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# Impact of agricultural infrastructure and government support on farmers' welfare in Indonesia

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## Abstract

The Indonesian government has focused on building infrastructure and providing support for agricultural development, both in Java, its economic center, and outside of Java. Therefore, this study aims to examine the impacts of agricultural infrastructure development and government support on Indonesian farmers' welfare. The study used secondary data from 33 provinces from 2007-2021. The data were analysed using multilevel mixed-effect logistic regression and propensity score matching. The use of such models is due to the significant heterogeneity of parameters between observations. The findings show that the urea fertilizer subsidies, two-wheeled tractors and water pump assistances have a positive impact and improve the farmers' welfare in Java. Meanwhile, the urea fertilizer subsidies, four-wheeled tractor assistance, and the construction of ponds have a positive impact and improve the farmers' welfare outside of Java. The surprising observation from our study is that the food self-sufficiency program harms the farmers' welfare in both areas.

**Keywords**: fertilizer subsidies, tractor, food self-sufficiency program, Java, outside of Java

## 1. Introduction

Developing-country governments continue to overcome numerous challenges through various policies and programs. All of these efforts have been expressed by Mosher (1966), who believes that agricultural development requires a progressive rural structure program. Six key components were highlighted as marketing outlets for agricultural products, adequate supply of production factors, credit, extension and training services; local verification pilots to support agricultural research, and farm-to-market roads. Mosher also emphasized the importance of rural industry and non-agricultural employment to support agricultural development (de Graaff, Kessler, & Nibbering, 2011). Mosher's theory has transformed into a modern agricultural development theory. Agricultural development is currently focused on a multidimensional integrated approach from upstream to downstream and not only focusing on new technologies, but also the environment (Ojiewo, Omoigui, Pasupuleti, & Lenné, 2020).

Indonesia is one of the developing countries that have launched a policy to develop small farming systems, ensure farmers' access to better technology and markets, improve rural-urban marketing channels, infrastructure, and communications, and advance cooperatives and agribusiness (Yamauchi, 2016). The implementation of several agricultural policies and programs is hampered by a lack of human resource development and little supporting research (Witjaksono, Rawung, Indrasti, & Tan, 2020). As a result, the agricultural development in Indonesia is not optimal, as indicated by low farmer incomes, increased conversion of agricultural land, and difficulties in farmer regeneration (Indonesian Central Statistical Bureau, 2022).

Hence, this study aims to examine the impacts of agricultural infrastructure development and government support on Indonesian farmers' welfare. This study is

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important for the development of an effective agricultural program in Indonesia. We separate the impacts of the agricultural programs based on Java and outside of Java to present the right recommendations. There are several reasons for the preparation of both models: First, the socio-economic conditions of the residents in Java are more advanced than those outside of Java, as can be seen from the development of the industrial sectors (Hakim, Nachrowi, Handayani, & Wisana, 2022; Pujiati, Nurbaeti, & Damayanti, 2023). Second, the agricultural infrastructure development and government support in Java have started since the beginning of Indonesia's independence, while areas outside of Java have only started massively in recent years through agricultural land intensification and extensification programs (Otsuka, 2021; Sekaranom, Nurjani, & Nucifera, 2021). Third, the agricultural land in Java is more fertile than outside of Java (de Zwart, 2021; Fahmid, Wahyudi, Agustian, Aldillah, & Gunawan, 2022).

This study also contributes to the advancement of econometrics by employing multilevel mixed-effect logistic regression and propensity score matching approaches that have never been combined in previous studies.

## 2. Research Method

### 2.1 Variables and data collection

According to agricultural development theory, infrastructure development includes the construction of ponds, the expansion of irrigation canals, and of the irrigated agricultural lands. Meanwhile, government support includes policies for distributing subsidized fertilizers to farmers, assistance with two-wheeled and four-wheeled tractors, assistance in procuring water pumps, and special efforts to increase food self-sufficiency (Table 1). One of the main programs of the Indonesian government to increase food self-sufficiency in the last decade is the special efforts for self-sufficiency in rice, corn, and soybeans (*Upaya Khusus Swasembada Padi, Jagung, Kedelai* / *UPSUS PAJALE*). All of these programs are included as the explanatory variables, while the dependent variable is the farmers' welfare as measured by the farmer's terms of trade.

