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From participation to well-being: The welfare effects of cooperative membership among food farmers in Indonesia

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Abstract

Purpose: This study examines the causal impact of cooperative membership on the subjective well-being of food crop farmers in Indonesia, measured through self-reported indicators of Happiness and Life Satisfaction.

Design/Methodology/Approach: Utilizing panel data from the Indonesian Family Life Survey 5 (IFLS-5), the study covers 13 provinces and includes 3,475 food-farming households, comprising 792 cooperative members and 2,683 non-members. A probit regression model is employed to identify socioeconomic determinants of cooperative participation, followed by Propensity Score Matching (PSM) and Inverse Probability Weighted Regression Adjustment (IPWRA) to estimate the treatment effects on well-being outcomes.

Findings: The probit results reveal that mobile phone usage, gender, experience of crop failure, and residential location significantly affect the likelihood of joining a cooperative. Both PSM and IPWRA estimates indicate that cooperative membership leads to a statistically significant increase in Happiness (by 42–45%) and Life Satisfaction (by 25–29%). These findings highlight that cooperatives contribute not only to economic stability but also to psychosocial dimensions of farmer well-being, including income predictability, future orientation, and social inclusion.

Social Implications: The study recommends repositioning cooperatives as inclusive institutions that not only provide economic services but also foster training, digital access, gender-sensitive participation, psychosocial support, and risk-sharing, thereby enhancing farmers' happiness, life satisfaction, and overall welfare.

Originality/Value: This study uniquely integrates subjective well-being indicators to assess cooperative impacts, offering national-scale evidence for psychosocial and economic welfare improvements.

Keywords: Happiness, life satisfaction, psychosocial dimensions, subjective well-being.

Katılımdan refaha: Endonezyalı gıda üreticisi çiftçiler arasında kooperatif üyeliğinin refah etkileri

Özet

Amaç: Bu çalışma, kooperatif üyeliğinin Endonezyalı gıda üreticisi çiftçilerin öznel iyi oluşu üzerindeki nedensel etkisini, mutluluk ve yaşam doyumu gibi öz bildirimli göstergelerle ölçerek incelemektedir.

Tasarım/Metodoloji/Yaklaşım: Çalışma, Endonezya Aile Yaşam Araştırması'nın (IFLS-5) beşinci dalgasından elde edilen panel verileri kullanmaktadır. 13 ili kapsayan çalışmaya, 792'si kooperatif üyesi ve 2.683'ü üye olmayan toplam 3.475 gıda üreticisi hane dâhil edilmiştir. Katılımın sosyoekonomik belirleyicilerini analiz etmek için probit regresyon modeli kullanılmış, ardından Koşullu Olasılık Eşleştirmesi (PSM) ve Ters Olasılık Ağırlıklı Regresyon Ayarlaması (IPWRA) yöntemleriyle öznel iyi oluş üzerindeki etkiler tahmin edilmiştir.

Bulgular: Probit sonuçları, cep telefonu kullanımı, cinsiyet, ürün kaybı yaşanması ve yerleşim yeri gibi değişkenlerin kooperatif üyeliği üzerinde anlamlı etkisi olduğunu göstermektedir. PSM ve IPWRA tahminlerine göre, kooperatif üyeliği mutluluğu %42–45 ve yaşam doyumunu %25–29 oranında artırmaktadır. Bu bulgular, kooperatiflerin yalnızca ekonomik istikrar sağlamakla kalmayıp, aynı zamanda gelir öngörülebilirliği, geleceğe yönelik bakış açısı ve sosyal dâhil olma gibi psikososyal boyutlarda da çiftçi refahına katkıda bulunduğunu göstermektedir.

Sosyal Çıkarımlar: Çalışma, kooperatiflerin yalnızca ekonomik hizmetler sunan değil, aynı zamanda eğitim, dijital erişim, toplumsal cinsiyete duyarlı katılım, psiko-sosyal destek ve risk paylaşımını da sağlayan kapsayıcı kurumlar olarak yeniden konumlandırılmasını önermektedir. Bu sayede çiftçilerin mutluluğu, yaşam memnuniyeti ve genel refahı güçlendirilebilir.

Özgünlük/Değer: Bu çalışma, kooperatiflerin etkilerini değerlendirmek için öznel iyi oluş göstergelerini entegre ederek, psikososyal ve ekonomik refah alanlarında ulusal düzeyde kanıt sunan özgün bir yaklaşım ortaya koymaktadır.

Anahtar kelimeler: Mutluluk, yaşam doyumu, psikososyal boyutlar, öznel iyi oluş.

INTRODUCTION

The World Bank has classified Indonesia as experiencing extreme poverty in 2025, with a poverty rate of 60.3% of the population (World Bank, 2025). However, this figure has sparked controversy among various stakeholders, as it contradicts the official statistics released by the Republic of Indonesia's Central Bureau of Statistics BPS (2025), which reports a poverty rate of 8.57%. The discrepancy arises from differing methodologies: the World Bank employs the global poverty standard for upper-middle-income countries (US$6.85 per day), whereas BPS uses the national poverty line, calculated based on basic needs (food and non-food) specific to each province. It is important to note that the World Bank's data is not intended to replace BPS figures but rather to facilitate global welfare comparisons, particularly among countries with similar geographical and economic conditions, such as agrarian economies. Fauziyah et al (2024) and Kubitza et al (2018) argue that, as an agricultural country, Indonesia's poverty among farming households is exacerbated by the predominance of small-scale farmers with limited land ownership. Supporting this claim, BPS (2024) data indicates that 48.86% of Indonesian agricultural households remain below the poverty line. This suggests that nearly half of the country's agricultural workers have yet to achieve a decent standard of living, underscoring the urgent need for structural policy interventions.

