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Exploring the relation between farmer organization and welfare using propensity score matching approach: Evidence from madurese traditional salt farmers in indonesia

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ABSTRACT
This research aims to examine the relation between farmer organization and welfare using Propensity Score Matching approach. Numerous prior studies have demonstrated that farmers' involvement in a producer group significantly affects their income levels, efficiency rates, and the adoption of cutting-edge agricultural technologies. However, there have been few studies on salt farming in Madura Island, despite its status as a primary salt producer in Indonesia. This study focused on examining how the participation of salt farmers in farmer groups, specifically known as the "Traditional Salt Business Group" (or Kelompok Usaha Garam Rakyat [KUGAR] in Indonesian), impacts their agricultural income. In this study, the researchers examined primary data collected through interviews with 115 traditional salt farmers on Madura Island, East Java, Indonesia. Logistic regression analysis revealed three independent variables affecting the decisions of salt farmers, specifically farmer's latest level of education, salt production in the last season, and the number of their family members. Then, employing a Propensity Score Matching (PSM) approach, the study showed a significant income disparity between salt farmers who were KUGAR members and those who are not. Moreover, the level of education emerged as a key determinant influencing salt farmers' decisions to join KUGAR. Furthermore, the Indonesian government could intervene by encouraging younger salt farmers to join the producer groups to realize benefits, including improvements in the well-being of salt farmers.

Contribution/Originality: This research adds to the theoretical framework by providing empirical evidence on the effects of participation in producer organizations among salt farmers on Madura Island, utilizing a propensity score matching approach. Additionally, it thoroughly investigates the socio-economic factors influencing the Madurese salt farmers' decisions to join producer organizations.

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1. INTRODUCTION

Madura Island is Indonesia's primary salt producer. Despite being a part of East Java, Madura Island maintains a geographical separation from Java Island. Ministry of Maritime Affairs and Fisheries in 2018 showed that almost 25% of Indonesia's salt supply in 2018 came from Madura Island. (Prihantini, Syaukat, & Fariyanti, 2017a) noted that the untapped potential of Pamekasan, Bangkalan, Sumenep, and Sampang regencies could potentially contribute to the national salt production in the future.

Historically, there have been two types of salt farming in Indonesia (Rochwulaningsih, 2012). The first type is small-scale salt farming conducted on individual salt fields either by individual farmers or owned by the community. The second type involves collaboration with one of the state-owned enterprises, namely PT Garam, resulting in a partnership between PT Garam and salt farmers. The local community typically acts as laborers, with contract farming arrangements frequently in place (Prihantini, Syaukat, & Fariyanti, 2017b).

It should be noted that there are three common salt production methods employed by salt-producing countries worldwide, namely solar evaporation, rock salt mining, and solution-mined salt (Ihsanuddin & Pinuji, 2020; Rochwulaningsih, 2012; Sedivy, 2009). Solar evaporation is a time-honored method that entails the production of salt through the evaporation of seawater in artificial ponds, salt marshes, or salt flats, marking one of the earliest techniques in the industry. This method heavily relies on weather conditions, evaporation rates, and the quality of the land or salt ponds. Rock salt mining is carried out using the extraction method. Rock salt (halite) is a term referring to the salt residue in ancient oceans formed millions of years ago when lagoons got dry. This salt layer is below the rock formations and can be found underground and within mountains. Rock salt is a term referring to dry salt extract from these salt-containing rock layers, using the mining methods. Lastly, solution-mined salt is produced by dissolving underground salt and then pumping the salty water to the surface. In this phase, the salt is extracted from the rock salt layers at a depth reaching 400 meters, in which water is pumped down and the resulted salty water is removed. The concentrated salt solution is then directed to collection tanks and transported to salt factories for softening and undergoing the crystallization process in evaporator plants. Based on salt production methods, salt in Madura Island is generally processed using the solar evaporation method (Jamil, 2014; Prihantini, 2016).

Despite being the largest salt producer in Indonesia, the prosperity of salt farmers in Madura Island is still relatively low (Prihantini, 2016; Prihantini et al., 2017a). Various efforts have been carried out to improve their welfare, including extensive, intensive, and revitalization measures. One form of the revitalization to enhance the prosperity of salt farmers is through the Traditional Salt Business Development (or Pengembangan Usaha Garam Rakyat [PUGAR] in Indonesian language) program by participating in the Traditional Salt Business Group (Indonesian: Kelompok Usaha Garam Rakyat [KUGAR]). Salt farmers expect various benefits from the PUGAR program, including intensive counselling, transfer of the latest production technology, and literacy in sustainable salt production, among others.

