sector [33].



**Figure 2.** Study area in Prachin Buri province, Thailand.

### *3.2. Sampling, Data Collection and Questionnaire*

Data collection comprised two phases. First, young farmers (aged 17–45 years) participating in the Young Smart Farmer programme were interviewed in Thai between September and mid-October, 2018. We received a list of names, addresses, and contact numbers of all current participants from the Prachin Buri Provincial Agricultural Extension Office [36] and the Farmer Development Division [37], in the Department of Agricultural Extension. A total of 123 participants were listed, all of whom were contacted. About 50% (61 YSF programme participants) agreed to be interviewed.

Second, as a control group, non-participants within the same age range were interviewed between mid-October and late-December, 2018. We used a purposive sampling technique to select non-participants who lived in the same or neighbouring villages as the interviewed participants, with the intention to interview three times the number of non-participants than participants (183 people), as suggested by Olmos and Govindasamy [38]. Upon request, the village headmen provided assistance in contacting non-participants for



the interviews. Although 183 people were contacted, about 81% (149 non-participants) agreed to be interviewed.

We used semi-structured questionnaires, which were slightly modified after a pilot test with seven participants in early-September, 2018. The questionnaire for the programme participants and non-participants consisted of three similar parts: (1) demographic, family, and social characteristics, (2) farming and other occupational experiences, and (3) receipt of other support from the government. The participant questionnaire included an additional section regarding the programme participation.

### 3.3. Data Analysis

To evaluate the impact of the YSF programme participation on participants' net farm income and adoption of innovative farming methods other than common machinery and chemicals, we applied the Propensity Score Matching (PSM) method. We followed the five suggested steps of the PSM method [38,39], as follows:

- (1) estimation of the binary logistics regression model and propensity scores,
- (2) examination of common support between the distribution of propensity score estimated for participants and non-participants,
- (3) matching non-participants with participants based on their similar estimated propensity scores,
- (4) estimation of the programme's impact, and
- (5) examination of matching quality and influence of unobserved factors on the estimated programme impact (Table S1 in Supplementary Materials).

The PSM method was suitable to be applied in this study because it only needed comparative data on outcome variables, net farm income, and adopted innovative farming methods of participants and non-participants after joining the programme, and it could restrict the influence of other observed factors on the programme participation and the outcome variables.

To evaluate the participating young farmers' satisfaction with the programme, we asked questions on a 4-point scale about participants' perceived levels of satisfaction with each aspect of the programme (1 = very dissatisfied, 2 = dissatisfied, 3 = satisfied, and 4 = very satisfied). Participants were asked how satisfied they were with five different aspects of the programme: (1) the overall programme, (2) the programme publicity, (3) the opportunity for attending training and field trips, (4) the opportunity for networking among participants, and (5) the post-programme follow-up. We then calculated the percentage of the participants who were satisfied with each of the aspects and the average satisfaction scores for each aspect. We also applied non-parametric Kruskal–Wallis H and Mann–Whitney U tests to examine how the scores differed among participants with different characteristics.

## 4. Results

### 4.1. Sample Description

In total, 210 responses were obtained, although 34 were discarded because their key questions were incomplete. Of the remaining 176, 35% were from participants and 65% from non-participants. Most participants (74%) started their involvement in the YSF programme between 2016 and early 2018, while the rest (26%) were involved in the programme between 2014 and 2015. Gender was nearly balanced, with men accounting for 54% of the total sample (Table 1). Participants were significantly younger than non-participants (38.7 vs. 41.3 years), better educated (higher than year 9, the compulsory education level in Thailand), and had less farming experience (7.3 vs. 13.9 years). Participants were also more likely than non-participants to adopt innovative farming methods, other than common machinery and chemicals (92% vs. 78%), and to own the land on which they farmed (69% vs. 48%). Innovative farming methods here refer to adopting (1) agricultural machinery, (2) agricultural chemicals, (3) information and communication technologies (ICT), (4) biological methods for improving soil and water quality and dealing with plant

diseases and pests, (5) environmentally-controlled houses for growing crops and raising livestock, (6) management of farm irrigation systems, (7) management of farmland for different usage purposes and collection of farm statistical data for production planning, (8) solar cells for generating electricity for farm use, (9) hydroponics, and (10) other more efficient cultivation and animal husbandry techniques, such as using mung bean peels to increase nitrogen in mushroom cultivation).