Poverty among farmers remains a persistent and unresolved issue in many developing economies. Multiple interrelated factors contribute to this challenge at the farm level. A key driver is the low economic value of staple food commodities (Amankwah & Gwatidzo, 2024), exacerbated by inefficient and uncoordinated food distribution systems (Toiba et al., 2020). Farmers also face structural constraints including weak socio-economic conditions (Islam & Farjana, 2024; Qiu et al., 2024; Massresha et al., 2021), technological gaps that depress productivity (Zegeye, Fikire, et al., 2022; Syafrial et al., 2021; Zegeye, Meshesha, et al., 2022; Hanani et al., 2024), and limited access to critical production resources such as arable land, capital, and labor due to rural outmigration (Deng et al., 2021; Afodu et al., 2021; Xu et al., 2023; Song et al., 2022). While various interventions have been proposed, agricultural cooperatives emerge as a particularly effective institutional solution. Research demonstrates that cooperatives enhance productivity (Geffersa, 2024), strengthen market bargaining power (Ng'ombe et al., 2025; Nowfal et al., 2025; Njoya et al., 2025; Yang et al., 2021), and improve farmers' socio-economic capacity (Ingutia & Sumelius, 2024). These findings suggest that cooperatives can play a transformative role in creating sustainable agricultural ecosystems, making them a critical component of poverty alleviation strategies.

While existing studies have explored the relationship between agricultural cooperatives and farmer welfare, significant research gaps remain particularly concerning Indonesia's food crop farmers. Previous analyses have predominantly focused on single-commodity case studies (e.g., dairy farming (Onyango et al., 2023), cashew production (Iyioku et al., 2024), and teff cultivation (Gemechu et al., 2025)), yielding fragmented insights that lack generalizability to broader food agriculture systems. Crucially, these studies fail to account for Indonesia's distinct agroecological conditions and cooperative institutional frameworks. Given this contextual disparity, there is a pressing need for nationally representative research examining how cooperatives influence the welfare of food crop farmers. Such studies would not only enhance the empirical validity of findings but also provide a stronger evidence base for targeted policy interventions.

Furthermore, existing studies evaluating the impact of agricultural cooperatives have predominantly focused on material welfare indicators, including income levels (Onyango et al., 2023; Baiyegunhi et al., 2022), technical efficiency (Gemechu et al., 2025), access to credit (Ingutia & Sumelius, 2024), and food security (Ng'ombe et al., 2025), with some extending to health-related outcomes (Wu et al., 2023). However, a critical gap remains in the examination of non-material dimensions of well-being particularly subjective measures such as Life Satisfaction and Happiness within the context of farmer cooperatives, especially those involving food crop producers. While some studies, such as Nugroho et al. (2022), have explored subjective well-being through the lens of social capital, and Rahman et al. (2023) investigated its relationship with digital connectivity, no research to date has systematically analyzed how cooperatives, as socio-economic institutions, influence well-being from a psychological perspective. This oversight has significant implications, as it limits our understanding of cooperatives' holistic impact on food farmers' welfare, particularly in the Indonesian context where such institutions play a crucial role in rural development. Addressing this gap would provide a more comprehensive framework for assessing cooperatives' effectiveness in enhancing farmer welfare beyond purely economic metrics.

This study makes four key empirical contributions to the existing literature. First, it provides evidence-based findings derived from a national survey dataset, offering unprecedented representativeness in analyzing the conditions of food farmers across Indonesia. To our knowledge, this constitutes one of the first comprehensive attempts to

systematically examine the influence of cooperatives on the subjective well-being of food farmers at a national scale. Second, the study introduces an innovative welfare measurement framework grounded in subjective well-being indicators an approach seldom employed in cooperative impact studies. By integrating social, economic, and psychological dimensions, this methodology presents a novel alternative for assessing farming household welfare, thereby establishing a valuable reference for future research in agrarian and institutional economics. Third, the findings offer critical insights for policymaking related to cooperative development in Indonesia. By demonstrating the connection between cooperative participation and psychological well-being, the research enables policymakers to design more holistic cooperative strengthening programs that extend beyond purely economic considerations. Such an approach directly supports the achievement of Sustainable Development Goals (SDGs), particularly in poverty reduction (SDG 1), improved well-being (SDG 3), and the development of inclusive institutions (SDG 16). Finally, the study provides practical benefits for cooperative institutions themselves. The results highlight the dual role of cooperatives as both economic entities and social welfare enhancers, offering empirical justification for cooperatives to enhance their services, strengthen social networks, and develop member-centric welfare programs. In light of these potential contributions, this study aims to rigorously measure the impact of cooperatives on the welfare of food farming households in Indonesia.