Numerous studies on the impact of farmers and fishermen's participation in a producer group or organization denoted positive effects. For example, current research indicates an increase in income (Abdul-Rahaman & Abdulai, 2018, 2020; Agarwal, 2018; Ma, Zheng, & Yuan, 2022) improvement in efficiency (Abate, Francesconi, & Getnet, 2014; Ainembabazi et al., 2017; Gong, Battese, & Villano, 2019; Olagunju, Ogunniyi, Oyetunde-Usman, Omotayo, & Awotide, 2021) higher productivity (Grashuis & Skevas, 2023; Lin, Wang, Jin, Yang, & Li, 2022) utilization of the new technologies (Ibnu, Offermans, & Glasbergen, 2018; Wossen et al., 2017; Wu, Guo, & Guo, 2023; Yang, Zhang, Liu, & Qiao, 2021) as well as other positive impacts (Fischer & Qaim, 2012; Grashuis, 2020; Hao et al., 2018).

Efficiency rate in the traditional salt farming process in Madura ranges from 55% to 78%, and this method remains profitable with a return on investment (R/C) or benefit-cost (B/C) ratio above 1 (Effendy, Zainuri, & Hafiludin, 2014; Prihantini, 2022). We have not extensively analyzed the impact of salt farmers' participation in Madura Island. However, this study is crucial for the Indonesian government, through the Ministry of Marine Affairs and Fisheries, in formulating policies that could potentially enhance the well-being of salt farmers, including their participation in KUGAR. Currently, salt farmers receive numerous benefits from their participation.

The first section of this paper discusses the characteristics of each respondent group, namely salt farmers who participate in KUGAR and those who do not. The second part explores the factors behind the participation of salt farmers in KUGAR, while the third section delves into the effect of this participation on the prosperity of salt farmers using the Propensity Score Matching approach. This research is expected to be empirical evidence for the government and relevant stakeholders in their efforts to enhance the welfare of salt farmers through the increased participation in KUGAR.

2. MATERIALS AND METHODS

2.1. Research Data

This research was conducted in a major salt-producing area of Madura Island, specifically Pamekasan Regency. This research location was intentionally chosen due to the highest level of salt farmer participation in KUGAR, compared to other regencies. Using the simple random sampling method, 115 salt farmers were selected. The salt farmers were categorized into two groups, namely the farmers joining KUGAR (treatment group) and other farmers not joining KUGAR (control group). Interviews were conducted with 115 respondents regarding the traditional salt farming, particularly in the least season of 2023.

2.2. Data Analysis Methods

2.2.1. The Analysis of Factors Influencing Salt Farmers' Participation in Traditional Salt Business Groups (Kelompok Usaha Garam Rakyat [KUGAR])

This analysis was conducted to examine the reasons behind the salt farmers' decision to join the Traditional Salt Business Group (Kelompok Usaha Garam Rakyat [KUGAR] in Indonesian language) program. Decision of these salt farmers' participation in KUGAR was investigated by utilizing the binary logistic regression as well as the Maximum Likelihood Estimator (MLE) method (Gujarati, 2003). Equation 1 represents the factors influencing the salt farmers' decision to participate in KUGAR.

$$L_i = ln\left(\frac{P_i}{1-P_i}\right) = Z_i = \gamma_0 + \gamma_1 X_1 + \gamma_2 X_2 + \gamma_3 X_3 + \gamma_4 X_4 + \gamma_5 X_5 + \gamma_6 X_6 \quad (1)$$

Where:

Li = Logarithmic equation.
Pi = Probability to participate in KUGAR.
(1 – Pi) = Probability not to participate in KUGAR.
Zi = Decision of the salt farmer.
γ_0 = Intercept.
γi = Parameter of variable Xi.
X_1 = Salt farmers' age (in years).
X_2 = Education level.
X_3 = Salt farmer's experience (in years).
X_4 = Salt production (in tons).
X_5 = Salt farm area (in Ha).
X_6 = Number of family members (total individuals in salt farmer's family).

Factors in the salt farmers' decision to join KUGAR were determined using theories and other empirical experiences from several researches conducted by Bernard and Spielman (2009); Barrett et al. (2012); Fischer and Qaim (2012); Ito, Bao, and Su (2012) and Verhofstadt and Maertens (2015).

