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**ARTICLE**

# Synergizing Policies and Farmers' Willingness in Arable Land Protection for Food Security in East Java Indonesia

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## ABSTRACT

This study examines the role of Farmers' Willingness in Arable Land Protection Cooperation (FWALPC) as a key factor influencing food security, taking into account the impact of government propaganda, government regulations, subsidy policies, ecological benefits, economic benefits, and social benefits. The study employs a quantitative survey method involving 200 farmers from key agricultural regions, and the data is analyzed using Structural Equation Modeling (SEM) to evaluate the direct and indirect relationships between variables. The findings reveal that FWALPC has a significant impact on food security and serves as a crucial mediating variable linking external factors to food security outcomes. Factors such as government propaganda, social benefits, and subsidy policies significantly influence food security both directly and indirectly, whereas ecological and economic benefits contribute more indirectly through FWALPC. Conversely, government regulations significantly affect FWALPC but do not show a direct significant impact on food security. This study makes a theoretical contribution by highlighting the importance of FWALPC as a connector between external factors and food security, while emphasizing incentive-based approaches, effective communication campaigns, and strengthening farmers' social networks as strategies to enhance their participation in land protection. These findings offer practical insights for policymakers in designing

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sustainable land protection policies to support food security. Moreover, the results underscore the importance of a holistic approach that integrates policy, ecological, social, and economic factors to strengthen food security through farmer participation in agricultural land protection.

***Keywords:*** Arable Land Protection: Policy; Perceptions; Farmer; Food Security

# 1. Introduction

Productive agricultural land is a strategic asset in supporting a nation's food security. However, the pressures of land conversion driven by urbanization and infrastructure development pose a significant threat to the sustainability of protected paddy fields. In Indonesia, this issue is particularly pressing due to its status as an agrarian country that heavily relies on agricultural productivity for national food security. Indonesia, renowned as an agrarian country with extensive agricultural land, dedicates much of this land to farming activities such as crop cultivation, livestock rearing, and processing of agricultural products. Over the past decades, Indonesia has faced increasing challenges in maintaining its agricultural land, particularly paddy fields, amidst rapid urban expansion and economic development. Historically, Indonesia was one of the largest exporters of agricultural products [1–3]. However, despite its agrarian identity, the country now struggles to balance agricultural sustainability with economic growth.

Land conversion has become rampant, driven by the need for residential areas and economic activities. Economic development further exacerbates the issue, with vast paddy fields being converted into office buildings, industrial zones, airports, and other facilities, threatening food security and ecosystem sustainability [4, 5]. The loss of paddy fields directly impacts rice production, endangering national food security and increasing dependency on rice imports. To control the conversion of paddy fields, the government has introduced several regulations aimed at preserving agricultural land, particularly paddy fields, to maintain food production and protect ecosystems. One of the most significant efforts is the enactment of Law No. 41 of 2009 on the Protection of Sustainable Food Cropland, which was designed to curb uncontrolled land conversion. However, over the years, government policies related to land conversion have proven ineffective in preventing the loss of paddy fields. Despite the regulatory framework, the conversion of paddy fields continues at an alarming rate, highlighting weaknesses in policy implementation and enforcement. From 2013 to the present, the rate of paddy field conversion remains alarming. Satellite imagery analysis estimates that by 2045, the national area of paddy fields could shrink to just 5.1 million hectares from 8.1 million hectares in 2000 [6–8]. This decline raises critical concerns about the future of Indonesia's food security.

In response to ongoing land conversion and efforts to prevent further loss of agricultural land, the government issued Presidential Regulation No. 59 of 2019 on the Control of Paddy Field Conversion [9, 10]. This regulation aims to address the rapid increase in paddy field conversion to non-agricultural use, which threatens national rice production [11]. Despite these policy interventions, compliance and effectiveness remain key challenges, as many farmers and landowners continue to sell or repurpose their land due to economic pressures [12, 13]. Various initiatives, such as government regulations, subsidy policies, and campaigns promoting land protection, have been implemented to encourage farmer participation in paddy field conservation programs. However, the effectiveness of these policies often depends on farmers' perceived benefits—economic, social, and ecological. Understanding these perceptions is crucial, as they directly influence farmers' decisions to participate in land conservation programs. Moreover, farmers' involvement in paddy field protection is tied to their sense of responsibility toward national food security. Amidst global challenges such as climate change, fluctuating rice prices, and increasing land scarcity, the need for a more farmer-centric approach to policy design is becoming more urgent.

Previous research on paddy field conversion has primarily focused on its negative impacts on food se-

curity and ecosystem sustainability. Studies have consistently highlighted the risks of reduced rice production caused by paddy field conversion, threatening national food stability [14]. While many studies emphasize the importance of government policies in controlling land conversion, few examine how these policies are perceived and understood by farmers, particularly concerning their perceived economic, social, and ecological benefits. Existing research tends to focus on macro-level policy effectiveness, with limited exploration of how farmers interpret and respond to these regulations. Research by Zhang et al. [15], confirms the significant role of government policies in managing paddy fields and ecosystems but lacks an in-depth analysis of farmers' perceptions of these policies in relation to their willingness to protect paddy fields. This gap in understanding suggests that policy effectiveness may depend on factors beyond regulatory enforcement, such as incentives, education, and community engagement. Additionally, while some studies explore the relationship between government policies and food security, there is a lack of research linking policies to farmers' willingness to participate in paddy field conservation programs. Research by Tufa et al. and Wu et al. [16, 17], shows a connection between government policies and farmers' perceptions but does not explicitly examine the factors influencing farmers' willingness to collaborate in land conservation. This omission leaves a critical gap in understanding how to align government strategies with farmer motivations.

Furthermore, while existing studies discuss factors influencing farmers' participation in land protection programs, limited research examines the synergy between government policies and farmers' perceptions in the context of paddy field conservation. Several research [18–20], indicates that policies and external interventions can influence agricultural sustainability outcomes but do not specifically address how government policies are received by farmers in land protection efforts. In addressing this gap, this study aims to analyze the interplay between government policies, farmers' perceptions, and their willingness to participate in paddy field conservation. Research by Zhang et al. [15], has examined the synergy between agricultural policies and farmers' perceptions in supporting Farmers' Willingness in Arable Land Protection Cooperation (FWALPC). However, this study has not yet explored its impact on food security. Thus, this research seeks to contribute by integrating policy assessment with farmers' perspectives, offering a comprehensive understanding of the drivers and barriers to paddy field conservation. This highlights the need for a more holistic approach that integrates policies, farmers' perceptions, and external support to promote paddy field conservation, ultimately improving food security. The study seeks to analyze the interplay between policies and farmers' perceptions, examining how these factors foster cooperation in paddy field protection. By identifying the key determinants of farmers' willingness to participate, this research aspires to make a significant contribution to evidence-based policy development for improving food security in developing countries.