MATERIAL AND METHOD

Research data

This study utilizes secondary data obtained from the fifth wave of the Indonesia Family Life Survey (IFLS 5), conducted by the RAND Corporation and publicly accessible through their official website (https://www.rand.org/well-being/social-and-behavioral-policy/data/FLS/IFLS.html). The IFLS 5 dataset represents cross-sectional data collected during 2014-2015, providing a robust representation of Indonesian household conditions. The survey's comprehensive coverage includes 83% of the Indonesian population (Nugroho et al., 2022) with data collected across 13 representative provinces (Rahman et al., 2023), ensuring strong external validity for national-level analysis. From the complete dataset containing information on cooperative participation for 31,411 households, we implemented a rigorous selection process to identify our target population. We specifically extracted data on agricultural households, categorizing them into five distinct groups: horticulture farmers, PALAWIJA (secondary crop) commodity farmers, plantation farmers (including coffee, sugarcane, etc.), livestock producers (meat and dairy), and fisheries. This selection process yielded a final analytical sample of 3,475 farming households, comprising 792 cooperative member households and 2,683 non-member households.

This study draws on specific variables from the IFLS5 dataset to address its research objectives. The key independent variable is operationalized as a binary measure of cooperative participation, where 1 indicates membership and 0 denotes non-membership. For assessing subjective well-being, we expand upon previous measurement approaches (Nugroho et al., 2022; Rahman et al., 2023) by incorporating multidimensional indicators grounded in established theoretical frameworks. Specifically, Life Satisfaction is measured through wealth level assessments (Wong et al., 2006) and standard of living evaluations, while Happiness is gauged through consumption needs fulfillment and health status satisfaction (Carver & Grimes, 2019; Mathentamo et al., 2024). The complete operational definitions, measurement scales, and item formulations for these subjective well-being variables are systematically presented in Table 1, providing a transparent foundation for our analytical approach.

Table 1. Indicator of the welfare variable

Variable	Description	Scores
Happiness	1.Current state regarding the level of *Happiness*	4= Very happy; 3 = Happy; 2 = Unhappy; 1 = Very unhappy
	2.Whether the household condition sufficiently meets daily needs	1= Insufficient; 2 = Just sufficient; 3 = More than sufficient
	3.Respondent's overall living condition	1= Insufficient; 2 = Just sufficient; 3 = More than sufficient
	4.Condition of healthcare services available to the household	1= Insufficient; 2 = Just sufficient; 3 = More than sufficient
	5.Respondent's perception of the adequacy of household needs over the next five years (assuming annual changes in the cost of living)	4 = Very easy; 3 = Easy; 2 = Difficult; 1 = Very difficult
Life Satisfaction	1Respondent's level of satisfaction with their current life	1 = Very dissatisfied; 2 = Dissatisfied; 3 = Somewhat satisfied; 4 = Satisfied; 5 = Very satisfied
	2.Respondent's current perception of their level of wealth (on a scale of 1 to 6)	1= Poorest; 6 = Wealthiest
	3.Respondent's future perception of their level of wealth in the next five years (on a scale of 1 to 6)	1 = Poorest; 6 = Wealthiest

Source: The Welfare Indicators, 2024 – BPS Statistics Indonesia

Furthermore, this study incorporates a comprehensive set of socioeconomic control variables to account for potential confounding factors. The selected variables include: demographic characteristics (age, gender, marital status); technological access (mobile phone ownership, internet usage); employment status (non-farm employment); agricultural risk exposure (crop failure probability); geographic factors (place of residence); health status; social assistance participation (cash transfer recipients); economic standing (family economic category); and educational attainment (categorized as primary, junior secondary, senior secondary, diploma, and tertiary education). These variables were carefully selected based on their established relevance to farmer welfare outcomes in previous literature. The operationalization of all socioeconomic variables, including their measurement specifications and response categories, is detailed in Table 2.

Table 1. Socioeconomic research variables

Variable	Description	Mean	Std.dev
Age	Age of the farmer (in years)	38.08719	15.68228
Marital status	1 if married, 0 otherwise	.7156835	.4511532
Mobile Phone Ownership	1 if the farmer owns a mobile phone for agricultural purposes, 0 otherwise	.2040288	.4030481
Internet Usage	1 if the farmer has internet access, 0 otherwise	.3548201	.4785276
Non-agricultural work	1 if any family member works in the non-agricultural sector, 0 otherwise	.337554	.4729436
Gender	1 = Male, 0 = Female	.4906475	.4999845
Risk of Crop Failure	1 if experienced crop failure in the past 12 months, 0 otherwise	.2886331	.4531922
Residence Location	1 = Urban, 0 = Rural	.4382734	.4962466
Happiness	Likert scale (1–4) for current level of *Happiness*, and (1–5) for adequacy of needs	11.27971	2.414104
Life Satisfaction	Likert scale (1–5) for satisfaction with life, and (1–5) for perceived wealth status	6.442014	1.52234
Health Condition	Respondent's health condition (4 = Excellent; 3 = Good; 2 = Fair; 1 = Poor)	2.93554	.696558
Cash Assistance	1 if the respondent received cash assistance from the government, 0 otherwise	.2382734	.4260885
Household Economic Status	Categorization based on the government-issued certificate of economic status (1 = Able; 0 = Poor/Underprivileged)	.2123741	.4090471
Primary Education	1 if respondents completed primary education, 0 otherwise	.3628777	.4808992
Junior High School Education	1 if respondents completed lower secondary education (SMP), 0 otherwise	.2946763	.4559627
Senior High School Education	1 if respondents completed upper secondary education (SMA/SMK), 0 otherwise	.2535252	.4350915
Diploma Education	1 if respondents completed diploma-level education, 0 otherwise	.0238849	.1527125
University Education	1 if respondents completed bachelor's, master's, or doctoral degree, 0 otherwise	.0638849	.244583