The odds ratio interpretation was frequently used in the logistic regression models, which illustrated the relationship among categorical variables. The odds value for salt farmers not participating in KUGAR ($y = 0$) was defined as $\frac{\pi 1}{(1-\pi 1)}$, while the odds value for salt farmers participating in KUGAR ($y = 1$) was defined as $\frac{\pi 2}{(1-\pi 2)}$. The odds ratio itself represented comparison of the odds value for $y = 0$ and the odds value for $y = 1$. Prihantini et al. (2017b) introduced the odds ratio equation, as shown in Equation 2.

$$Odds\ Ratio = \frac{\frac{\pi 1}{(1-\pi 1)}}{\frac{\pi 2}{(1-\pi 2)}} \quad (2)$$

Subsequently, the produced logistic regression model was tested for its adequacy. Tests were conducted three times in this research, in (a) model significance tests, (b) model goodness-of-fit tests, and (c) partial tests and model formation. These tests showed the decisions based on hypotheses as formulated earlier.

2.2.1.1. Model Evaluation

Every regression required an assessment of its models' suitability. The tests conducted on every model were based on the regression model and the utilized method. This study applied two diverse models and methods, namely binary logistic regression with Maximum Likelihood Estimator (MLE) method as well as multiple linear regression with the Ordinary Least Squares (OLS) method. The tests were conducted as follows by the writers:

2.2.1.2. Model Significance Test (G-Test)

The logistic model significance test was conducted for assessing significance of the salt farmers' participation and their characteristics in participating in KUGAR. This test was conducted by analyzing the G-value and deciding the formulated hypotheses. The hypotheses were explained as follows:

$H_0 = 0$: *Independent variables without any significance towards dependent variable.*
$H_1 \neq 0$: *Independent variables having significance towards dependent variable.*
Decisions to be made were as follows.
Accept H_0 for p-value higher than α.
Reject H_0 for p-value lower than α.

2.2.1.3. Model Goodness-of-Fit Tests

These tests aimed to analyze salt farmers' decision-making and participation in KUGAR. These tests were conducted by examining the values from each method, namely Pearson, Deviance, and Hosmer–Lemeshow tests. Decisions were made based on the resulting p-value from every method. The formulated hypotheses were as follows:

H_0: The model is sufficiently capable of defining data.
H_1: The model is not sufficiently capable of defining data.
Decisions to be taken were as follows:

Accept H_0 for p-value higher than α.

Reject H_0 for p-value lower than α.

2.2.1.4. Partial Test and Model Formation

The test was conducted to examine effect of each independent variable on its dependent variable. Decisions were made in accordance with the p-value from every independent variable. Hypotheses are formulated as follows:

H_0: The i-th independent variable did not have any significance towards dependent variable.

H_1: The i-th independent variable had significance towards dependent variable.

Decisions to be taken are as follows:

Accept H_0 for p-value higher than α.

Reject H_0 for p-value lower than α.

2.2.2. The Effect of Involvement in KUGAR towards Salt Famers' Prosperity

This analysis aimed to estimate effect of the salt farmers' participation in KUGAR on their prosperity. This impact analysis was conducted using Propensity Score Matching (PSM) technique. This method was widely applied to accurately analyze treatment effects by ensuring that these distinctions were considered to minimize a selection bias. It enabled the construction of a counterfactual scenario for the treatment group using the control group (Abadie & Imbens, 2006; Heinrich, Maffioli, & Vázquez, 2010).

PSM is among estimation techniques to evaluate a program or intervention by striving to form a control group closely resembling the participant (treatment) group, by considering the observed characteristics (Getler, Martinez, & Premand, 2010; Khandker, Koolwal, Gayatri, & Samad, 2010). The current study was designed by involving participant (treatment) groups, who were salt farmers participating in KUGAR. The control group included salt farmers who were not participating in KUGAR. A commonly fundamental issue when using the PSM was an inability to simultaneously measure the potential outcomes of respondents participating in KUGAR (Y_{1i}) and the control group (Y_{0i}). Since only one of the groups can be observed, the utilized estimation model allowed for examining the average impact of participating in KUGAR. This method is known as the Average Treatment Effect on the Treated (ATT) approach. The PSM estimation model and ATT approach were capable of estimating the average value for respondents participating in KUGAR and those who were not. The ATT model can be expressed in Equation 3 (Getler et al., 2010; Khandker et al., 2010).

$$ATT = E(Y_1|D = 1) - E(Y_0|D = 1) \quad (3)$$

In the equation, ATT is the difference in the outcome variable (net income from the traditional salt business in the last season), estimated from the household needs of salt farmers participating in KUGAR, i.e., E [Y1i | Di = 1], subtracted by household needs of salt farmers not participating in KUGAR, i.e., E [Y0i | Di = 0]. The area where the propensity distribution overlapped, between the salt farmers who participated in KUGAR and those who did not was termed the common support area. If characteristics of some salt farmers in KUGAR group cannot be matched with those of salt farmers in the non-KUGAR group, the effect cannot be accurately calculated.