## 2. Literature Review

### 2.1. Government Policy and Land Protection

The protection of agricultural land is a crucial component in achieving food security in agrarian countries like Indonesia. Previous studies have emphasized the role of government policies, such as Law No. 41 of 2009 and Presidential Regulation No. 59 of 2019, in mitigating the rapid conversion of paddy fields [8, 9]. However, although these regulations establish a framework for land protection, their effectiveness heavily relies on the active participation of farmers [15]. Farmers' willingness to collaborate in conservation efforts, influenced by their perceptions of economic, social, and ecological benefits, has emerged as a critical variable in this context [7]. Government policies play a fundamental role in safeguarding agricultural land from urbanization and industrialization. Law No. 41 of 2009 on the Protection of Sustainable Agricultural Land was introduced to regulate the conversion of agricultural land and ensure long-term food security. Despite its intentions, studies have shown that implementing this law faces various challenges, such as inconsistent enforcement, limited farmer involvement, and the absence of clear mapping for agricultural zones [8]. Additionally, Presidential Regulation No. 59 of 2019 was designed to address these

issues by providing more comprehensive guidelines and incentives for paddy field protection. However, key challenges remain, such as delays in publishing protected land maps and the lack of clear incentives for farmers [15]. Comparative studies provide valuable insights. For instance, Japan's Agricultural Land Zoning policy strictly regulates land conversion, ensuring the preservation of agricultural land through clear zoning mechanisms and consistent enforcement. Similarly, sustainable subsidy programs in the Netherlands incentivize farmers to maintain agricultural productivity while conserving ecosystems, proving effective in preventing land conversion [21, 22]. These international examples highlight the necessity for Indonesia to adopt a combination of regulatory and incentive-based measures to improve policy outcomes.

### 2.2. Farmer Perceptions and Participation

Farmers' willingness to participate in land protection initiatives is strongly influenced by their perceptions of economic, social, and ecological benefits. Research shows that farmers are more likely to engage in conservation programs when they see tangible economic benefits, such as increased income, reduced operational costs, and access to stable markets for their agricultural produce [15]. Subsidy policies, in particular, play an important role in motivating farmer participation by reducing financial barriers and increasing access to resources (Nguyen et al., 2021). Social benefits, such as increased cooperation and support within farming communities, also increase participation. Research shows that strong social networks encourage a sense of collective responsibility and increase the success of conservation programs. These networks provide mutual support, reduce risks, and create a shared commitment to protect agricultural land [23]. Likewise, ecological benefits, such as increased soil fertility, better irrigation management, and reduced erosion, also motivate farmers to participate in land protection efforts. Farmers who recognize the long-term environmental benefits of conservation are more likely to adopt sustainable practices [24]. However, there is a significant research gap in understanding how these perceptions interact with government policy to influence farmers' willingness to collaborate. Addressing this gap requires integrating insights from behavioral studies and policy analysis to identify strategies that align farmer motivations with policy goals.

### 2.3. Synergy between Policy and Farmer Collaboration

The interaction between government policy and farmer perceptions is an important determinant of the success of land protection efforts. Research by Zhang et al. [15] show that government propaganda and awareness campaigns significantly increase farmers' understanding of policy objectives, thereby increasing their willingness to participate. These campaigns can bridge the gap between policy objectives and farmer perceptions by effectively communicating the benefits of land protection initiatives. However, regulations alone often fail to achieve a meaningful impact on food security unless complemented by active farmer collaboration. Recent research emphasizes the role of Farmers' Willingness to Cooperate on Agricultural Land Protection (FWALPC) as a mediating factor. FWALPC links external policy interventions to conservation outcomes on the ground, ensuring that policies are translated into real improvements in land management and food security [7, 25]. An integrated approach combining financial incentives, education, and capacity building programs has proven effective in encouraging collaboration. For example, Liu et al. [14] found that a subsidy program combined with training sessions significantly increased farmer participation in conservation activities. These findings highlight the importance of overcoming external constraints and intrinsic motivation to achieve sustainable outcomes.

## 3. Material and Methods

### 3.1. Research Problem

Government policies aimed at controlling the conversion of agricultural land, as outlined in Law No. 40 of 2009 on the protection of agricultural land, were followed by the issuance of Regional Regulation No. 6 of 2015 on agricultural land protection at the district level. However, this regulation does not necessarily prevent agricultural land, particularly rice fields, from be-

ing converted to other uses. Similarly, in urban areas, the amount of agricultural land continues to decrease each year, exacerbated by the absence of a regional regulation specifically addressing agricultural land protection in urban zones. Presidential Regulation No. 59 of 2019, as a derivative regulation of previous policies on controlling land conversion, was expected to offer solutions for food security and the preservation of rice field ecosystems. However, as of the time this research was conducted, the protected rice field maps promised in the Presidential Regulation for cities and districts had yet to be published. At the same time, farmers are still awaiting the clarity of the incentives promised by the government under this regulation. These incentives are expected to serve as a stimulus for making agricultural land more productive in generating food, maintaining soil fertility and ecosystem balance, and improving farmers' welfare. Several countries have demonstrated success in managing and protecting agricultural land through stricter and more measurable regulations. For example, Japan has implemented a rigorous Agricultural Land Zoning policy, effectively controlling land conversion [26]. In the Netherlands, a system of sustainable subsidies is provided to farmers who maintain the productivity of their agricultural land while preserving the ecosystem [21]. Research in Indonesia has also identified various approaches that can be adapted. For instance, a study by Zinngrebe et al. [7], found that fiscal incentives for farmers in Central Java could prevent the conversion of rice fields. Additionally, research by Dewi and Wulansari [9], highlighted the importance of multi-stakeholder collaboration in ensuring the effectiveness of land protection regulations at the regional level.

## 3.2. Research Design

Food security is a global issue that remains a primary focus in development policy planning, particularly in the agricultural sector. Arable land, as the main resource for food production, faces significant threats from land conversion, environmental degradation, and development pressures. To ensure the sustainable productivity of arable land, the active participation of farmers as key stakeholders is crucial. However, this participation is not solely influenced by government policies but also by how farmers perceive the social, economic, and ecological benefits of land protection. This study addresses the need to understand the factors driving farmers' willingness to collaborate in arable land protection, referred to as Farmers' Willingness in Arable Land Protection Cooperation (FWALPC). By exploring the synergy between government policies and farmers' perceptions, the study aims to identify the complex relationships between regulations, subsidies, government campaigns, and farmers' perceived benefits in their willingness to support land protection policies [15, 27]. Ultimately, the study also seeks to measure the direct impact of FWALPC on food security as the ultimate goal of arable land preservation efforts (**Figure 1**). The conceptual framework of this study incorporates various dimensions of policy and farmer perceptions, emphasizing the importance of collaboration among stakeholders in creating a holistic approach to land protection. Using a Structural Equation Modeling (SEM) approach, this research provides empirical insights that can inform the development of more effective and sustainability-oriented policy strategies.

## 3.3. Research Location

This study was conducted in East Java, specifically in the Greater Malang area, which encompasses two main administrative regions: Malang City and Malang Regency (**Figure 2**). The research was conducted between July and November 2024. This area was chosen as the research location due to its geographic, social, and economic characteristics, which are relevant to the study's objectives, particularly in the context of arable land protection to support food security. Greater Malang is one of the agricultural hubs in East Java, known for its fertile land, diverse high-value agricultural commodities, and significant contribution to regional and national food production [3, 24].