Source: Author's calculation Based on Secondary Data, 2025

Estimation strategy

Our empirical analysis yielded three key findings: (1) comparative socio-demographic characteristics between cooperative members and non-members among food farmers, (2) determinants influencing farmers' participation decisions in cooperatives, and (3) the causal effect of cooperative participation on subjective welfare outcomes (Happiness and Life Satisfaction).

To examine systematic differences between cooperative members and non-members, we employed independent samples t-tests with the following specification:

$$T_{test} = \frac{\bar{x} - \mu_0}{\hat{S}/\sqrt{n}} \quad 1$$

where $\bar{x}$ represent sample means, $\hat{S}$ denotes the pooled standard deviation, and n indicates sample sizes for each group (cooperative members vs. non-members). This analytical approach allows us to rigorously test for statistically significant differences in socioeconomic characteristics between the two populations (Toiba et al., 2020). The results provide crucial insights into the baseline comparability of these groups prior to examining participation determinants and welfare impacts.

Then, we employ a probit regression model to analyze the determinants of cooperative participation among food farmers, with our dichotomous dependent variable coded as 1 for cooperative members and 0 for non-members. probit regression function can be formulated as follows:

$$Pi(Yi = 1|Xi) = \Phi(Z) = \Phi(b0 + b1X1) \quad 2$$

The probit model specification estimates the probability that farmer i participates in a cooperative $Pi(Yi = 1|Xi)$ through the standard normal cumulative distribution function $\Phi(Z)$ that can be modeled on the following integral values:

$$\begin{aligned} \text{Pi} = \Phi(Z) &= \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{zi} e^{-\frac{1}{2}z^2}\, dz \\ \text{Pi} = \Phi(Z) &= \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{(b0+b1X1)} e^{-\frac{1}{2}z^2}\, dz \end{aligned} \quad 3$$

So it will then be derived as follows:

$$\begin{aligned} \Phi^{-1} &= [Pi(Yi = 1|Xi)] = \Phi^{-1}[\Phi bo + b1X1] \\ \Phi^{-1} &= [Pi(Yi = 1|Xi)] = Z = b0 + b1X1 + e \end{aligned} \quad 4$$

The latent variable Z in our probit specification spans the range $-\infty$ and ∞ , with this formulation specifically accommodating the binary nature of our outcome variable while preserving the assumption of normally distributed errors. The model coefficients (β) capture the marginal effects of each explanatory variable on the underlying propensity for cooperative participation, with the estimated probabilities derived through partial derivatives ($\frac{\partial Y}{\partial x}$).

These probit regression results serve dual analytical functions: first, they quantify how each covariate affects participation probabilities; second, they generate the propensity scores essential for our matching procedure. Following established causal inference protocols (Rosenbaum & Rubin, 1984; Pan & Bai, 2015; Mtenga et al., 2024; Ma et al., 2018; Wang et al., 2025; Rhezandy et al., 2023), we implement Propensity Score Matching to compare cooperative members (treatment group) against comparable non-members (control group). This approach enforces common support conditions, mathematically expressed as:

$$e(xi) = P(Zi = 1|Xi = xi) = \frac{exp(\beta 0 + \beta 1X1 + \cdots \ldots + \beta nXn)}{1 + exp(\beta 0 + \beta 1X1 + \cdots \ldots + \beta nXn)} \quad 5$$

where the common support region ensures systematic balance of observed characteristics, thereby enhancing the validity of our causal estimates regarding cooperative membership's welfare effects. The coefficients (β) represent the estimated parameters for each covariate (X) in the model. Following the estimation of these parameters, we address potential selection bias between the two comparison groups, cooperative member farmers (treatment group) and non-member farmers (control group) through a rigorous matching procedure. This matching process, which ensures comparability between groups by balancing observed characteristics, is implemented through the following functional specification:

$$A(Pi) = \underbrace{min}_{0} \|P1 - P0\|, 0\ \epsilon\ I0 \quad 6$$

The propensity score values for treatment and control groups are denoted as $P1$ and $P0$ respectively, with $I1$ and $I0$ representing the corresponding sample sets. Our analysis employs multiple matching algorithms to ensure robust estimation: (1) Nearest Neighbor Matching, which pairs participants with the most similar propensity scores (Pan & Bai, 2015); (2) Radius Matching with a caliper of 0.1 standard deviations of the propensity score (J. Wang et al., 2025); (3) Kernel Matching, utilizing weighted averages of comparable samples (J. Wang et al., 2025); and (4) Stratification Matching, which estimates treatment effects within propensity score strata before aggregating to an overall average (Austin, 2011). Through these approaches, we derive the Average Treatment Effect on the Treated (ATT) in equation 7, our primary estimate of how cooperative participation affects farmer welfare outcomes, operationalized through both Happiness and Life Satisfaction measures.