**Table 1.** Definition and descriptive statistics of variables.

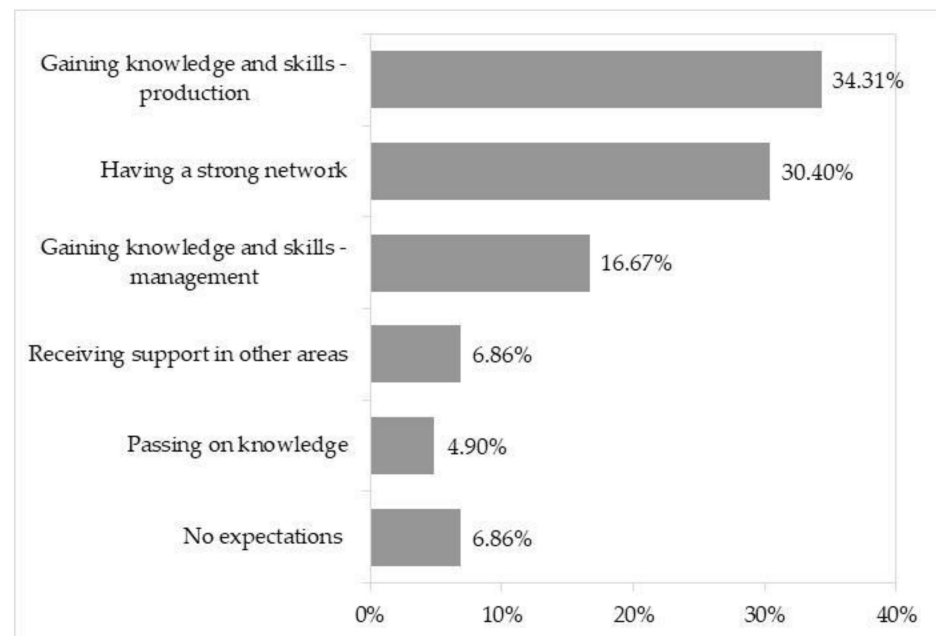
Variable	Coding/Definition	Total Sample ( <i>n</i> = 176)		Non-Participants ( <i>n</i> = 115; 65%)		Participants ( <i>n</i> = 61; 35%)		Difference
		Mean	SD	Mean	SD	Mean	SD	
<b>Outcome</b>								
<i>Net income</i>	Net farm income per rai in baht	31,152	111,541	27,979	73,215	37,134	161,391	<i>t</i> = −0.52
<i>Innovative method</i>	1 = adopts innovative farming methods other than common machineries and chemicals, 0 = none	0.83	0.38	0.78	0.41	0.92	0.28	$\chi^2 = 5.17$ **
<b>Demographic and family characteristics</b>								
<i>Gender</i>	1 = male, 0 = female	0.54	0.50	0.54	0.50	0.54	0.50	$\chi^2 = 0.001$
<i>Age</i>	Age of the farmer	40.40	5.47	41.31	4.75	38.67	6.30	<i>t</i> = 2.87 ***
<i>Education</i>	1 = completes education above year 9, 0 = none	0.62	0.49	0.46	0.50	0.92	0.28	$\chi^2 = 35.33$ ***
<i>Child</i>	1 = has a dependent child, 0 = none	0.63	0.48	0.64	0.48	0.62	0.49	$\chi^2 = 0.02$
<b>Farming characteristics</b>								
<i>Size</i>	Total area of farming in rai	30.75	40.29	30.91	33.50	30.46	51.03	<i>t</i> = 0.07
<i>Tenure</i>	1 = owns most of farmland, 0 = none	0.55	0.50	0.48	0.50	0.69	0.47	$\chi^2 = 7.12$ ***
<i>Activity</i>	1 = only produces rice, 0 = none	0.27	0.45	0.28	0.45	0.26	0.44	$\chi^2 = 0.05$
<i>Experience</i>	Number of years of own farming	11.61	8.17	13.91	8.22	7.27	6.08	<i>t</i> = 6.09 ***
<i>Off-farm income</i>	1 = off-farm income, 0 = none	0.75	0.43	0.79	0.41	0.67	0.47	$\chi^2 = 3.02$ *
<i>Other support</i>	1 = receives other farming support from the government, 0 = none	0.93	0.26	0.93	0.26	0.92	0.28	$\chi^2 = 0.09$
<b>Farming problem characteristics</b>								
<i>Marketing problem</i>	1 = faces falling product prices, rising costs, and insufficient funds; 0 = none	0.51	0.50	0.64	0.48	0.25	0.43	$\chi^2 = 25.20$ ***
<i>Pest problem</i>	1 = faces outbreak of plant diseases, weeds, insect, and animal pests; 0 = none	0.30	0.46	0.30	0.46	0.28	0.45	$\chi^2 = 0.13$
<i>Weather problem</i>	1 = faces irregular weather, 0 = none	0.39	0.49	0.43	0.50	0.33	0.47	$\chi^2 = 1.61$
<i>Soil problem</i>	1 = faces poor quality soil, 0 = none	0.06	0.24	0.05	0.22	0.08	0.28	$\chi^2 = 0.60$
<b>Farm location characteristics</b>								
<i>Distance1</i>	Distance from the farmer's farm to district agricultural extension office in km	14.21	8.52	13.82	8.85	14.93	7.86	<i>t</i> = −0.82
<i>Distance2</i>	Distance from the farmer's farm to provincial agricultural extension office in km	39.55	20.67	40.46	20.72	37.83	20.62	<i>t</i> = 0.80

**Notes.** Dependent child = child under 20 years old; irregular weather = flood and drought; \*, \*\*, \*\*\* significant at 10%, 5%, and 1% level.