Salt farmers who participated in KUGAR were believed to be experience an increase in production, quality, and overall well-being. This analysis aimed to identify the effects of salt farmers' involvement in KUGAR on their well-being. Therefore, the study investigated a significant difference between salt farmers who were KUGAR as well as non-KUGAR participants, viewed from their prosperity.

3. RESULTS AND DISCUSSION

3.1. Respondents' Characteristics

Table 1 described net income of KUGAR members at average IDR 12,833,732.69, while that of non-KUGAR members was average IDR 22,283,846.32. This indicated that average net income earned by the salt farmers not participating in KUGAR was lower. Furthermore, the average age of non-KUGAR members was averagely 44.46 years, compared to 50.41 years for KUGAR members. This result indicated that the average age of KUGAR members was younger.

The family members of non-KUGAR participants were averagely 2-3 people, while those of KUGAR participants were also averagely 2-3 people. The number of family members in each group was often the same. The farming experience of non-KUGAR members was averagely 11-12 years, while that of KUGAR members was averagely 16-17 years. This showed that the average experience of salt farmers participating in KUGAR was longer.

The production of non-KUGAR members was averagely 81.77 tons, whereas that of KUGAR members was averagely 192.58 tons. This indicated that the average production of salt farmers participating in KUGAR was higher. The average land area of non-KUGAR members was 1 hectare, whereas that of KUGAR members was averagely 2.15 hectares. This indicated that the average land area owned by the salt farmers participating in KUGAR was wider.

Table 1. Descriptive statistics of salt farmers' samples.

Variables	Participation	N	Minimum	Maximum	Mean	Std. deviation
Income	Non-KUGAR	13	4910075.00	19492625.00	12833732.69	3746216.93
	KUGAR	102	5277033.33	203552650.00	22283846.32	26294157.20
Age	Non-KUGAR	13	35.00	64.00	44.46	10.10
	KUGAR	102	31.00	69.00	50.41	8.85
Number of family members	Non-KUGAR	13	2.00	4.00	2.38	0.65
	KUGAR	102	1.00	8.00	2.80	1.47
Farming experience	Non-KUGAR	13	2.00	25.00	11.15	7.65
	KUGAR	102	2.00	50.00	16.04	9.58
Production	Non-KUGAR	13	65.00	110.00	81.77	12.92
	KUGAR	102	60.00	1702.00	192.58	216.12
Land area	Non-KUGAR	13	1.00	1.00	1	0
	KUGAR	102	1.00	20.00	2.15	2.44

3.2. Determinants of Salt Farmers' Decision to Participate in KUGAR

This study used a binary logistic regression analysis to examine several factors that influence salt farmers' decision to be KUGAR members. The analysis incorporated six independent variables in the salt farmers, namely age, education level, the farming experience, the width of salt land owned, salt production volume, and the number of family members.

3.2.1. Model Significance Test (G-Test)

G-test results in Table 2 showed G-value of 47.070 and a log-likelihood value of -4.774. Based on the criteria for accepting or rejecting H_0, the obtained p-value was 0.000 (p-value < 0.10). Therefore, the decision was to reject H_0. H_0 = 0 signified that independent variables did not significantly affect dependent variables), while $H_1 \neq 0$ indicated that independent variables significantly affected dependent variables. A conclusion to reject H_0 implied that independent variables collectively and significantly affected salt farmers' decisions regarding their participation in KUGAR. In other words, the independent variables in this logistic regression model can affect decision to get involved in KUGAR, so the model can be utilized in further analyses.

3.2.2. Model Goodness-of-Fit Tests

The output resulted by the SPSS program in Table 2 showed a result from goodness-of-fit tests, as shown in the p-value for each method used, namely Pearson, Deviance, and Hosmer–Lemeshow tests. The reason for rejecting H_0 in this test was p-value > α. It turned out that each method had a p-value > α (p-value > 0.10). In the context of H_0 (the model adequately defined data) and H_1 (the model did not adequately define data), it was concluded that H_0 was rejected. To put it another way, we deemed this model of salt farmers' decisions regarding KUGAR participation sufficiently capable of explaining the collected field data, making it suitable for estimating their decisions.