$$ATT = E(Y1|\text{P(X)}, D = 1) - E(Y0|\text{P(X)}, D = 0) \quad 7$$

To enhance the robustness of our causal estimates, we complement the Propensity Score Matching analysis with Inverse Probability Weighted Regression Adjustment (IPWRA). This doubly robust estimator provides consistent impact estimates by combining propensity score weighting with outcome regression modeling, thereby offering greater protection against model misspecification (Mekonnen et al., 2025; Toiba et al., 2024; Bari et al., 2024). The IPWRA framework consists of two key components: first, a treatment model estimating the probability of cooperative participation conditional on observed covariates

$$p(treatment = 1) = f(x_i; \beta) + e_i \quad 8$$

and second, an outcome model specifying the relationship between welfare measures and explanatory variables.

$$Outcome_i = f(x_i; \alpha) + u_i \quad 9$$

These components jointly identify the average treatment effect (ATE) as

$$ATE_{ipwra} = E(outcome_{i1} - outcome_{i0}) \quad 10$$

where the superscripts denote potential outcomes under treatment and control conditions respectively.

RESULTS AND DISCUSSION

Mean difference of socioeconomic and welfare variables

Table 3 presents a comparative analysis of socioeconomic characteristics between cooperative-affiliated and independent food farmers. The results show no marked differences in age, marital status, internet usage, non-agricultural employment, health status, cash transfers, household economic classification, or educational attainment (junior high, senior high, and diploma levels).

Table 2. Mean Differences of Socioeconomic and Outcome Variables Between Cooperative and Non-Cooperative Food Crop Farmers

Variable	Mean Difference		Pooled	Diff
	Cooperative Farmers	Non-Cooperative Farmers		
Socio-Demography				
Age	38.54924	37.9508	38.08719	0.5984411
Marital Status	0.7146465	0.7159896	0.7156835	-0.0013431
Mobile Phone Ownership	0.239899	0.1934402	0.2040288	0.0464588***
Internet Usage	0.3598485	0.3533358	0.3548201	0.0065127
Non-agricultural Work	0.3421717	0.3361908	0.337554	0.0059809
Gender	0.5252525	0.4804324	0.4906475	0.0448202**
Risk of Crop Failure	0.2575758	0.297801	0.2886331	-0.0402252**
Residence Location	0.4103535	0.4465151	0.4382734	-0.0361616*
Health Condition	2.916667	2.941111	2.93554	-0.024444
Cash Assistance	0.2310606	0.2404025	0.2382734	-0.0093419
Economic Status Category	0.2260101	0.2083489	0.2123741	0.0176612
Elementary Education	0.3333333	0.371599	0.3628777	-0.0382656**
Junior High School Education	0.3005051	0.2929556	0.2946763	0.0075494
Senior High School Education	0.25	0.2545658	0.2535252	-0.0045658
Diploma Education	0.0290404	0.022363	0.0238849	0.0066774
University Education	0.0858586	0.0573984	0.0638849	0.0284602***
Outcome Variable				
Happiness	11.61364	11.18114	11.27971	0.4324958***
Life Satisfaction	6.642677	6.38278	6.442014	0.2598963***
Observation	792	2683		

Notes: ***) Significant at 1% level, **) Significant at 5% level, *) Significant at 10% level
Source: Author's calculation Based on Secondary Data, 2025

Comparative analysis between cooperative member and non-member food farmers reveals notable differences across several dimensions. Cooperative members exhibit more prevalent mobile phone usage. This pattern aligns with the predominant rural residence of cooperative-affiliated food farmers. This pattern may stem from several contextual factors: rural farmers often rely on mobile phones due to limited broadband infrastructure, making voice/SMS services more accessible than internet-dependent platforms, and mobile phones are more affordable and energy-efficient in areas with unstable electricity. Notably, despite comparable internet adoption rates, rural users may prioritize mobile connectivity for basic communication needs. Furthermore, the data indicate that cooperative participation in Indonesia remains predominantly male-dominated, suggesting potential gender disparities in institutional access.

Cooperative members demonstrate markedly lower crop failure risk, suggesting access to technical support through cooperative networks. Educational attainment patterns show pronounced differences: cooperative members exhibit higher qualification levels, with bachelor's, master's, and doctoral degrees being substantially more prevalent among this group. Conversely, non-members predominantly possess only primary education. These educational disparities may reflect cooperatives' role in facilitating human capital development through training programs and resource sharing. Furthermore, preliminary welfare assessments indicate cooperative members report greater subjective well-being, manifesting in both higher Happiness levels and Life Satisfaction scores. This welfare

advantage potentially stems from multiple cooperative benefits: enhanced economic stability through collective bargaining, improved risk mitigation strategies, and stronger social support networks (Liang et al., 2023). These findings collectively suggest cooperatives may serve as important institutional mechanisms for both risk mitigation and human capital development among Indonesian food farmers.