The data for this study came from the Indonesian Statistical Bureau and the Indonesian Ministry of Agriculture. After that, the data were organized into panel data. The time series data are from 2007 to 2021 (15 years), and the cross-section data represent 33 Indonesian provinces. Because North Kalimantan Province was formed in 2012, its data have been combined with East Kalimantan Province.

## 3. Data Analysis

### 3.1 Farmers' welfare

The measure of the farmers' welfare is the ratio between the price received and the price paid by farmers, known as the farmer's terms of trade (Prasada, Dhamira, & Nugroho, 2022):

$$ToT = (PR/PP) \times 100 \quad (1)$$

where ToT is the value of the farmer's terms of trade, PR is the price received by farmers, and PP is the price paid by farmers. Based on this equation, a ToT larger than 100 indicates that the PR is higher than the PP, or that the farming activities provide profits. However, a ToT less than 100 means that farming activities are driving down the farmers' welfare (Prasada *et al*., 2022).

### 3.2 Determinant factors of the farmers' welfare

The determinant factors of the farmers' welfare were analysed using a multilevel mixed-effect logistic regression model. This model is used in panel data types with binary categorical dependent variables. Theoretically, the logistic regression model cannot solve equations with a high degree of heterogeneity due to varying parameters across observations. Therefore, the multilevel mixed-effect logistic regression was chosen to minimize bias in data with heterogeneity symptoms (Park & Park, 2022).

We created Equation (2) based on previous studies carried out by various scholars. Lau and Yotopoulos (1989) introduced the concept of agricultural development based on farmers' resources. Farmers can implement labor-intensive farming if labor is abundant, but farmers can use new technology if labor is scarce. De Janvry (2010) stated that government assistance, natural factors, and environmental concerns will accelerate agricultural development, improve farmer welfare, and optimize economic growth.

Infrastructure provision in the agricultural sector aims to facilitate on-farm or off-farm activities and improve farmers' welfare. The types of infrastructure provision are

Table 1. Variable information

| Variable | Description | Measurement | Source |
|---|---|---|---|
| ToT | Farmer's terms of trade | Index | Computed |
| IRI | Irrigated agricultural land | Hectare | Indonesian Central Statistical Bureau |
| URE | Distribution of subsidized urea fertilizer | Ton | the Indonesian Ministry of Agriculture |
| NPK | Distribution of subsidized NPK fertilizer | Ton | the Indonesian Ministry of Agriculture |
| TWT | Two-wheeled tractor assistance | Unit | the Indonesian Ministry of Agriculture |
| FWT | Four-wheeled tractor assistance | Unit | the Indonesian Ministry of Agriculture |
| WPP | Water pump assistance | Unit | the Indonesian Ministry of Agriculture |
| PND | Construction of a pond for agricultural activities | Unit | the Indonesian Ministry of Agriculture |
| UPS | Special efforts to self-sufficiency in rice, corn, and soybeans (UPSUS PAJALE) | 0=Other;<br>1= Implementation period of UPSUS PAJALE | the Indonesian Ministry of Agriculture |

very diverse: water reservoirs and irrigation canals. The provision of reservoirs helps farmers' resilience to climate change, while good quality and coverage of irrigation canals will improve farmers' welfare (Vico, Tamburino, & Rigby, 2020).

Apart from providing infrastructure, the government helps the agricultural sector by providing subsidies for fertilizer, tractors, and programs to increase agricultural production (Mokgomo, Chagwiza, & Tshilowa, 2022). Government support will increase the farming scale economies and the farmers' welfare.

The ToT in this study is made into a binary variable: 1 indicates ToT higher than 100 and 0 indicates that the ToT is less than or equal to 100.

$$logit(\Pr(ToT_{ij} = 1)) = \beta_0 + \beta_1 IRI_{ij} + \beta_2 URE_{ij} + \beta_3 NPK_{ij} + \beta_4 TWT_{ij} + \beta_5 FWT_{ij} + \beta_6 WPP_{ij} + \beta_7 PND_{ij} + \beta_8 UPS_{ij} + u_j \quad (2)$$

Expected estimation mark $\beta_1$, $\beta_2$, $\beta_3$, $\beta_4$, $\beta_5$, $\beta_6$, $\beta_7$, $\beta_8$, > 0.