3.2.3. Measures of Association

The values in measures of association were employed to examine the variability from dependent variable. Based on the concordant value in Table 2, a percentage of 98.8 was obtained. This value indicates that the dependent variables in the model define 98.8 percent of the dependent variable variability, while independent variables outside the model define 1.2 percent.

Table 2. Result of the regression analysis on aspects affecting salt farmers' decisions regarding their participation in KUGAR in Pamekasan Regency, 2023.

Variables	Coefficient	*P*-value	Odds ratio
Constant	5.129	0.152	
Age of salt farmers	0.133	0.069**	0.876
Extent of salt land	0.0001983	0.916	1.000
Experience of salt farmers	0.092	0.272	1.097
Education of salt farmers	0.742	0.096**	0.476
Salt production	0.082	0.004***	1.085
Number of family members	0.822	0.131*	2.275
Log-likelihood = -4.774			
Test that all slopes are zero: G = 47.070, DF = 5, *P*-value = 0.000			
Goodness-of-fit tests			
Method	Chi-squared	DF	*P*
Pearson	15.122	35	0.999
Deviance	9.548	35	1.000
Hosmer-Lemeshow	4.183	8	0.840
Measures of association			
Concordant	98.8 %		

Note: Statistical significance (Robust): ***p < 0.01, **p < 0.1, *p < 0.15.
Source: Processed primary data, 2024.

Table 2 shows the values for Somers' D and Goodman–Kruskal's gamma approach 1. This indicated that the predictive capacity of the model obtained was quite robust (Firdaus, Harmini, & Farid, 2011). In essence, the model for salt farmers' decisions regarding participation in KUGAR has demonstrated sufficient effectiveness for practical use.

3.2.4. Partial Test and Model Formation (Wald Test)

The output from the SPSS program in Table 2 indicated that five independent variables significantly affected the dependent variable. The criterion for accepting H_0 was p-value > α. Several variables, namely the age of salt farmers, the latest education of salt farmers, salt production volume, and the number of family members, had p-values < α (p-value < 0.01; 0.1; 0.15), leading to the decision to reject H_0. In the context of H_0 (i-th independent variable had no significance towards dependent variable) and H_1 (i-th independent variable had significance towards dependent variable), these four variables were considered to have a significant effect on the salt farmers' decisions regarding their participation in KUGAR. Meanwhile, the other two variables (i.e., experience and land width of the salt farmers) were deemed to have no effects on salt farmers' decisions to be KUGAR members.

3.2.5. Interpretation of Odds Ratio Values

Wald test revealed that four independent variables significantly affected dependent variable. These variables were the age of salt farmers, education of the salt farmers, salt production volume, and family members. A variable for the number of family members was significant at α = 15%. In addition, the age of salt farmers and their education level were significant at α = 10%. Furthermore, the salt production volume variable was significant at α = 1%. Conversely, the independent variables without significance at α = 15% were the experience of salt farmers and the extent of salt land. These variables were suspected to have a non-significant impact due to the limited data variation obtained in the field, indicating homogeneity in the acquired data. Subsequently, the odds ratio values obtained for these independent variables will be interpreted further. The odds ratio values depicted the likelihood comparison of salt farmers participating in KUGAR versus salt farmers not participating in KUGAR.

3.2.5.1. Age of the Salt Farmers

The p-value obtained for this variable was 0.069. The criterion for accepting H_0 was p-value < α. Therefore, the decision made was to accept H_0, indicating that the age of salt farmers significantly affected their decision regarding the participation in KUGAR with a confidence interval of 90 percent. A variable, age of the salt farmers, had an odds ratio value of 0.876. This value can be interpreted as meaning that salt farmers who were ten years older had an 8.76 times higher chance of participating in KUGAR compared to salt farmers who were ten years younger. In other words, older salt farmers had a greater possibility of 0.876 times joining KUGAR.

The parameter value generated for this variable was positive. This meant that older salt farmers were more likely participate in KUGAR. This tendency may arise because salt farmers were generally divided into an above-average or older age group. This finding matched other studies as conducted by Abdul-Rahaman and Abdulai (2020) and Baga, Utami, and Wahyudi (2023). According to Baga et al. (2023) older farmers may be more experienced in agricultural practices, compared to their younger counterparts, providing them with greater access and networks within the farming community. However, this did not suggest that younger farmers were not interested in joining farmer groups, more likely due to their lower representation in the agricultural sector.