Factors influencing food farmers' decision to participate in cooperatives

The results of our probit regression analysis are presented in Table 4. We also report the bias selection results for the propensity score values estimated from the probit regression. Based on the estimation results, the socioeconomic factors that exert a statistically significant influence include cellphone usage, gender, risk of crop failure, and place of residence. The remaining factors show no significant statistical influence.

Table 3. Probit regression estimation

Variable	Probit Regression		Bias Selection (Mean)		
	Marginal Effect	Std Error	Treated	Control	%bias
Age	0.0004428	0.001552	38.549	38.424	0.8
Marital Status	-0.0051576	0.0539745	0.71465	0.73611	-4.8
Mobile Phone Ownership	0.0489355***	0.0581751	0.2399	0.23864	0.3
Internet Usage	0.0022661	0.0495282	0.35985	0.34596	2.9
Non-agricultural Work	-0.0004107	0.0506313	0.34217	0.34217	0
Gender	0.0333443**	0.0474279	0.52525	0.53914	-2.8
Risk of Crop Failure	-0.0399341***	0.0532293	0.25758	0.24747	2.3
Residence Location	-0.0260189*	0.04801	0.41035	0.41162	-0.3
Health Condition	-0.0101502	0.0340839	2.9167	2.9381	-3.1
Cash Assistance	-0.0112523	0.0579432	0.23106	0.23485	-0.9
Economic Status Category	0.0227043	0.0591727	0.22601	0.24621	-4.9
Elementary Education	-0.0375347	0.7013958	0.33333	0.36742	-7.1
Junior High School Education	-0.016328	0.7016451	0.30051	0.28535	3.3
Senior High School Education	-0.0218858	0.7018903	0.25	0.23485	3.5
Diploma Education	0.0264682	0.7153547	0.02904	0.02399	3.2
University Education	0.0558984	0.7058577	0.08586	0.08712	-0.5
Cons		0.7136085			
Log Likehood	-1846.7218		Mean Bias	2.5	
LR chi2 (16)	36.92		MedBias	2.8	
Prob>chi2	0.0022				
Pseudo R2	0.0099				

Notes: ***) Significant at 1% level, **) Significant at 5% level, *) Significant at 10% level
Source: Author's calculation Based on Secondary Data, 2025

Mobile phone use has a positive and statistically significant effect on the likelihood of farmers joining agricultural cooperatives. Specifically, a 1% increase in mobile phone adoption among the population of food crop farmers is associated with a 4% rise in cooperative membership. This finding aligns with the argument of Nwangwu et al. (2024), who posit that mobile phones facilitate access to critical agricultural information and enhance participation in collective farming activities. Further supporting this, Ayim et al. (2022) demonstrate that mobile phones are more effective than internet-based platforms in disseminating farmer-relevant information, owing to their accessibility and lower literacy barriers. Given these findings, policymakers should prioritize improving digital infrastructure either through government-led initiatives or partnerships with private providers to expand mobile network coverage in rural Indonesia. Such investments would empower food crop farmers to engage more actively in cooperatives and other social groups that bolster agricultural productivity and resilience.

Gender exerts a positive and statistically significant influence (at the 5% level) on cooperative participation, with male farmers being 3% more likely than female farmers to engage in cooperatives. This finding aligns with Rombeallo et al. (2024), who observed a similar gender disparity in coffee producer cooperatives, where male farmers predominantly influence production decisions, particularly at the household level. Toiba et al. (2024) and Qorri & Felföldi (2024) further corroborate this pattern, noting that male farmers dominate in both social and institutional agricultural activities. In contrast, female farmers often face constraints in accessing economic resources and opportunities due to entrenched traditional practices (Samputra & Antriyandarti, 2024). To address this gender gap, empowering women in food farming cooperatives in Indonesia is critical. Interventions should focus on enhancing women's access to decision-making, production resources, financial tools, and other key areas to mitigate existing inequalities. Empirical studies support this approach, demonstrating that women's empowerment through cooperatives improves household food security (Jemaneh & Shibeshi, 2023), strengthens production control and income (Mwambi et al., 2021), and enhances market access and bargaining power (Begum et al., 2024).

The participation of Indonesian food farmers in agricultural cooperatives is significantly influenced by prior crop failures, exhibiting a statistically negative relationship whereby each incidence of crop failure reduces farmers' likelihood of cooperative involvement by 3%. This stems from diminished financial capacity, as income losses render farmers unable to afford mandatory membership fees. A finding supported by Feryanto et al. (2023), who observed farmers prioritize short-term asset liquidation over long-term institutional investments during crises. Compounding this financial barrier is a crisis of institutional trust, wherein potential members remain skeptical of cooperative benefits due to uncertain returns relative to upfront costs (Ma et al., 2021; Donkor & Hejkrlik, 2021; Yu et al., 2023). Exacerbated by documented cases of cooperative failures in developing contexts Nguyen-Trung et al (2024) in Vietnam. To address these dual challenges, Indonesian cooperatives must implement two key interventions: inclusive governance structures ensuring farmer participation in decision-making, and robust risk mitigation mechanisms including harvest insurance and emergency funds. Such measures would not only rebuild trust but also enhance institutional resilience, ultimately strengthening the cooperative model as a vehicle for agricultural development and food security.