#### 4.2. Inputs, Activities, and Outputs of the Young Smart Farmer Programme

Between 2014 and 2018, the research area received an annual budget of 3843 USD (128,082 baht) for implementing the YSF programme. This budget was calculated by taking the average of 50% of the Smarter Farmer programme's budget between 2014 and 2018 and dividing it by Thailand's 77 provinces [40]. In terms of personnel input, six officials of the Prachin Buri Provincial Agricultural Extension Office were made responsible for driving and overlooking the YSF programme. In addition to these officials, experts were invited from outside agencies, such as the Prachin Buri Agricultural Research and Development Center, the Office of Prachin Buri Provincial Commercial Affairs, and the Bank for Agriculture and Agricultural Cooperatives, to deliver the lectures as part of the programme.

Participants joined the programme because they mainly expected to gain knowledge and information about crop production, livestock, and edible insect culture (~34%); farm product management and marketing (~17%); as well as networking (~30%; Figure 3).



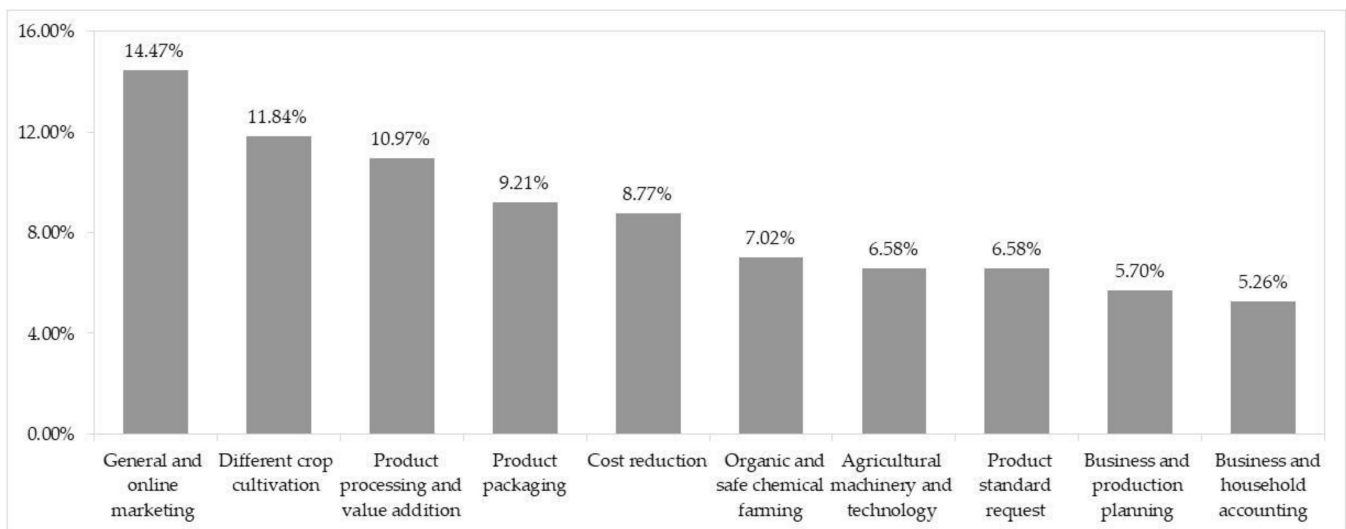
**Figure 3.** Reasons for participation in the Young Smart Farmer programme. **Notes.** *n* is 102, as some participants had more than one expectation; for more details, see Table S2 in Supplementary Materials.

In terms of activities and outputs, knowledge and information on post-harvest management; crop, aquaculture, and livestock production; and farming business administration were disseminated during the training, field trips, and meetings. Most of the knowledge and information participants gained were related to general and online marketing (~15%); different crop production (~12%); product processing and value addition (~11%); and product branding, packing, and story creation (~9%; Figure 4). However, many participants (~44%) stated that they were still unable to fully utilise the knowledge and information gained, while the remaining ~56% could utilize the knowledge quite fully. Additionally, networks among participants at both the provincial and district levels had been formed. Some participants also networked with participants in other provinces. About 69% of participants were still active members of the network. Amongst the members, ~86% stated that they received useful knowledge and information through the network, while the remaining 14% rarely had contact with the network. A mobile application (LINE) was used as a channel for communication among participants and relevant officials. The Young Farmer Development Learning Centre located in the study area was about to open for service in early October 2018.