Malang Regency, the largest area in Greater Malang, is predominantly agricultural and serves as the primary base for agrarian activities. Meanwhile, Malang City, despite being more urban, also has significant agricultural areas, particularly for horticulture and food crops. However, both regions face serious challenges related to land conversion due to rapid urbanization and infrastructure development. These conditions raise concerns about the

sustainability of arable land, which could pose a threat to future food security. The selection of Greater Malang was also based on the diverse socio-economic conditions of farmers in the area, reflecting a mix of traditional and modern farming practices. This diversity provides an opportunity to understand varying perceptions and levels of willingness among farmers to collaborate in protecting arable land. Consequently, the findings of this study are expected to not only have local relevance but also contribute significantly to the formulation of broader land protection policies at the national and international levels.

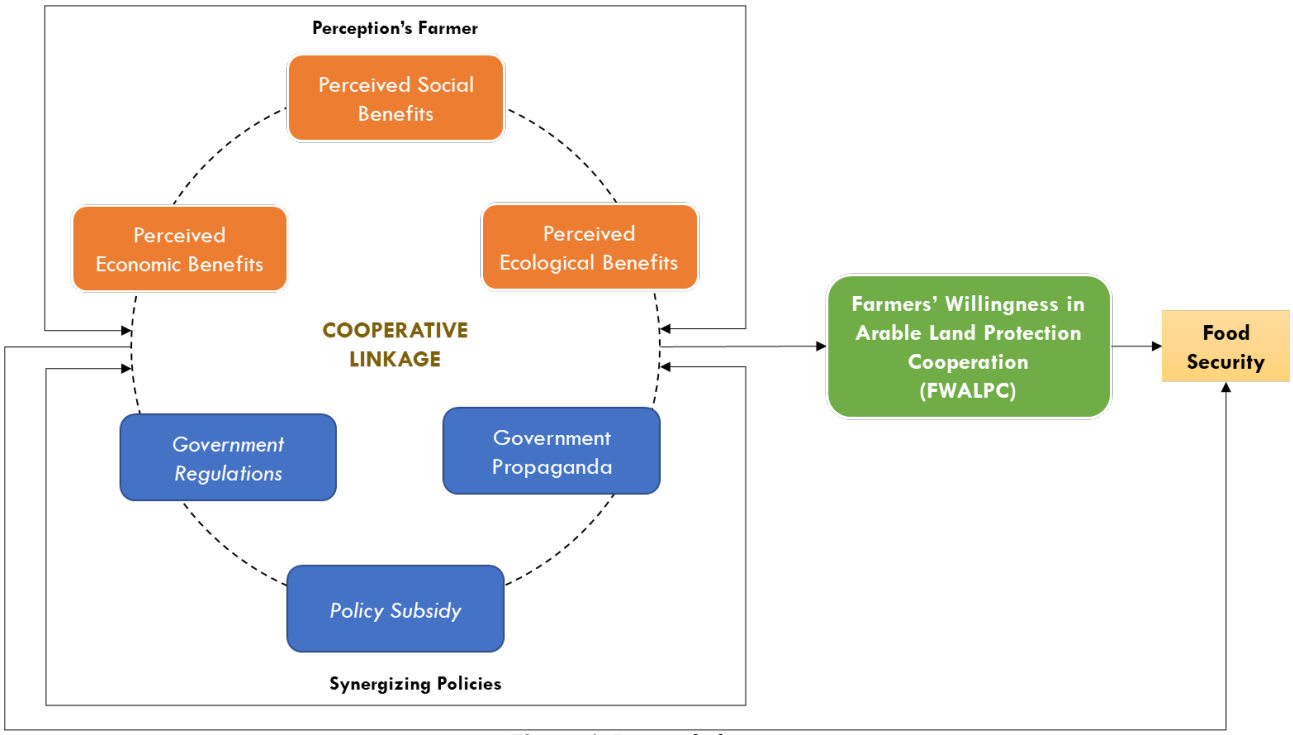


**Figure 1.** Research design.

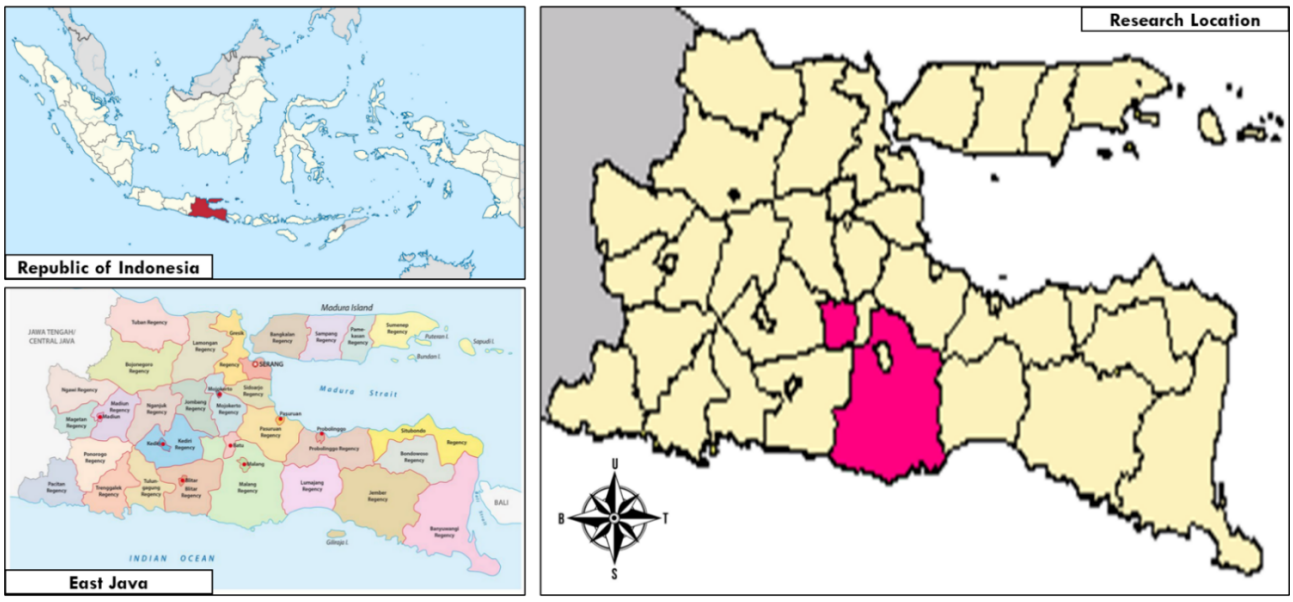


**Figure 2.** Research location.

## 3.4. Determinations of Respondent

This study involved 200 farmers as respondents, selected using the simple random sampling method. This approach was chosen to ensure that every farmer in the study area had an equal chance of being selected, thereby providing a more representative depiction of the overall conditions [28]. Respondent selection was conducted in the Greater Malang area, taking into account the diverse characteristics of farmers, including land size, types of commodities cultivated, and their agricultural experience. The sample size of 200 respondents was determined based on the requirements of quantitative research utilizing Structural Equation Modeling (SEM) [29]. This number is deemed sufficient to meet the statistical criteria for testing relationships between latent variables with multiple indicators. Respondents were chosen from a list of active farmers obtained through relevant agencies, such as the Department of Agriculture or local farmer groups, ensuring that the sampling process was conducted randomly and without bias. The selection process was carried out through random drawing using statistical software, ensuring objective respondent involvement. Selected respondents were contacted directly and asked to complete a research questionnaire designed to measure their perceptions, experiences, and attitudes toward arable land protection (Farmers' Willingness in Arable Land Protection Cooperation – FWALPC). Through this method, the study aims to collect valid and reliable data to support analysis and conclusions.