The author develops two multilevel mixed-effect logistic regression models based on the areas of agricultural development in Java (East Java, Central Java, the Special Region of Yogyakarta, West Java, Banten, and the Special Capital Region of Jakarta Provinces) and outside of Java (27 provinces). Java is the main island that contributes greatly to Indonesia's economic growth (Solihin, Wardana, Fiddin, & Sukartini, 2021). Economic growth in Java in 2022 reached 5.30% while outside of Java it was 4.69% (Indonesian Central Statistical Bureau, 2022). Java is also the center of food production in Indonesia, producing 30.67 million tons of rice (56.02% of Indonesia's total production) while outside of Java is the center of plantation crop production, especially oil palm. 55.94% of Indonesia's population lives on the island of Java, hence land conversion rate is very high, reaching 187.72 hectares per year (Rondhi, Pratiwi, Handini, Sunartomo, & Budiman, 2018).

The multilevel mixed-effect logistic regression model is valid when it meets the likelihood ratio test criteria (LR test), Wald test, and produces the smallest Akaike's & Bayesian information criteria when compared to other models (Lorah & Womack, 2019). In addition, the variables must also avoid non-stationary behavior (Prasada & Dhamira, 2022). The stationarity test in this study was carried out using the Levin, Lin and Chu (LLC) method. The stationarity test results show that most of the variables are stationary at the 1st difference level. The PND is the only variable that is stationary at the level (Table 2).

### 3.3 Impact evaluation of agricultural infrastructure and support on farmers' welfare

The findings of the multilevel mixed-effect logistic regression cannot explain the influence of each variable on the farmers' welfare. Therefore, further analysis using the propensity score matching (PSM) method is needed to determine the impacts of the policy on the farmers' welfare (Prasada, Dhamira, Aisyah, Anisya, & Puspajanati, 2024). Impact evaluation can be carried out using several stages of analysis. First, identify the control group and treatment group. Second, identify outcomes that can be measured using impact evaluation analysis. Third, carry out a characteristic matching process between the control group and the treatment group to determine the effect of the treatment on the predetermined outcomes (Kuss, Blettner, & Börgermann, 2016).

The control group in this study was in the period before agricultural infrastructure development and government support, whereas the treatment group experienced infrastructure development and government support.

$$ATT = E(R_1|I = 1) - E(R_0|I = 0) \quad (3)$$

$$ATT = E\{R_1|I = 1, p(Z)\} - E\{R_0|I = 0, p(Z)\} \quad (4)$$

where ATT (Average Treatment effect of the Treated group) is the value of the impact of treatment on outcomes based on all the data used, $I$ indicates the treatment indicator applied to the study ($I = 0$ for the control group, $I = 1$ for the treatment group), $R_0$ indicates the value outcome of the control group, $R_1$ is the outcome value of the treatment group, and $p(z)$ indicates the propensity score resulting from the PSM analysis. $p(z)$ is obtained from the probit estimation results of the dummy variable level of farmers' welfare (ToT). The results of the PSM are valid when two assumptions are met: conditional independence and overlapping (Sseguya *et al.*, 2021).

Table 2. LLC stationarity test

| Variable | Java | | | Outside of Java | | |
|---|---|---|---|---|---|---|
| | Stage | LLC Statistic | p-value | Stage | LLC Statistic | p-value |
| IRI | 1st Difference | -5.55 *** | 0.00 | 1st Difference | -6.53 *** | 0.00 |
| URE | 1st Difference | -4.03 *** | 0.00 | Level | -3.36 *** | 0.00 |
| NPK | 1st Difference | -3.97 *** | 0.00 | Level | -2.65 *** | 0.00 |
| TWT | 1st Difference | -3.68 *** | 0.00 | Level | -3.32 *** | 0.00 |
| FWT | 1st Difference | -3.52 *** | 0.00 | Level | -4.93 *** | 0.00 |
| WPP | 1st Difference | -4.87 *** | 0.00 | Level | -4.15 *** | 0.00 |
| PND | Level | -3.82 *** | 0.00 | Level | -8.81 *** | 0.00 |

Note: *** significant at 0.01.