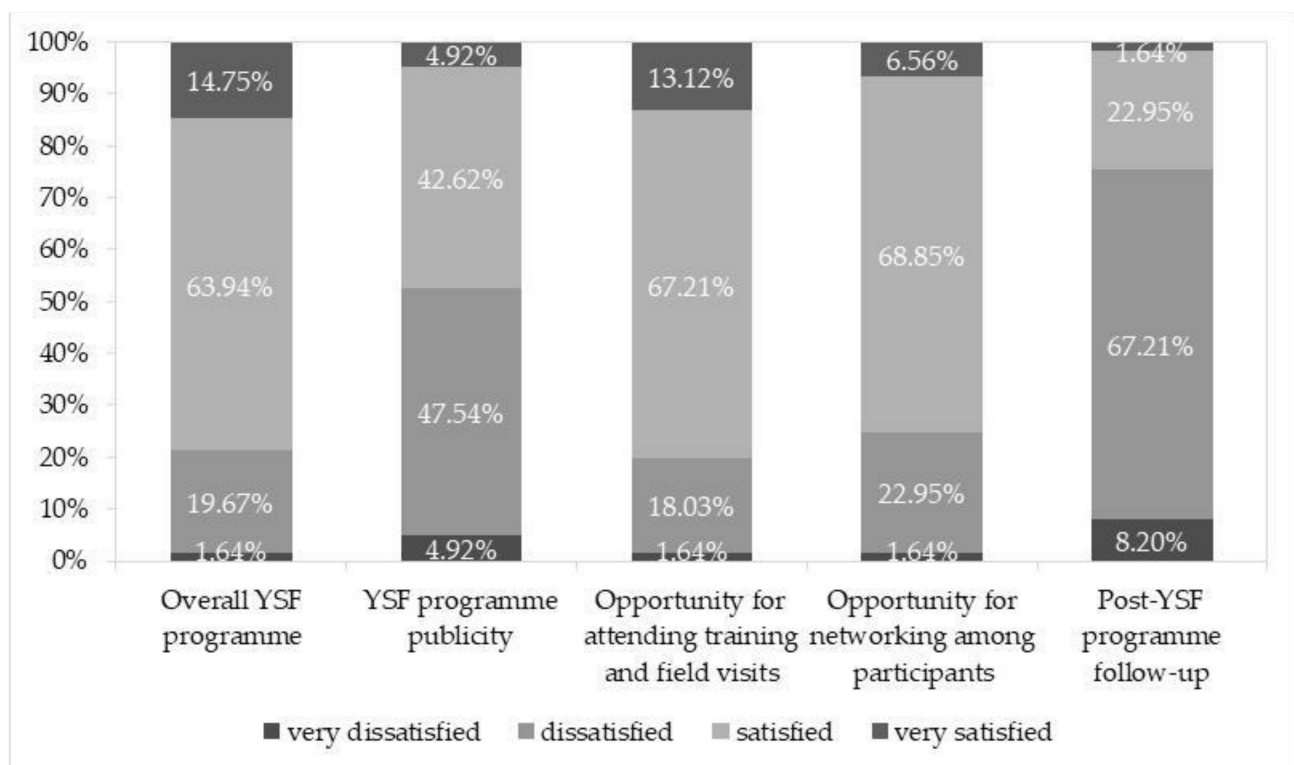
#### 4.3. Satisfaction with the Young Smart Farmer Programme

Overall, most participants were satisfied with the YSF programme (79%; ~64% satisfied and ~15% very satisfied; Figure 5). Participants were particularly satisfied with the main activities of the programme: training and field trips (~80%) and networking (~76%) opportunities provided. In addition, the participants' mean satisfaction score with the programme was 2.9 (SD = 0.64), which was closer to 3 (satisfied) than 2 (dissatisfied) (Table S4 in Supplementary Materials). Hypothesis 3 was therefore supported.





**Figure 4.** Top 10 areas of knowledge and information participants received from The Young Smart Farmer programme. **Notes.** For more details see Table S3 in Supplementary Materials.



**Figure 5.** Percentage of participants being satisfied at different levels with each aspect of the Young Smart Farmer programme. **Notes.**  $n = 61$  (number of interviewed participants), YSF = Young Smart Farmers.

Net farm income, farmland tenure, and farm activity had significant effects on the mean satisfaction, while innovative farming methods, farm size, off-farm income, and marketing problem had none (Table S5 in Supplementary Materials). Participants with medium (5001 to 10,000 baht/rai; 1 baht = 0.03 USD) and low farm income (<5001 baht/rai) had higher levels of mean satisfaction with the overall programme, and specifically, with the opportunities provided, than those with high farm income (>10,000 baht/rai). Those who did not own or who rented most of their land were more satisfied with the overall programme,

while those who only cultivated rice were more satisfied with the overall programme and, specifically, with the programme publicity and the opportunities provided.

#### 4.4. Impact Evaluation of the Young Smart Farmer Programme on Participants' Economic Viability

##### 4.4.1. Binary Logistic Regression Model and Propensity Score Estimation

The binary model had a reasonably good predictive power of farmer participation in the YSF programme, with a McFadden's R-squared of 0.37 (Table 2). The model showed that farmers were more likely to participate in the programme if they were better educated and had less farming experience, confirming the result of the bivariate analysis (Section 4.1). Those with more farmland, not facing challenges relating to marketing and irregular weather, and those whose farms were far from district agricultural extension offices were more likely to participate.