## 3.5. Data Analysis

Data analysis in this study utilized the Structural Equation Modeling (SEM) method, a multivariate statistical technique used to examine the relationships between latent variables and their indicators use SmartPLS [30]. SEM was chosen due to its capability to test complex conceptual models, including both direct and indirect relationships among latent variables, such as government policies, farmers' perceptions, willingness to collaborate (Farmers' Willingness in Arable Land Protection Cooperation – FWALPC), and food security. The SEM analysis was conducted in two main stages: evaluation of the measurement model and evaluation of the structural model. This study employed 32 indicators to analyze eight observed variables. The Average Variance Extracted (AVE) of the indicators being $\geq 0.50$ indicates that they meet the criteria for convergent validity, while composite reliability (CR) and Cronbach's alpha (CA) values of $\geq 0.70$ confirm their reliability [31]. The influence of livelihood assets on adaptive capacity is illustrated through a path diagram. Below are the variables and indicators used in this study. It can be concluded that all variables and indicators employed in this research are valid and reliable (**Table 1**). Data collection for research instruments was conducted using a questionnaire with Likert scale 1–5.

**Table 1.** Research variables.

| No. | Variable | Indicator | Notation | Average Variance Extracted (AVE) | Composite Reliability (CR) | Cronbach's Alpha (CA) |
|---|---|---|---|---|---|---|
| 1. | Government Regulations | Clarity of land protection regulations for rice fields. | GR1 | 0.561 | 0.860 | 0.791 |
| | | Consistency in the implementation of regulations in the field. | GR2 | | | |
| | | Firmness of sanctions for violations of regulations. | GR3 | | | |
| | | Socialization of regulations to farmers. | GR4 | | | |
| | | Compliance with regulations with farmers' needs | GR5 | | | |
| 2. | Policy Subsidy | Suitability of regulations with farmers' needs. | PS1 | 0.563 | 0.860 | 0.791 |
| | | The amount of subsidy received by farmers. | PS2 | | | |
| | | The ease of procedures to obtain subsidies. | PS3 | | | |
| | | The sustainability of subsidies from the government. | PS4 | | | |
| | | Timeliness of subsidy distribution. | PS5 | | | |
| 3. | Government Propaganda | Effective use of subsidies to support rice field land protection. | GP1 | 0.738 | 0.894 | 0.824 |

**Table 1.** *Cont.*

| No. | Variable | Indicator | Notation | Average Variance Extracted (AVE) | Composite Reliability (CR) | Cronbach's Alpha (CA) |
|---|---|---|---|---|---|---|
| 3. | Government Propaganda | Frequency of campaigns or socialization conducted by the government. | GP2 | 0.738 | 0.894 | 0.824 |
| | | Quality of campaign materials provided to farmers. | GP3 | | | |
| 4. | Perceived Economic Benefits | The level of farmer participation in rice field land protection campaigns. | PE1 | 0.721 | 0.912 | 0.871 |
| | | Increased income of farmers due to rice field land protection programs. | PE2 | | | |
| | | Reduction of operational costs in rice field management. | PE3 | | | |
| | | Availability of stable markets for agricultural products. | PE4 | | | |
| 5. | Perceived Social Benefits | Guarantee of fair prices for harvests. | PS1 | 0.767 | 0.908 | 0.848 |
| | | Improved cooperation among farmers within the community. | PS2 | | | |
| | | Social support from the surrounding community for rice field land protection programs. | PS3 | | | |
| 6. | Perceived Ecological Benefits | Improved relationships between farmers and the government. | PEc1 | 0.692 | 0.899 | 0.852 |
| | | Increased soil fertility in rice fields. | PEc2 | | | |
| | | Better management of irrigation water. | PEc3 | | | |
| | | Reduced erosion or land degradation. | PEc4 | | | |
| 7. | Farmers' Willingness in Arable Land Protection Cooperation (FWALPC) | Increased population of local species around rice field areas. | FW1 | 0.730 | 0.890 | 0.813 |
| | | Willingness of farmers to participate in training related to rice field land protection. | FW2 | | | |
| | | Commitment of farmers to comply with rice field land protection regulations. | FW3 | | | |
| 8. | Food Security | Farmers' participation in activities that support rice field land protection. | FS1 | 0.667 | 0.909 | 0.874 |
| | | Food availability. | FS2 | | | |
| | | Food accessibility. | FS3 | | | |
| | | Food utilization. | FS4 | | | |
| | | Food stability. | FS5 | | | |

Source: Adapted from Zhang et al. [15].

The analysis process using Structural Equation Modeling (SEM) can be explained as follows (**Figure 3**). The analysis begins with processing data from the questionnaire, which is then used to construct the measurement model. At this stage, the measurement model is determined based on the relationship between latent variables and their indicators, with formulas involving factor loadings, errors, and the values of latent variables. Next, reliability and construct validity analysis are conducted to ensure measurement quality. Reliability is assessed using Composite Reliability (CR) and Cronbach's Alpha (CA) values, while validity is determined through Average Variance Extracted (AVE). The next step is the specification of the structural model, which links latent variables through causal relationships in accordance with the hypotheses being tested. Here, path coefficients are examined for significance using p-values, with $p < 0.05$ indicating a significant relationship. After the model is estimated, model fit is evaluated using several measures, including R-squared ($R^2$), Q-squared ($Q^2$), and Goodness of Fit (GoF). The $R^2$ value measures the model's predictive ability, $Q^2$ assesses the prediction of observations, and GoF integrates construct validity and the model's predictive ability. If all criteria are met and the model is deemed valid, the results of the analysis can be interpreted to answer the research questions and test the proposed hypotheses. The final step is presenting the interpretation of the results in the form of a comprehensive and in-depth conclusion.