3.2.5.2. Salt Land Area

The p-value of salt land area variable was 0.916, higher than 10 percent (p-value > 0.15). Therefore, it was decided to accept H_0. This means that, with a confidence interval of 85 percent, the variable of salt land area possessed by salt farmers did not significantly affect salt farmers' decision to join KUGAR. The salt land area variable had an odds ratio value of 1.00. This value can be interpreted as meaning that salt farmers with larger or smaller salt field areas had an equal possibility of participating in KUGAR. In other words, all salt farmers intending to participate in KUGAR had no constraints related to the size of their salt land area. Salt farmers with limited salt land were equally likely to participate in KUGAR as those with extensive salt land. Therefore, regardless of the salt land area possessed by a salt farmer, they can freely decide to participate in KUGAR.

The obtained parameter value was positive. The desire to participate in KUGAR tended to increase with the larger salt land area possessed by a salt farmer because salt farmers with sufficient experience understood that participation in farmer groups, including KUGAR, allowed them to gain more benefits, namely information on production technology, access to government assistance, and other advantages. This study was in line with other research conducted by Bernard and Spielman (2009); Chagwiza, Muradian, and Ruben (2016); Fischer and Qaim (2012); Grashuis and Cook (2018) and Baga et al. (2023). Research by Baga et al. (2023) explained that farmers owning wider land are more likely to join farmer organizations, in line with land status within these farmer groups. Farmers who actively manage their cultivated land tend to participate in farmer groups. As observed in other instances, wealthier farmers are more inclined to join farmer groups compared to their less affluent counterparts.

3.2.5.3. Farming Experience of Salt Farmers

The p-value obtained for this variable was 0.272, higher than 10 percent (p-value > 0.15). It was concluded to accept H_0. This means that the farming experience variable had no bearing on their decisions. The farming experience variable had an odds ratio value of 1.097. This odds ratio value indicated that for every additional year of farming

experience, the likelihood of participating in KUGAR increased by 1.097 times, compared to salt farmers with lower farming experience.

The parameter value for the farming experience variable turned out to be positive. This showed that a longer farming experience was associated with a greater desire to participate in KUGAR. Additionally, the parameter sign for this variable was positive. This implied that with the increasing farming experience, salt farmers acquired a deeper understanding of the nuances involved in salt farming. Salt farmers will understand that participating in KUGAR will provide them with more benefits. According to Baga et al. (2023); Abdul-Rahaman and Abdulai (2020) and Grashuis and Cook (2021) farmers with extensive experience tended to have broader access and networks compared to those with shorter or lower experience. Rahman and Huang (2021) also obtained similar research results, where experience in performing fishing activities (in their case, fishermen in East Java Province) also had a non-significant influence on fishermen's decisions regarding participation in fishermen groups.

3.2.5.4. Latest Education Level of Salt Farmers

The p-value obtained for this variable was 0.096, lower than 10 percent (p-value < 0.10). Therefore, it was decided to reject H_0. This indicated that salt farmers' education level had a significant impact on their decision to participate in KUGAR. The education level variable of salt farmers had an odds ratio value of 0.476. This odds ratio value can be interpreted as meaning that salt farmers with higher education had a higher likelihood of 0.476 times to join KUGAR, compared to salt farmers with lower education. In other words, higher education level can enhance the likelihood of joining KUGAR at 0.476 times. This conclusion was similar to the researches by Qu et al. (2020) and Yang et al. (2021) in which education level affected decisions regarding participation in farmer groups.

The positive parameter sign in the education level variable indicated that higher education level showed a greater tendency to participate in KUGAR. This result supported several previous studies, including those conducted by Ma and Abdulai (2016) and Methamontri, Tsusaka, Zulfiqar, Yukongdi, and Datta (2022) in which a higher participation level in farmer groups was related to higher formal education levels among rice farmers. Rahman and Huang (2021) and Baga et al. (2023) also had the similar research findings for this variable.

3.2.5.5. Salt Production

For the salt production variable the p-value was 0.004. This value was smaller than a significance level of 10% (p-value < 0.01). Therefore, it was decided to reject H_0. This indicates that, at a 99 percent confidence level, the produced salt production variable significantly affected the salt farmers' decision to join KUGAR. The salt production variable had an odds ratio value of 1.085. It can be interpreted that for salt farmers whose salt production was ten tons higher, the likelihood of participating in KUGAR increased by 10.085 times, compared to salt farmers with lower production.