**Table 2.** Result of a binary logistic regression model of farmers' participation in the Young Smart Farmer programme.

Variable	Participation (n = 176)		
	Coef.	SE	OR
Gender	−0.29	0.46	0.75
Age	−0.001	0.04	1.00
Education	2.26 ***	0.63	9.60
Child	−0.005	0.44	1.00
Size	0.01 **	0.01	1.01
Tenure	0.005	0.48	1.01
Activity	0.84	0.60	2.31
Experience	−0.09 **	0.04	0.91
Off-farm income	−0.27	0.50	0.77
Other support	−0.38	0.81	0.69
Marketing problem	−2.31 ***	0.59	0.10
Pest problem	−0.80	0.51	0.45
Weather problem	−0.92 *	0.51	0.40
Soil problem	0.56	0.96	1.75
Distance1	0.09 **	0.04	1.10
Distance2	−0.02	0.02	0.98
Hosmer and Lemeshow goodness of fit test (Chi-squared)		8.99	
p-value		0.34	
McFadden's R-squared		0.37	

Notes. OR = odds ratio; \*, \*\*, \*\*\* significant at 10%, 5% and 1% level.

The binary model's propensity score estimate revealed adequate common support for further matching non-participants with participants (Figure S1 in Supplementary Materials). For every propensity score estimated for participants, there was the same or a close propensity score estimated for non-participants.

##### 4.4.2. Matching and Estimating the Young Smart Farmer Programme Effect on Participants' Net Farm Income and Adoption of Innovative Farming Methods

Using eight different matching algorithms, non-participants and participants with similar propensity scores were matched, and the matched sample was extracted from the total sample for each match for further estimation of the effect of the programme (Table 3).

**Table 3.** Result of simple linear and binary logistic regression models of the effect of the Young Smart Farmer programme on net farm income and adoption of innovative farming methods.

Variable	Matching Algorithm							
	NNM	NNMR 2:1	NNMR 0.20	NNMR 0.25	GM	OM	FM	SUB
	Net farm income							
Participation	−7526 (23,643) <sup>1</sup>	−7596 (31,097) <sup>1</sup>	−4703 (33,204) <sup>1</sup>	−4589 (32,724) <sup>1</sup>	−7716 (23,638) <sup>1</sup>	−7526 (23,643) <sup>1</sup>	−7188 (32,601) <sup>1</sup>	−8818 (29,023) <sup>1</sup>
	Innovative farming methods							
Participation	0.79 (2.20) <sup>2</sup>	0.53 (1.69) <sup>2</sup>	0.37 (1.45) <sup>2</sup>	0.37 (1.45) <sup>2</sup>	0.90 (2.46) <sup>2</sup>	0.79 (2.20) <sup>2</sup>	0.54 (1.72) <sup>2</sup>	0.60 (1.81) <sup>2</sup>
Matched samples	122	97	85	86	122	122	113	113
Non-participants	61	36	25	25	61	61	52	52
Participants	61	61	60	61	61	61	61	61

**Notes.** NNM = one-to-one nearest neighbour matching; NNMR 2:1 = two-to-one nearest neighbour matching with replacement; NNMR 0.20 = one-to-one nearest neighbour matching with replacement within a 0.20 caliper; NNMR 0.25 = one-to-one nearest neighbour matching with replacement within a 0.25 caliper; GM = one-to-one genetic Matching; OM = one-to-one optimal matching; FM = full matching; SUB = subclassification; <sup>1</sup> Numbers in parentheses = standard error; <sup>2</sup> Number in brackets = odds ratio; None of the estimated average net farm income difference and probability of adopting innovative farming methods was significant ( $p$ -value > 0.1).

The simple linear regression model after each match showed no effect of the programme on participants' net farm income. We found that, in general, although the estimated average net farm income difference between non-participants and participants differed across all matches, they had the same direction (Table 3). Participants tended to have a lower net farm income than non-participants, at between 4589 and 8818 baht/rai. However, the estimated net farm income difference was statistically insignificant for all matches ( $p$ -value > 0.1), meaning that participants had a similar net farm income to non-participants. Hypothesis 1 was, therefore, rejected.

The binary logistic regression model after each match also revealed no effect of the programme on participants' adoption of innovative farming methods other than common machinery and chemicals. We found that, generally, although the estimated probability of adopting innovative farming methods had the same direction for all matches, their values were different (Table 3). Participants tended to have 45% to 146% higher probability of adopting innovative farming methods than non-participants, although, again, the estimated probability of adopting innovative farming methods was statistically insignificant for all matches ( $p$ -value > 0.1), meaning that participants and non-participants adopted the same innovative farming methods. Therefore, hypothesis 2 was also rejected.