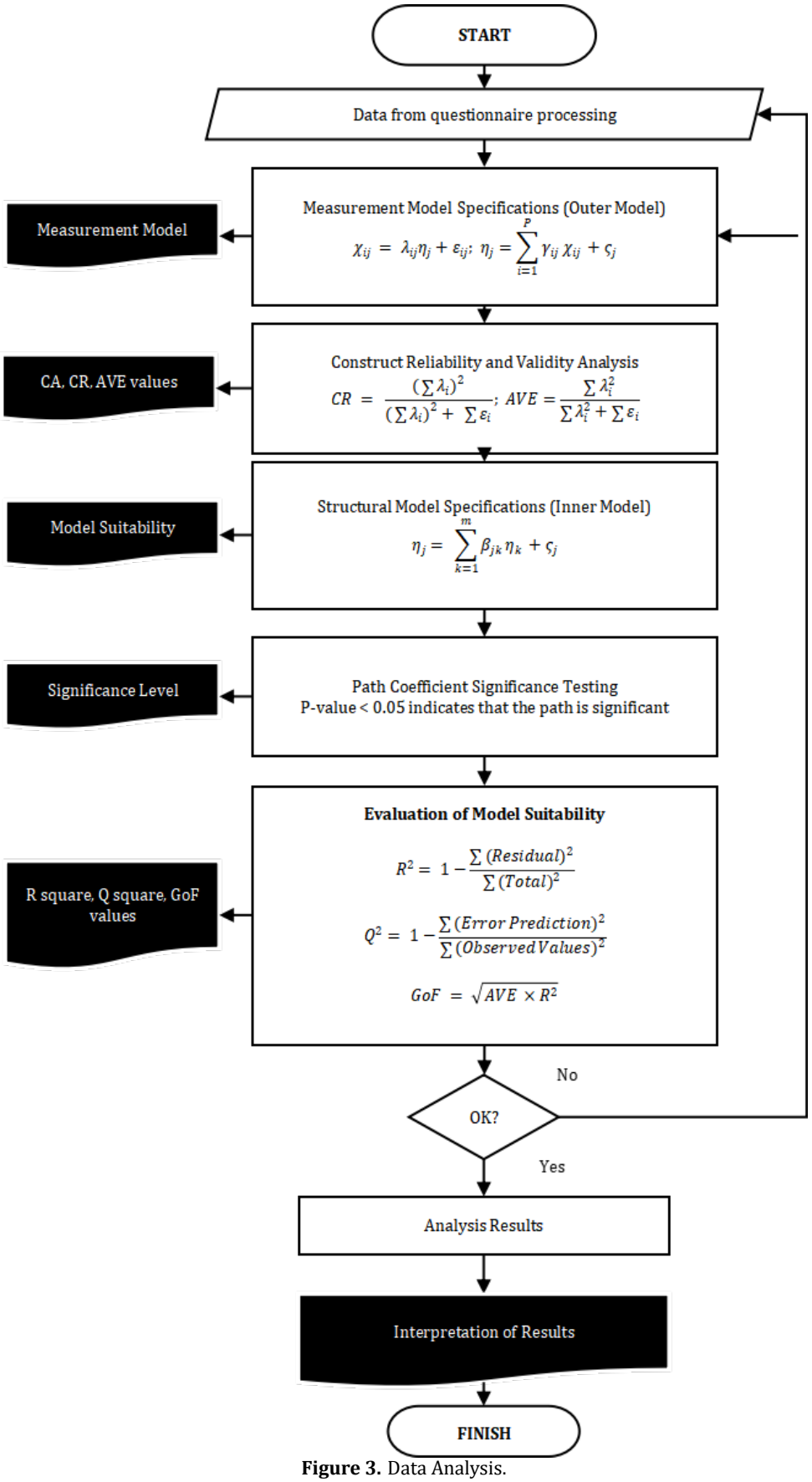


**Figure 3.** Data Analysis.

### 3.6. Research Ethics

This study will comply with rigorous ethical guidelines, which include obtaining informed consent, ensuring the confidentiality of data, and upholding the rights of participants [32]. All participants will receive clear and comprehensive information about the study's purpose and procedures and will have the option to withdraw at any point without facing any adverse consequences.

## 4. Result

### 4.1. Evaluation of Measurement and Influence among Variables

In data analysis, evaluating measurements is essential to ensure that the variables measured accurately represent the intended construct. Cross-loading occurs when indicators have significant loadings on more than one latent variable. The evaluation process begins with calculating the loading matrix, which displays the loading of each indicator on its associated latent variable. In this analysis, loading values are expected to exceed 0.70 to demonstrate that the indicators strongly contribute to the measured construct [33, 34] (**Table 2**). The loading factor analysis results reveal that most indicators have high values for their respective latent variables, with dominant values exceeding 0.5 and many approaching or surpassing 0.9. Additionally, residual components, represented as E (error) terms for observed dependent variables and D for latent dependent variables, contribute to model specificity beyond the known independent variables. These residual variables are latent and independent, interacting within the structural model framework. Although they are not included in direct interpretation, analyzing their relationships provides valuable insights into the model's comprehensiveness. Therefore, the overall loading factor results suggest that the model exhibits strong construct validity while acknowledging that unexplained variance, captured by the residual terms, may be due to model limitations or external influences not accounted for within the current framework.

### 4.2. R-Square Test

The R-Square and Adjusted R-Square values (**Table 3**) reflect the extent to which the independent variables in the model explain the variability of the dependent variable, providing an overview of the model's predictive power and overall fit [35].

**Table 2.** Loading factor.

| | GR | PS | GP | PE | PS | PEc | FW | FS |
|---|---|---|---|---|---|---|---|---|
| GR1 | 0.556 | | | | | | | |
| GR2 | 0.537 | | | | | | | |
| GR3 | 0.863 | | | | | | | |
| GR4 | 0.868 | | | | | | | |
| GR5 | 0.844 | | | | | | | |
| PS1 | | 0.556 | | | | | | |
| PS2 | | 0.532 | | | | | | |
| PS3 | | 0.855 | | | | | | |
| PS4 | | 0.874 | | | | | | |
| PS5 | | 0.845 | | | | | | |
| GP1 | | | 0.827 | | | | | |
| GP2 | | | 0.878 | | | | | |
| GP3 | | | 0.873 | | | | | |
| PE1 | | | | 0.809 | | | | |
| PE2 | | | | 0.869 | | | | |
| PE3 | | | | 0.855 | | | | |
| PE4 | | | | 0.860 | | | | |
| PSo1 | | | | | 0.873 | | | |
| PSo2 | | | | | 0.895 | | | |
| PSo3 | | | | | 0.859 | | | |
| PEc1 | | | | | | 0.765 | | |
| PEc2 | | | | | | 0.831 | | |
| PEc3 | | | | | | 0.891 | | |

**Table 2.** *Cont.*

| | GR | PS | GP | PE | PS | PEc | FW | FS |
|---|---|---|---|---|---|---|---|---|
| PEc4 | | | | | | 0.835 | | |
| FW1 | | | | | | | 0.884 | |
| FW2 | | | | | | | 0.891 | |
| FW3 | | | | | | | 0.784 | |
| FS1 | | | | | | | | 0.817 |
| FS2 | | | | | | | | 0.833 |
| FS3 | | | | | | | | 0.844 |
| FS4 | | | | | | | | 0.855 |
| FS5 | | | | | | | | 0.727 |

**Table 3.** R-Square Value.

| Variables | R-Square | R-Square Adjusted |
|---|---|---|
| FWALPC | 0.722 | 0.719 |
| Food Security | 0.714 | 0.710 |

The R-Square value of 0.722 indicates that the independent variables in the model collectively explain 72.2% of the variability in Farmers' Willingness in Arable Land Protection Cooperation (FWALPC). Meanwhile, the Adjusted R-Square value of 0.719 shows that, after adjusting for the number of predictors and sample size, 71.9% of the variability can still be explained. These values suggest that the model has very strong predictive power for FWALPC. This highlights the relevance and significant influence of factors such as policy synergy and farmers' perceptions on their willingness to participate in the implementation of protected rice fields. For the Food Security variable, the R-Square value of 0.714 indicates that 71.4% of the variability in food security is explained by the independent variables in the model. The Adjusted R-Square value of 0.710 shows that, after adjustment, 71.0% of the variability is still accounted for. These results demonstrate that the predictors in the model (e.g., farmers' willingness to participate in the implementation of protected rice fields) are relevant and strongly influence food security outcomes. Furthermore, while the model accounts for a substantial proportion of variance, the presence of residual terms (E and D) suggests that additional unexplored factors contribute to the overall variability. The minimal difference between the R-Square and Adjusted R-Square values suggests that the model does not suffer from overfitting, further enhancing the reliability of the results.