The place of residence exhibits a statistically significant negative influence on cooperative participation at the 10% level, with urban farmers showing a 2% lower probability of joining cooperatives compared to their rural counterparts. This finding aligns with Ma & Abdulai (2017), who demonstrated that cooperative membership yields fewer benefits for urban farmers relative to rural areas. As Kopiyawattage et al (2019) and Manda et al (2020) explain, urban agricultural systems typically feature easier market access, higher commodity prices, and greater technological adoption among farmers - factors that diminish the perceived value of cooperative membership. These results suggest that cooperative development efforts should prioritize rural areas, where they can more effectively enhance farmers' socioeconomic conditions, facilitate technology adoption, and improve market access and product valuation. This recommendation is particularly relevant given the characteristic challenges of rural agrarian communities, which often face subsistence production systems, limited technological integration, and low productivity levels (Achmad et al., 2022; Araya et al., 2024).

The probit regression results indicated that 2.5% of the socioeconomic variables could be eliminated, enabling the subsequent Propensity Score Matching analysis. The initial sample revealed selection bias among 27 non-cooperative food farmers due to socioeconomic characteristic disparities. Following sample refinement, the final analytical sample comprised 792 cooperative members and 2,656 non-members within the common support area, suitable for matching procedures. These matched samples were subsequently analyzed using both Propensity Score Matching (PSM) and Inverse Probability Weighted Regression Adjustment (IPWRA) methodologies to estimate treatment effects, with detailed impact estimation results presented in the following chapter. The matching process ensured comparability between treatment and control groups by balancing observable characteristics, thereby reducing potential selection bias in our impact evaluation. This rigorous approach enhances the reliability of our findings regarding the effects of cooperative participation on farmer outcomes (Happiness and Life Satisfaction).

The impact of cooperative participation on the welfare of food farmers in Indonesia

Our well-being measure captures two distinct dimensions: (1) Happiness, operationalized through consumption adequacy and health status, and (2) Life Satisfaction, measured via wealth indicators and future orientation. Table 5 presents the impact estimates, demonstrating consistently positive and statistically significant treatment effects across both analytical approaches. The Propensity Score Matching analysis yields significant Average Treatment effect on the Treated (ATT), while the Inverse Probability Weighted Regression Adjustment (IPWRA) shows robust Average Treatment Effects (ATE). These results collectively indicate that cooperative participation among Indonesian food farmers generates statistically meaningful improvements in farming households' Happiness and Life Satisfaction levels.

Table 4. Estimating the impact of cooperative participation on the welfare of food crop farmers

Matching Method		***Happiness***			***Life Satisfaction***	
Propensity Score Matching	**Treat.**	**Cont.**	**ATT**	**Treat.**	**Cont.**	**ATT**
Nearest Neighbor	792	654	0.441***	792	654	0.293***
Radius	792	2656	0.423***	792	2656	0.254***
Kernel	792	2656	0.424***	792	2656	0.254***
Stratification	792	2656	0.428***	792	2656	0.266***
IPWRA	**Treat.**	**Cont.**	**ATE**	**Treat.**	**Cont.**	**ATE**
Potential Outcome Means	11.63***	11.18***	0.453***	6.640***	6.380***	0.259***
(POM) Coef (Robust std.error)	(0.084)	(0.046)	(0.096)	(0.054)	(0.029)	(0.061)

Notes: ***) Significant at 1% level, **) Significant at 5% level, *) Significant at 10% level
Notes: Treat. (Treated); Cont. (Control)
Source: Author's calculation Based on Secondary Data, 2025

The IPWRA analysis reveals significant potential outcomes for Indonesian food farmers. Without cooperative participation, the average farmer's well-being scores are projected at 11.8 (Happiness) and 6.380 (Life Satisfaction). Cooperative membership increases these metrics by 45.3% (Happiness) and 25.9% (Life Satisfaction), respectively. These findings are corroborated by Propensity Score Matching, which estimates a 42%–44% increase in Happiness and a 25%–29% improvement in Life Satisfaction among cooperative participants. While prior studies have not explicitly examined Happiness and Life Satisfaction, they demonstrate that cooperative participation enhances food security (Ng'ombe et al., 2025), income (Yang et al., 2021; Geffersa, 2024; Wu et al., 2022), and socioeconomic resilience (Onyango et al., 2023; Njoya et al., 2025), including technological adoption (G. Wang & Xu, 2025). Such income gains likely fulfill basic household needs (Happiness) while bolstering self-efficacy and future confidence (Life Satisfaction). Cooperatives further augment well-being by facilitating access to inputs, training, markets, and financial services (e.g., credit, insurance), thereby improving farming efficiency. Although this study does not quantify income effects, we posit that income stability and predictability are fundamental in shaping Happiness and Life Satisfaction (Markussen et al., 2018). Cooperative participation is associated with shared ownership, leading to greater life satisfaction and happiness. Through cooperative participation, farmers can overcome social isolation through collective engagement, thereby reducing the psychological pressures associated with crop failure, poverty, and related challenges (Liang et al., 2023).