For validating the results, we examined the covariate balance and found that the matches were of good quality for all eight matching algorithms used (Table S6 in Supplementary Materials). When conducting the Rosenbaum's sensitivity analysis, we also found that the estimated programme effects were accurate and insensitive to unobserved confounders (Table S7 in Supplementary Materials).

## 5. Discussion

### 5.1. The Young Smart Farmer Programme Participation and Satisfaction

Farmers with less farming experience had a higher probability of participation in the YSF programme than those with more experience. This was not surprising because the YSF programme targets farmers who have just started their own farming business. In addition, farmers with limited experience might desire to improve their knowledge and skills and seek out the programme for this reason. Although farmer age has no effect on participation, those who were better educated were more likely to participate, perhaps because better-educated farmers had changed careers, probably either as a lifestyle choice or to return to support ageing parents in the rural area. These farmers might lack a farming background or, in the latter case, have left their parents' farm for another career path and, therefore, lack farming experience.

It was surprising to find that farmers with more farmland were more likely to join the programme than those with less, because young farmers generally start with smaller plots. However, some of these farmers may have farmed before or had taken over their

parents' large plots. This may also have been because they prioritize networking, as many participants with large farmlands indicated in the open-ended questions about their expectations from the programme. They networked to share their knowledge of new farming practices, to form large-scale farming groups to gain bargaining power when purchasing inputs and distributing their products, and to present their needs and opinions directly to government agencies. Farmers who had not faced any farming challenges, such as marketing and irregular weather, were also more likely to participate in the programme than those who had, which may be because some of these participants were relatively new to farming and may not yet have either experienced or been aware of these challenges.

One of the three desired programme's outcomes was achieved: that of being satisfactory to the participants. We found that participants were satisfied with the overall programme and with the two main activities of the programme: the provision of training and field trips and the formation of a young smart farmer network. This may have been because the programme provided a wide range of knowledge and information, from production to distribution, as well as related technologies and farm business management, that they may then have been able to apply later in their farming career, as discussed by participants (~32% of the comment, Table S8 in Supplementary Materials). They also had received some helpful information and advice from their peers and other members of the established young smart farmer network, as shown in Section 4.2 and described by Pratiwi and Suzuki [41]: the contributions to farm development provided by the advisory role of farmers' social networks.

We also found that satisfaction differed by net farm income, farmland tenure, and farm activity. In contrast to Phiboon, Cochetel, and Faysse [7], we found that farmers with a high income were the least satisfied. This may have been due to their independence from the programme support, indicating that they had the least to gain from participation. Those who do not own land or rent most of their land were more satisfied with the overall programme, because most of them (~74%) belong to the low-income group. Farmers with different farming types have different information needs, which influence their satisfaction levels of public extension services [42]. This was also shown here, with rice farmers being the most satisfied, which may again be related to the low-income of the majority of rice farmers (~94%). Those who rented most of their land and produced only rice, therefore, may have gained the most from programme participation.

### 5.2. Impact of the Young Smart Farmer Programme

It was surprising to find that the YSF programme implemented in the study area fell short of delivering two of its three desired outcomes, in that it neither increased participants' financial independence nor motivated participants to adopt innovative farming methods other than common machinery and chemicals. We found that participants and non-participants were alike in terms of net farm income and adoption of innovative farming methods. As a result, the programme may be less likely to reach its overall aim of incentivising young people to continue, return to, or enter farming and thereby provide a replacement for older farmers. This was also found by Filloux [43], who concluded that the programme weakly influenced agricultural students in Chachoengsao, Sa Kaew, Roi Et, and Sakhon Nakhon provinces in their agricultural career choices and interests in becoming full-time farmers.

The explanations for the missing relationship between programme participation and increase in net farm income, which differed from the existing studies on similar programmes (e.g., [32,44,45]), may have been related to the problems of the programme's inputs, activities, and outputs, as discussed by participants (Table S9 in Supplementary Materials). First, the programme's activities still lacked continuity and excessively focused on theoretical knowledge and information transfer through training or meeting, with little practices and field trips and no additional relevant services and assistances (~17% of the problems discussed). These may not be enough support for participants whose farms are struggling for survival against challenges, such as water shortage, lack of infrastructure,

smaller plots, narrow marketing channels, and encounters with disasters, as also described elsewhere [7,17,21,46,47].

Second, the same trainings and field trips were provided to all participants, regardless of their levels of farming knowledge, experience, farming activities, and products (~16% of the problems discussed). Third, the contents of the programme's trainings and field trips were still largely determined by the agency responsible for the programme, with little involvement by participants (~12% of the problems discussed). Phiboon, Cochetel, and Faysse [7] and Tripp, Wijeratne, and Piyadasa [21] also reflected on this problem that, under the bureaucracy, the agencies still primarily focused on implementing such programmes to achieve their own goals rather than the participants' goals. Fourth, as a result of the previous two problems, the contents of the trainings and field trips still do not fit participants' current farming purposes (~14% of the problems discussed), and therefore, they allowed participants to partially utilise the knowledge and information gained from the programme, as shown in Section 4.2. While some of participants who had just started farming set their first priority purposes of developing themselves into productive producers, they noticed that some of the knowledge transferred was instead aimed at developing them into modern entrepreneurs and vice versa. Last, some of participants were already satisfied with their farming practices and simple and peaceful lives and, therefore, had little incentive to attend all training and field trips provided (~11% of the problems discussed).