## 4.3. Significance Test

The analysis of **Table 4** shows that Farmers' Willingness in Arable Land Protection Cooperation (FWALPC) significantly affects food security, with a p-value of 0.000. This confirms that farmers' willingness to collaborate in protecting agricultural land has a direct impact on improving food security. Government propaganda also has a significant influence on FWALPC ($p = 0.000$) and food security ($p = 0.003$), highlighting the critical role of the government in raising awareness and encouraging farmer collaboration to support food security. Government regulations have a significant influence on FWALPC ($p = 0.007$) but not on food security ($p = 0.333$). This suggests that government regulations can encourage farmers' willingness to participate in land protection, even though their direct impact on food security is less evident. Conversely, perceived ecological benefits significantly influence FWALPC ($p = 0.000$) but not food security ($p = 0.933$). This indicates that the perception of ecological benefits primarily motivates farmers' participation directly rather than having a direct impact on food security.

Perceived economic benefits significantly influence FWALPC ($p = 0.000$) but not food security ($p = 0.482$). In contrast, perceived social benefits significantly influence both FWALPC ($p = 0.001$) and food security ($p = 0.027$), showing that social relationships and community support play a crucial role in enhancing farmers' participation and food security. Subsidy policies have

a significant effect on both FWALPC ($p = 0.000$) and food security ($p = 0.001$), emphasizing the importance of economic incentives in fostering farmers' willingness to collaborate while also supporting food security. Overall, these findings indicate that government propaganda, regulations, ecological benefits, economic benefits, social benefits, and subsidy policies are critical factors influencing FWALPC. On the other hand, food security is more influenced by FWALPC, government propaganda, social benefits, and subsidy policies.

**Table 4.** Direct Influence.

| | ***p*-Values** | **Significance Test** |
|---|---|---|
| FWALPC -> Food Security | 0.000 | Significant |
| Government Propaganda -> FWALPC | 0.000 | Significant |
| Government Propaganda -> Food Security | 0.003 | Significant |
| Government Regulations -> FWALPC | 0.007 | Significant |
| Government Regulations -> Food Security | 0.333 | Not Significant |
| Perceived Ecological Benefits -> FWALPC | 0.000 | Significant |
| Perceived Ecological Benefits -> Food Security | 0.933 | Not Significant |
| Perceived Economic Benefits -> FWALPC | 0.000 | Significant |
| Perceived Economic Benefits -> Food Security | 0.482 | Not Significant |
| Perceived Social Benefits -> FWALPC | 0.001 | Significant |
| Perceived Social Benefits -> Food Security | 0.027 | Significant |
| Policy Subsidy -> FWALPC | 0.000 | Significant |
| Policy Subsidy -> Food Security | 0.001 | Significant |

In summary, these results suggest that factors such as government propaganda, perceptions of ecological, economic, and social benefits, as well as subsidy policies, play a vital role in improving FWALPC and food security. Conversely, government regulations have yet to show a significant impact, suggesting that incentive-based approaches and effective communication campaigns are more advisable for encouraging farmer participation and strengthening food security in the future. The analysis results in **Table 5** indicate that all indirect effects through Farmers' Willingness in Arable Land Protection Cooperation (FWALPC) on food security are significant. Government propaganda indirectly affects food security through FWALPC with a p-value of 0.001. This indicates that government campaigns not only enhance farmers' willingness to protect arable land but also strengthen their overall contribution to food security. Furthermore, government regulations also show a significant indirect effect on food security through FWALPC ($p = 0.021$), suggesting that while regulations may be less effective directly, their success can be maximized through the mediation of FWALPC.

**Table 5.** Indirect influence.

| | ***p*-Values** | **Significance Test** |
|---|---|---|
| Government Propaganda -> FWALPC -> Food Security | 0.001 | Significant |
| Government Regulations -> FWALPC -> Food Security | 0.021 | Significant |
| Perceived Ecological Benefits -> FWALPC -> Food Security | 0.001 | Significant |
| Perceived Economic Benefits -> FWALPC -> Food Security | 0.003 | Significant |
| Perceived Social Benefits -> FWALPC -> Food Security | 0.010 | Significant |
| Policy Subsidy -> FWALPC -> Food Security | 0.000 | Significant |

Perceived ecological benefits have a significant indirect effect on food security through FWALPC, with a p-value of 0.001. This finding emphasizes that farmers' perceived environmental benefits, such as improved soil quality and resource conservation, can motivate their collaboration in land protection efforts, ultimately supporting food security. In addition, perceived economic benefits also demonstrate a significant indirect effect on food security through FWALPC ($p = 0.003$), reaffirming the importance of financial gains as a key driver of farmers' participation in land protection. Perceived social benefits likewise have a significant indirect effect on food se-

curity through FWALPC ($p = 0.010$). This highlights that social relationships, trust, and cooperation among farmers play a crucial role in fostering collective awareness and supporting food security objectives. Finally, subsidy policies exhibit a highly significant indirect effect on food security through FWALPC, with a p-value of 0.000. This underscores that financial support from the government not only encourages farmers' involvement in land protection efforts but also substantially contributes to achieving food security. Overall, these findings affirm that FWALPC plays a critical mediating role in ensuring the success of various factors in supporting food security. **Figure 4** illustrates the model for enhancing food security through farmers' participation in arable land protection. This model presents various influencing factors, including government regulations, policy subsidies, government propaganda, perceived ecology, economic, and social benefits, as well as their impact on food security.