The obtained parameter value was positive. As the salt production and reception by salt farmers increased, the inclination to participate in KUGAR tended to rise. Based on the field observation, this phenomenon occurred because salt farmers actively engaging in KUGAR typically had a wider access to information, including the latest salt production technology. Consequently, their production results and land productivity were higher compared to non-KUGAR salt farmers. The research conducted by Barrett et al. (2012) concluded that agricultural land managed by farmers actively participating in producer groups was more productive than that of non-participating farmers. This was in line with other studies conducted by Blekking, Gatti, Waldman, Evans, and Baylis (2021); Chagwiza et al. (2016); Gong et al. (2019) and Qu et al. (2020) who stated that farmers engaged in the producer groups were relatively more productive and efficient than non-participating farmers. Farmers in producer groups significantly motivated themselves to achieve high agricultural yields, which influenced this phenomenon. This will unquestionably bring about positive outcomes for salt farmers if the salt fields they cultivate yield favorable results, as it directly influences the income and profits obtained by these salt farmers.

3.2.5.6. Number of Family Members of Salt Farmers

The p-value obtained for this variable was 0.131. A requirement for rejecting H_0 was the p-value < α. Therefore, the decision to be taken was to reject H_0, indicating that the variable representing family members of salt farmers significantly affected the decision to participate in KUGAR within an 85 percent confidence interval. The number of family members had an odds ratio of 2.275. It can be interpreted that salt farmers with one more family member had a 2.275 times higher likelihood of joining KUGAR. In other words, one more family member can increase the likelihood to join farmers' group by 0.26 times. These research findings were similar to the conclusions of Gyau, Franzel, Chiatoh, Nimino, and Owusu (2014) and Ito et al. (2012) stating that family member were a decisive factor in joining producer groups or organizations.

The parameter value was positive. The number of family members among salt farmers possibly had a positive correlation with the decision to join KUGAR. The result of this research was similar to a study by Mojo, Fischer, and Degefa (2017). Binary logistic regression regarding an involvement in the cooperative indicated that demographic and socio-economic factors (e.g., age, level of education, the number of family members, and land ownership) significantly increased the possibility of farmers joining the cooperative.

3.3. Propensity Score Matching Analysis on the Effects of Salt Farmers' Involvement in KUGAR on Their Welfare

This research examined the effect of salt farmers' using the Propensity Score Matching (PSM) analysis. The PSM was estimated through the psmatch2 command in STATA. The variables used as covariates in the matching procedure significantly affected salt farmers' decision to join KUGAR based on result of the logit analysis. Significant variables,

in estimating the aspects of salt farmers' participation in KUGAR, included the latest level of education, family members, and the period of farming activities. The outcome between treatment and control groups was the net income earned by salt farmers in the last cropping season of 2023. The first step involves determining the propensity values for treatment and control groups by conducting a logit regression on the covariate variables. Table 3.displays the logit reaction result to determine the propensity scores.

Table 3. Results of logit regression testing to obtain propensity score.

Variables	Coefficient	Z	$P>\|z\|$	Note
Age	0.061	0.41	0.680	Not significant
Latest education level	-1.236	-2.14	0.032*	Significant
Number of family members	-1.954	-2.03	0.043*	Significant
Farming duration	-0.336	-2	0.045*	Significant
Production	0.044	1.19	0.233	Not significant
Mobile phone ownership	-2.232	-1.12	0.263	Not significant
Internet access	-2.906	-1.8	0.071	Not significant
Region of origin	-0.409	-0.37	0.712	Not significant
Constant	9.525	1.31	0.189	Not significant

Note: Statistical significance level (Robust): *$p < 0.05$.
Source: Processed primary data, 2024.

The impact of farmers' participation in KUGAR was calculated using PSM with the nearest-neighbor (NN) method, which involved matching the nearest propensity scores of every respondent of treatment group (participating in KUGAR) with control group (not participating in KUGAR) in a single matching process. This matching process resulted in ATT, representing distinctions found in treatment and control groups. ATT value signified distinction between treatment and control groups. Variables without any significant effect on farmers' decisions to participate in KUGAR, (e.g., age, production, mobile phone ownership, internet access, land size, social factors, and region of origin) were excluded as covariates in estimating ATT. Table 4 illustrates the outcome distinction in the treatment and control groups, by applying the psmatch2 program in STATA 17.