Furthermore, although previous studies found a positive relationship between agricultural extension programmes participation and the adoption of novel farming technologies (e.g., [48–50]), our results did not indicate a similar conclusion. This may have been because of the two already mentioned problems. First, the technological knowledge and information participants gained from the programme were inconsistent with and inapplicable to the farming activities of some participants. Second, the programme had neither direct technological (e.g., related materials, equipment, tools, machineries, and designs) nor financial support for individual participants, and participants themselves may also have had no other financial resources to pay for innovative methods. Technology-based methods, such as greenhouses and automatic irrigation systems, are relatively expensive (e.g., [32,47]) for farmers to adopt without further support. Third, some participants may have already adopted some methods (e.g., biofertilizers and biopesticides) before joining the programme and did not intend to adopt more. Last, most participants had just joined the programme (one to three years prior to the survey), and this period might not have been long enough to detect the impact of the programme on their adoption of innovative farming methods and increase in net farm income, as sometimes a policy's impact on individuals' economic well-being can take multiple years to be adequately measured [51].

Although our study implied that the programme's overarching aim might not have been achieved, during the discussions with the participants, most of them (~62%) had commented that their farming, which was mostly organic and low-chemical farming, could help inspire young people to take up farming due to the non-monetary farming benefits they gained, such as being healthy and living close to their family. It also should be noted that the programme's ineffectiveness on improving farmers' financial independence and innovative farming methods adoption found in our study might not always be the case in other provinces of Thailand where the programme had also been implemented. In Khon Kaen Province, it was found that the programme helped farmers to upskill their entrepreneurial capacity and to develop market-oriented productions, novel technology use, self-reliance and bargaining power, and eventually succeeded in stabilising their incomes [52].

### 5.3. Policy Recommendations

Participants' expectations of gaining knowledge and information, especially on a theoretical basis, from the YSF programme appeared to be met, and participants seemed to be satisfied with the knowledge and information transferred. However, knowledge and information transfer itself, as it is currently conducted, might not motivate participants



to stay in the programme and continue their farming in the long run. If participants do not concretely become economically independent in their farming, they are likely to change career paths, sooner or later, particularly those with better education. Based on our findings and participants' suggestions (Table S10 in Supplementary Materials), we, therefore, recommend that the programme should improve its own implementations to enable participants to more fully utilise the knowledge and information transferred and to meet its two unmet outcomes, i.e., improving participants' financial independence and innovative farming method adoption, as follows.

Programmes that fail to provide support that meets the participants' needs will undermine the participants' interest in joining other similar programmes [7,21,22]. Participants in this study also suggested that the programme's activities should be based on their needs and include more hands-on practice sessions (~33% and ~9% of the suggestions, respectively). First, the programme should, therefore, ask participants what subjects they really want to learn and use that information every time to design and hold trainings and field trips for participants. Such training and field trips should also be focused more on the workshops and visits of participants' and other farmers' farms in both the study area and nearby provinces. Second, modifying extension services' methods and content to suit each client group will help to increase service usage, performance, and satisfaction [7,21,25,35,40], and participants also suggested that the development provided by the programme should be differentiated and appropriate for each participant group with different types of farming activities (~8% of the suggestions). The programme could, therefore, apply a career path design to provide better-targeted training and field trip methods and content based on a production system (rice cultivation, fruit tree plantation, and organic vegetable production). Additionally, within each career path, participant development should be divided based on their farming knowledge and skill level, such that those participants without basic knowledge and skills are separated from those with basic, intermediate, and advanced knowledge and skills. For example, newcomers could be trained to focus on how to grow crops to generate a high yield, and beginners could be trained on how to improve their product quality. Training those with intermediate knowledge and skills could be on product processing and marketing channels, and training for the advanced could be on agribusiness and entrepreneurship.

Rural out-migration of young people and ageing farmers increases the risk of not meeting the food demand of a growing population. Motivating young people to stay as farmers is only one aspect. The other is to ensure the farms are more efficient and benefit from an economy of scale, using innovative technologies. Instead of increasing or retaining the number of small-scale farms, one solution might be to convert small-scale farms into larger and more competitive farms [2]. Participants also suggested that any support other than or related to training and field trips are needed and should be provided to improve their farming performance (~26% of the suggestions). Third, we therefore recommend that the programme could provide loans with soft and flexible terms (e.g., low-interest rate, long instalment period, and long interest-free period) to participants to make this transition into more commercial farms, also consistent with Faysse, Phiboon, and Fillous [17] and Salvago [20]. With better financial resources, farmers could buy or lease additional land from those farmers who retire and do not have a successor, and they could invest in better technologies and machinery.