Policy Implications and Practical Applications

Our findings yield concrete policy implications for enhancing the role of agricultural cooperatives in Indonesia. For policymakers, cooperative managers, and practitioners, the results suggest that beyond their conventional economic functions, cooperatives should be strategically developed to foster psychosocial well-being. Beyond their conventional economic functions, cooperatives should be strategically developed to foster psychosocial well-being through non-economic initiatives such as training programs, communal activities, and member discussion forums. This broader welfare-oriented approach requires transforming cooperatives from mere input distributors or marketing channels into dynamic learning communities that facilitate adaptive social support. Such institutional evolution would enable cooperatives to serve as platforms for knowledge exchange, social network strengthening, and emotional support critical resources for mitigating agrarian uncertainties. Empirical evidence substantiates this proposition: studies demonstrate that meaningful social engagement and community belonging significantly enhance Happiness and Life Satisfaction (Amati et al., 2018; Nugroho et al., 2022; Ahmed & Mesfin, 2017; Tselempi et al., 2024; Zahnow, 2024; Kpadé et al., 2023). Consequently, cooperatives functioning as comprehensive social ecosystems can catalyze farmers' subjective well-being through dual pathways: economic stability via traditional services, and psychosocial enrichment through community-based support systems. This holistic approach aligns with contemporary understandings of rural development that recognize social capital as equally vital as economic capital for sustainable welfare improvement.

In addition, this study offers several concrete recommendations. The first concerns the urgent need to strengthen digital infrastructure, so that information about cooperatives can reach farming households more effectively, especially in rural areas where access to reliable networks is often limited (Rahman et al., 2023). Second, cooperative managers need to pay closer attention to gender. Programs that give women farmers a stronger voice in leadership and decision-making are essential if cooperatives are to reduce the persistent gender gaps in rural institutions. Another challenge is how to help farmers cope with crop failures, which often place heavy burdens on household income. Here, cooperatives should work together with government and development partners to provide insurance schemes and emergency funds that are simple and accessible. These kinds of measures would make cooperatives more than just service providers, they would become trusted partners in sustaining farm livelihoods. And with greater trust, membership is more likely to grow. In the longer run, such changes would not only support economic resilience, but also improve farmers' subjective well-being, seen in higher levels of happiness and life satisfaction.

CONCLUSION

The findings of this study highlight the positive role of cooperatives in enhancing the welfare of food farmers in Indonesia. The results demonstrate that cooperatives contribute meaningfully to improving farmers' livelihoods by expanding access to information through mobile phones, empowering women farmers, and providing post-harvest protection, particularly in rural areas where access to technology and markets is limited. Participation in cooperatives increases the likelihood that farmers experience both psychological and evaluative well-being. Importantly, the rise in farmers' happiness is not driven solely by higher income, but also by the stability and certainty of livelihoods gained

through access to production inputs, markets, training, and financial support. Likewise, life satisfaction improves because cooperatives create spaces that foster future expectations, a sense of belonging, and greater control over resources. In this sense, cooperatives function not only as economic institutions but also as sources of social capital that strengthen farmers' psychological resilience, especially in the face of crop failures and economic pressures. This study underscores the considerable potential of cooperatives as instruments for holistic welfare development among farmers. Their role should extend beyond serving as marketing channels for crop distribution, to becoming learning communities and forums for social support, particularly in shaping women farmers' economic participation and providing mechanisms such as insurance schemes and emergency funds to ease the psychological burden associated with crop failures. Such strategies would reinforce the position of cooperatives as inclusive institutions capable of responding to the multidimensional challenges of welfare-oriented agricultural development in Indonesia.

This study's measurement of well-being is limited to subjective indicators, specifically capturing psychological dimensions through Happiness and Life Satisfaction metrics. Future research should incorporate explicit psychosocial measures such as self-efficacy, social trust, and perceived social support to better elucidate the non-economic pathways through which cooperatives influence farmer well-being. In addition, longitudinal designs employing before-after impact assessments would strengthen causal inference and provide critical insights into the medium and long-term welfare effects of cooperative participation. Such methodological advancements would yield more robust evidence regarding both the economic viability and contextual relevance of cooperatives as vehicles for socio-economic improvement in agricultural communities. Furthermore, this study did not explicitly examine variations across the 13 provinces and food-farmer groups included in the IFLS dataset. Given Indonesia's diverse agro-ecological and institutional contexts, future research could extend the analysis by incorporating provincial-level and sector-specific heterogeneity, which may provide deeper insights into the differentiated welfare effects of cooperative membership.

Competing interests

The authors declare that they have no competing interests

Ethic Declaration

This research utilized publicly accessible secondary data from the Indonesian Family Life Survey (IFLS-5), which has been anonymized by the data provider (RAND Corporation) and does not involve any direct contact with human participants. Hence, the study did not require formal ethical clearance from an institutional review board. All procedures followed the ethical principles outlined in the Declaration of Helsinki and adhered to the responsible conduct of research, including transparency, confidentiality, and integrity in data handling and reporting.

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