Table 4. Effect of the involvement in KUGAR analyzed by psmatch2 and nearest neighbor method.

Variable	Samples	Not participating in KUGAR	Participating in KUGAR	Difference	SE	T-stat
Income	Unmatched	12833732.7	22283846.3	9450113.65	7329611.34	1.29
	ATT	14380982.1	22283846.3	7902864.24	3049005.11	2.59

In Table 4, the effect of salt farmers' involvement in KUGAR on their income was evident in the difference of IDR 9,450,113.65 (IDR means the Indonesian Rupiah (Rp), the official currency of Indonesia). After matching, as indicated by the ATT, the net income of salt farmers showed a difference of IDR 7,902,864.24. Based on the impact assessment using the psmatch2 and nearest neighbor methods, it can be observed that the participation of salt farmers in KUGAR can enhance the net income of salt farming.

Table 4 indicates that the difference in net income for salt farmers participating and not participating in KUGAR, before matching, was IDR 9,450,113.65. After matching, the difference was IDR 7,902,864.24. The net income for those participating in KUGAR was IDR 22,283,846.30, while for those not participating, it was IDR 14,380,982.10. The *t*-test results revealed that after matching, the net income of salt farming in both KUGAR and non-KUGAR groups showed a significant difference (*t*-test > 2). This indicates that participating in KUGAR can significantly increase the net income of salt farming.

The findings of this research were similar to another research conducted by Baga et al. (2023) indicating that participation in producer organizations (including farmer groups, fishermen groups, livestock groups, and cooperatives) empirically had a significant impact on prosperity. Farmers participation in producers groups or organizations significantly influences productivity, agricultural efficiency, and the ease of accessing marketing and distribution channels. As previously conducted, research shows a positive relationship and supports theories and concepts regarding this.

In general, farmers' participation also affects their access to government programs, such as assistance in production inputs, cash aid to farmers, subsidies for production inputs, and the adoption of the latest production technologies. Therefore, it is essential to prioritize extension activities to sustain and enhance community participation in farmers' groups, emphasizing that this engagement should persist beyond government assistance programs. This is due to the myriad of benefits and advantages that farmers stand to gain through their active engagement in producer groups/organizations.

4. CONCLUSION

The productivity of the agricultural sector, in a broad sense, is important for the sustainable development in the densely populated and developing countries, such as Indonesia. This research focuses on examining the significance of

involvement in salt farmer groups in shaping salt farming practices and the well-being of farmers in the Indonesian salt sector. Despite Indonesia having the longest coastline globally, the livelihoods of coastal communities, including salt farmers, are not entirely categorized as prosperous. Empirical findings confirm a positive relation between participation in salt farmer groups and prosperity of salt farmers on Madura Island. Salt farmers engaged in salt farmer groups (i.e., KUGAR) experience higher levels of well-being compared to those who do not participate in these groups. Therefore, these results consistently support the argument for the significance of farmer groups in enhancing the well-being of farmers, as emphasized in several previous studies.

Moreover, participation in farmers' groups is affected by some aspects, including age, education, farming experience, width of the owned salt land, salt production quantity, and number of their family members. These factors positively affect the likelihood of participating as members of a farmers' group. Several policies can be made from empirical findings in this research. In general, these findings mark the advantages of salt farmers' participation in their groups in an effort to improve the prosperity of small-scale salt farmers on Madura Island. Enhancing the well-being of salt farmers may not solely rely on increasing agricultural production factors. Interventions in institutional aspects, such as promotion of salt farmer groups or other collective actions, can support any development project. In practice, the government can leverage the role of farmers' groups to implement or introduce new production technology products. This also reduces the transaction costs in the implementation of agricultural projects, leading to more effective and efficient agricultural policies.

Therefore, increasing and sustained support from various stakeholders—including the government, private companies, and other development institutions—is crucial in forming farmer groups and undertaking development projects in the agriculture sector more broadly. Despite the common assumption that farmer groups can merely serve as a tool for government politics to convey their interests, particularly in Indonesia, the farmer groups play an important role in enhancing prosperity of many farmers should not be overlooked.

The level of education significantly influences salt farmers in deciding their participation in salt farmer groups (KUGAR). This indicates that the education of salt farmers should be a primary concern, especially for the younger generation in agriculture, to cultivate interest in the agricultural sector, including fisheries, livestock, and salt farming. Direct educational programs for farmers' or their children can achieve this.

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Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
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