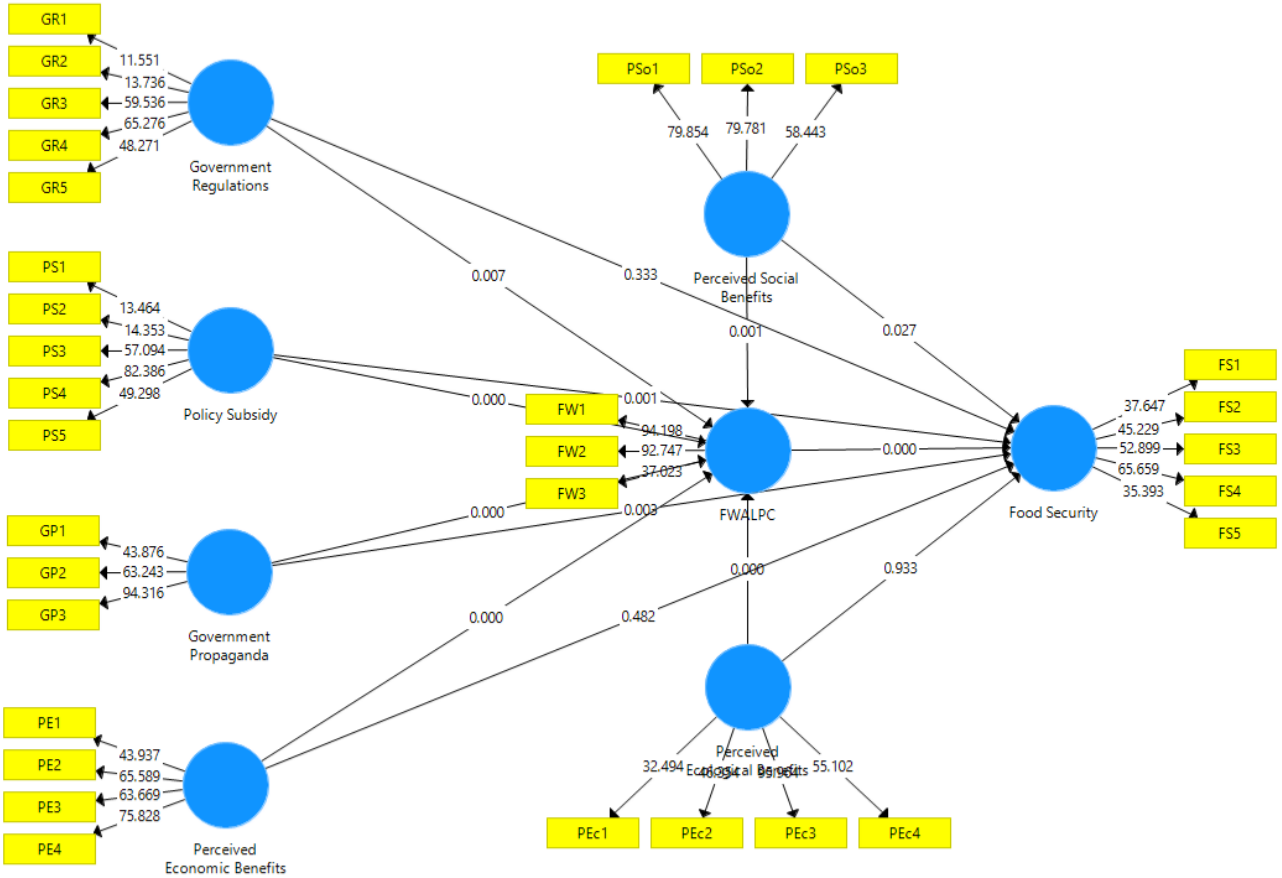


**Figure 4.** Model for enhancing food security through farmers' participation in the arable land protection.

# 5. Discussion and Research Implication

## 5.1. Discussion

The research findings indicate that Farmers' Willingness in Arable Land Protection Cooperation (FWALPC) has a significant influence on food security. This emphasizes that active farmer collaboration in land protection has a direct and strong impact on strengthening food security. FWALPC plays a crucial role as it directly contributes to improving food production and ensuring the sustainability of land resources. Therefore, initiatives to encourage farmers' willingness to collaborate in such efforts should be a priority in government policies. These findings also highlight the mediating role of FWALPC in ensuring the effectiveness of various interventions. Previous studies [1, 36, 37], have shown that farmer collaboration can prevent land conversion, which is relevant to the threats posed by urbanization

in many regions. Government propaganda significantly influences FWALPC and food security, demonstrating the critical role of government in raising awareness and encouraging farmer collaboration. Effective campaigns and communication from the government can enhance farmers' understanding of the importance of land protection. This direct impact is evident in increased farmer engagement and their contributions to food security. Additionally, government propaganda fosters a positive perception among farmers regarding land protection. Research by Zhang et al. and Lu et al.[15, 38], emphasizes that relevant government campaigns have proven effective in boosting farmer participation by highlighting the tangible benefits of land protection. Therefore, sustained and relevant communication strategies are essential.

Government regulations significantly influence FWALPC but have no direct significant effect on food security. These findings suggest that regulations can motivate farmers' willingness to participate in land protection, even though their direct impact on food security remains unobservable. Regulations may serve as an initial step to encourage farmer participation; however, full success requires support from other elements, such as incentives and campaigns. Thus, regulations should be integrated with other policies to achieve more significant outcomes. Studies by Liu et al. and Lohan et al.[14, 19] emphasize that effective regulations often require community-based programs to ensure their sustainability. Perceived ecological benefits have a significant influence on FWALPC but are not directly significant to food security. This suggests that the perception of ecological benefits, such as improved soil quality and environmental sustainability, motivates farmers more to engage in land protection than directly affecting food security. Hence, ecological benefits can serve as a primary driver for farmer participation. Programs highlighting the environmental benefits of land protection can be effective tools. Nevertheless, the ultimate impact on food security requires a more comprehensive approach. Studies[13, 39, 40] support this, showing that ecological benefits tend to have long-term effects that are less visible in direct analyses.

Perceived economic benefits significantly influence FWALPC but not food security. This indicates that financial gains are a primary motivator for farmers to engage in land protection, even though the impact on food security is not immediately apparent. Economic incentives such as subsidies or financial assistance can strengthen farmers' willingness to collaborate. However, achieving success necessitates integration with other factors to ensure its impact on food security. Research by Kim et al. and Maniruzzaman et al.[41, 42], highlights that incentive-based policies can be a critical catalyst for farmer participation, although they need to be combined with other approaches for sustainable effects. Conversely, perceived social benefits significantly influence both FWALPC and food security. Strong social relations, trust, and community support significantly contribute to farmer participation and food security. Social interactions among farmers create a collective awareness that strengthens engagement in land protection. Therefore, policies supporting the strengthening of farmers' social networks are crucial. Previous research[12, 43, 44] shows that social relations play a significant role in fostering a sense of collective responsibility that supports the long-term success of land protection programs. Measures such as group training or the development of community-based agricultural initiatives can be included.

Subsidy policies significantly influence both FWALPC and food security. This underscores the importance of financial incentives in driving farmers' willingness to collaborate while supporting food security. Subsidies provide direct economic incentives that assist farmers in implementing land protection measures. Additionally, subsidies can enhance farmers' access to technology and resources that support food production. Previous research[45–47] supports these findings, stating that direct subsidies can provide significant immediate benefits to farmer engagement. Therefore, subsidy policies must be carefully designed to maximize benefits for farmers. Indirect influence analysis reveals that FWALPC plays a critical mediating role in various factors affecting food security. Government propaganda has a significant indirect influence on food security through FWALPC. This indicates that government campaigns not only increase farmers' willingness to protect land but also strengthen their contribution to food security. Thus,

effective propaganda can be a powerful tool for integrating various policy efforts. Research by Bopp et al. and Tesfaye et al.[48, 49] emphasizes the importance of strategic communication for achieving long-term impacts on food security.

Government regulations also show a significant indirect influence on food security through FWALPC. This finding suggests that while their direct impact on food security is less significant, regulations can achieve success through FWALPC mediation. Therefore, strengthening regulations must be accompanied by measures that encourage farmer participation. With this approach, regulations can have broader impacts. This also highlights the importance of a comprehensive policy framework, as proposed by Zhou et al.[12, 13]. Perceived ecological benefits have a significant indirect influence on food security. This underscores the importance of environmental benefits in driving farmer collaboration for land protection. The perception of ecological benefits can be used as a central narrative in land protection campaigns. This way, farmers can be more motivated to participate in these efforts. Furthermore, Ha and Thanh[50] note that perceptions of ecological benefits often create collective momentum for land protection, although the impact on food security takes longer to materialize.