Fourth, also in line with Faysse, Phiboon, and Fillous [17] and Salvago [20], the programme could provide subvention (periodic payment or lump sum) and insurance to participants to mitigate their inadequate or reduced incomes and to enable them to continue farming during their initial start-up period, when they are not competitive or sufficiently profitable, or when they face difficulties in production and product distribution, such as flooding, drought, plant disease and pest outbreak, or the current pandemic (COVID-19).

Fifth, the programme could also provide other non-monetary support to participants to directly help them in solving their structural farming problems, such as water shortages or a narrow and limited marketing channel. For instance, the programme could help partic-

ipants with pond construction to reserve water for dry season use, develop the prominent points of their products to distinguish them from other farmers' groups, publicise their products to the general public, and arrange for them to become a permanent supplier to a store or establish a shop for them to sell their products.

#### 5.4. Study Limitations

Although our study's results were in line with a prior study by Filloux [43] in terms of potential ineffectiveness of the programme, our study still had some limitations. First of all, we did not directly evaluate the impact of the programme on the rates of young people entering and exiting farming as its primary aim, but we inferred this from the evaluation of the programme's impact on its desired outcomes, as was done by Nordin and Lovén [2]. Future research could gather such data over the timeframe of the programme.

Second, the sample size of our study was relatively small and limited to one area. While the methods can be applied elsewhere, the results may not be generalized across the country. The implementation of the programme throughout the country is based on the same principles, but the outcomes of the programme are likely to differ from one area to another, as seen in a prior study [52].

## 6. Conclusions

The decline in the number of young farmers, which Thailand and many other countries are currently experiencing, may lead to challenges in maintaining the countries' agricultural sector competitiveness, sustainability, and food security. To cope with these potential challenges, young farmers' capacity-building programmes have been implemented in many countries, including Thailand. In Thailand, the latest of such a programme is the Young Smart Farmer (YSF) programme. It started in 2014, with the desired outcomes to improve young farmers' financial independence, to enhance innovative farming method adoption of young farmers, and to obtain satisfaction from young farmers, thereby maintaining their long-term involvement. This was done with the hope to motivate young people to continue, return to, or enter farming. Although some of these programmes have been in place for some time, and the YSF programme has been in place for over seven years, no rigorous impact evaluation had yet been made. This study contributes to the literature on the role of government in retaining and increasing the number of young people in the agricultural sector. We did so by applying quantitative analytical methods to evaluate the success of the YSF programme, which specifically aimed to improve the economic status of young farmers. We applied the Propensity Score Matching (PSM) method to evaluate the impact of the YSF programme on participants' net farm income and adoption of innovative farming methods other than common machinery and chemicals, and we used farmers' self-rated satisfaction to evaluate satisfaction with each aspect of the programme. We found that the majority of participants (79%) were satisfied with the overall programme and particularly with the training, field trips, and networking opportunities provided. Participants with low and medium farm income, renting most of their land, and solely producing rice were more satisfied with the overall programme. We could not detect a significant difference in net farm income or the probability of adopting innovative farming methods between participants and non-participants, and therefore, we failed to assure that the programme had been meeting two of its three desired outcomes. Therefore, the overarching aim of the programme of persuading young people to continue, return to, or enter farming may be less likely to be achieved. Reasons for this failure might be related to the training and field trips that are offered through the programme, that are not targeted to specific farmer groups, and that may fail to meet the knowledge and information needs of farmers with different experience and skill levels. Additionally, farmers might prefer support beyond the provisions of training and field trips, but this is not yet available through the programme. The results can help to improve the programme and to make it fit for the purpose of eventually halting the exodus of young farmers in Thailand. The evaluation technique and the findings of this study are also relevant to similar programmes

in other countries, such as the agricultural entrepreneurship education programme in the Philippines and the farmer field school programme in Sri Lanka, which have not yet been adequately evaluated and which face the similar implementation problems, leading to less effectiveness of the programmes [21,24].

**Supplementary Materials:** The following are available online at <https://www.mdpi.com/article/10.3390/su132111611/s1>: Table S1: Five steps of PSM analysis. Table S2: Reasons for participation in the Young Smart Farmer programme. Table S3: Receipt of knowledge and information from The Young Smart Farmer programme. Table S4: Satisfaction with the Young Smart Farmer programme. Table S5: Satisfaction with the Young Smart Farmers programme by participants' characteristics. Table S6: Result of calculating the absolute standardized mean difference and chi-square statistics for examining the covariate balance before and after matching. Table S7: Result of analysing Rosenbaum's sensitivity. Table S8: Participants' comments on the merits and benefit of the Young Smart Farmer programme. Table S9: Participants' comments on the problems of the Young Smart Farmer programme. Table S10: Participants' recommendations on the Young Smart Farmer programme. Figure S1: Distribution of propensity scores predicted for participants and non-participants.

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