Perceived economic benefits also show a significant indirect influence on food security through FWALPC. This demonstrates that economic incentives not only encourage farmers' participation in land protection but also have long-term impacts on food security[51, 52]. Therefore, policies supporting economic benefits should continue to be strengthened. Subsidies, financial assistance, and market support are examples of interventions that can be considered. Thus, economic benefits can serve as leverage in land protection policies. Perceived social benefits show a significant indirect influence on food security through FWALPC. This indicates that social relationships, trust, and cooperation play a crucial role in achieving food security goals. Building strong communities can enhance the effectiveness of various land protection programs. Several studies[23, 26, 53, 54] also state that strengthening social networks creates synergistic effects that support the overall success of programs. Therefore, policies supporting social network development are highly relevant. These interventions may include group training or community-based agricultural development.

Finally, subsidy policies show a highly significant indirect influence on food security through FWALPC. This highlights the importance of subsidies as a primary driver of farmer engagement and their contribution to food security. Subsidies can provide dual benefits by increasing farmers' willingness to collaborate and strengthening food production. A report by Wicaksono[51], notes that subsidy designs tailored to local needs can enhance the sustainability of food production. Therefore, subsidy designs must consider local needs and farmers' characteristics. With this approach, subsidies can deliver broader and more sustainable impacts. Overall, these findings affirm that FWALPC plays a crucial mediating role in various factors influencing food security. Factors such as government propaganda, perceived ecological, economic, and social benefits, as well as subsidy policies, play vital roles in enhancing FWALPC and food security. Conversely, government regulations have yet to provide significant direct impacts on food security, requiring complementary approaches. Incentive-based approaches and effective communication campaigns are more recommended for encouraging farmer participation. Therefore, integrated and adaptive policies are necessary to ensure the success of land protection programs in supporting future food security.

## 5.2. Research Implication

The implications of this study provide critical insights for policymakers, practitioners, and academics to strengthen strategies for arable land protection and food security. First, the findings underscore the importance of farmers' willingness to collaborate in land protection as a key factor in ensuring food security. Therefore, the government and other stakeholders should prioritize initiatives that enhance farmer engagement through community-based approaches, incentives, and relevant education. This aligns with previous literature indicating that farmer collaboration directly reduces the risk of land conversion and supports sustainable food production. Second, the significant role of government propaganda on FWALPC and food security highlights the

importance of effective and sustained communication campaigns. The government must develop communication strategies that emphasize the importance of land protection and its impact on food security. These campaigns should be designed considering the local context to ensure that the messages are relevant and well-received by farmers. Prior research also confirms that effective communication can enhance farmer awareness and strengthen their participation in environmental programs. Third, while government regulations significantly influence FWALPC, their direct impact on food security is not significant. This suggests that regulations need to be complemented by additional policies, such as economic incentives or community-based programs. Regulations that are too rigid without supporting elements may be less effective in encouraging farmer participation. Therefore, the government should integrate regulations with more adaptive and inclusive approaches, such as subsidies or group-based training programs, to achieve optimal outcomes.

Fourth, farmers'perceived ecological benefits play a key role in promoting their willingness to collaborate, although their influence on food security is not significant. This indicates that efforts to increase farmers' awareness of ecological benefits, such as improved soil quality and resource conservation, should be an integral part of land protection programs. Governments and environmental organizations can develop educational programs that emphasize the long-term impacts of land protection on ecosystem sustainability. Fifth, perceived economic benefits have a significant influence on FWALPC, making incentive-based policies highly relevant. Subsidies and financial assistance, such as tax reductions or price support, can serve as effective tools to encourage farmer involvement in land protection. However, these incentives should be carefully designed to ensure that their impacts also support sustainable food security. Poorly targeted economic support may not yield optimal results if not integrated with other efforts. Furthermore, perceived social benefits significantly impact both FWALPC and food security, emphasizing the importance of social relationships in enhancing farmer participation. Strengthening social networks among farmers can be achieved through group training, the formation of agriculture-based communities, and the development of collaborative programs. These social-based interventions not only promote farmer involvement in land protection but also create synergistic effects that collectively support food security. Finally, subsidy policies have proven to be among the most effective policy tools in this study. Subsidies not only increase farmers' willingness to protect land but also contribute directly to food security. Therefore, the government should ensure well-designed subsidies that address local needs and consider farmer characteristics to maximize their benefits. This approach may include performance-based subsidies, where farmers demonstrating significant land protection results receive additional incentives. Overall, these findings emphasize that incentive-based policies, effective communication, and strengthening farmers' social networks play vital roles in supporting land protection and food security. The study also indicates that a regulation-only approach is insufficient for achieving desired success. Therefore, an integrated, adaptive, and evidence-based policy framework is needed to ensure that all interventions produce significant and sustainable impacts on food security in the future.

# 6. Conclusions

This study demonstrates that farmers' willingness to collaborate in arable land protection (Farmers' Willingness in Arable Land Protection Cooperation or FWALPC) plays a crucial role in supporting food security. Factors such as government propaganda, ecological benefits, economic benefits, social benefits, and subsidy policies significantly influence FWALPC, ultimately strengthening food security. On the other hand, government regulations have a significant impact on FWALPC but do not directly affect food security. This indicates the need for an integrated policy approach to optimize the impact of regulations on food security. The findings also highlight the mediating role of FWALPC in the relationship between various factors and food security. Government propaganda and social benefits contribute significantly to food security both directly and indirectly, emphasizing the importance of communication-based approaches and strengthening social networks. Subsidy policies,

which have proven to exert both direct and indirect effects, provide strong evidence that incentive-based policies are effective tools for encouraging farmer collaboration and enhancing food production. This study underscores the necessity of evidence-based policy strategies, including the design of appropriate subsidies, relevant communication campaigns, and the strengthening of farmers' social connections. Moreover, integrating government regulations with economic incentives and education has the potential to produce a more significant impact on food security. These findings contribute to the literature on arable land protection and food security while offering practical guidance for policymakers to develop more effective and sustainable programs. Despite its significant contributions, this study has several limitations that should be acknowledged. First, the research relies on cross-sectional data, which cannot fully capture the dynamic changes in the relationships between the variables analyzed. Longitudinal studies are needed to identify how these relationships evolve over time. Additionally, this study employs a quantitative approach based on respondents' perceptions, which may be influenced by subjective biases. Further qualitative research, such as in-depth interviews or case studies, could provide richer insights into the motivations and challenges farmers face in land protection collaboration. Nonetheless, this study provides a solid foundation for understanding the factors influencing FWALPC and its implications for food security.

## Author Contributions

Conceptualization, Y.I. and A.A.; methodology, Y.I., N.H. and R.T.; software, Y.I.; validation, Y.I., A.A., N.H. and R.T.; formal analysis, Y.I. and R.T.; investigation, Y.I.; resources, Y.I.; data curation, Y.I.; writing—original draft preparation, Y.I.; writing—review and editing, Y.I., A.A. and R.K.; visualization, Y.I.; supervision, A.A., N.H. and R.K.; project administration, A.A. All authors have read and agreed to the published version of the manuscript.

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## Institutional Review Board Statement

Not applicable.

## Informed Consent Statement

Not applicable.

## Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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## Conflicts of Interest

The authors declare no conflict of interest.

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