## 4. Results

The Wald test results in the Java and outside of Java models are significant, indicating a significant variation of the explanatory variables in the proportion of obtaining a ToT higher than 100 (Pr($T_0T_{ij}$ = 1). In addition, the likelihood ratio (LR test) for Java and outside of Java models are significant, implying that the models are better than the ordinary logistic regression. The values of Akaike's and Bayesian information criteria are the smallest compared to the ordinary logistic regression model (Table 3). This shows that the multilevel mixed-effect logistic regression model is valid for this study.

The interclass correlation (ICC) for outside of Java model shows that the variation in data is greater than in Java, meaning that the variations between provinces outside of Java and in Java are 67.00% and 21.00% respectively. These values are also in line with the values of random intercept variance (Province var.) which is higher for the model outside of Java (6.70) compared to the Java model (0.89).

The results show that the amount of urea fertilizer subsidy (URE), two-wheeled tractor assistance (TWT), and water pump assistance (WPP) in Java have a significant and positive impact. This shows that higher amounts of URE, TWT, and WPP in Java will increase the farmers' welfare probability. Nevertheless, the special efforts programs for self-sufficiency in rice, corn, and soybeans (UPSUS PAJALE / UPS) have a negative and significant impact. This result can be interpreted as a reduction in farmers' welfare in Java during the government's national program.

The URE, the four-wheeled tractor assistance (FWT), and the pond construction for agricultural activities (PND) have a positive and significant effect on the farmers' welfare outside of Java. However, the UPS has a negative and significant impact, meaning that farmers outside of Java have lower welfare during the UPSUS PAJALE.

The PSM method appears to have met the conditional independence requirements for Java and outside of Java. The total bias reduction values for the TWT, WPP, and UPS in Java model show this, with these experiencing bias reductions of 88.40%, 99.20%, and 99.00%, respectively (see Table 4). Meanwhile, the total bias reductions for TWT, PND, and UPS in outside of Java model were 66.40%, 99.90%, and 95.40% respectively. A bias reduction of more than 60% indicates that the Java and outside of Java models avoid the possibility of bias in the model development. This reduction in bias is also supported by the pseudo $R^2$ and LR $chi^2$ which are significant at 0.01, demonstrating that the model's bias reduction is significant.

Table 3. Determinants of the farmers' welfare in Java and outside of Java

| Variable | Java | | | Outside of Java | | |
|---|---|---|---|---|---|---|
| | Coefficient | Std. error | Prob. z-statistic | Coefficient | Std. error | Prob. z-statistic |
| IRI | $-2.36^{ns}$ | 5.63 | 0.68 | $0.77^{ns}$ | 1.28 | 0.55 |
| URE | $6.40^{*}$ | 3.42 | 0.06 | $1.20^{**}$ | 0.50 | 0.02 |
| NPK | $5.11^{ns}$ | 4.37 | 0.24 | $-0.95^{ns}$ | 0.65 | 0.14 |
| TWT | $1.60^{**}$ | 0.79 | 0.04 | $-0.02^{ns}$ | 0.29 | 0.95 |
| FWT | $-1.20^{ns}$ | 0.91 | 0.19 | $1.19^{**}$ | 0.54 | 0.03 |
| WPP | $3.16^{***}$ | 1.03 | 0.00 | $0.48^{ns}$ | 0.36 | 0.18 |
| PND | $-0.78^{ns}$ | 0.56 | 0.17 | $1.27^{**}$ | 0.52 | 0.02 |
| UPS | $-2.02^{**}$ | 0.97 | 0.04 | $-2.56^{***}$ | 0.62 | 0.00 |
| Cons. | $-0.03^{ns}$ | 0.82 | 0.97 | $-2.48^{***}$ | 0.36 | 0.00 |
| Province var. | 0.89 | 0.98 | | 6.70 | 3.13 | |
| Interclass correlation (ICC) | 0.21 | 0.19 | | 0.67 | 0.10 | |
| Number of observations | | 84.00 | | | 378.00 | |
| Number of groups | | 6.00 | | | 27.00 | |
| Akaike's information criterion | | 86.73 | | | 300.86 | |
| Bayesian information criterion | | 111.03 | | | 340.21 | |
| Wald $chi^2$ | | 14.98 | | | 27.33 | |
| Prob. Wald $chi^2$ | | 0.06 | | | 0.00 | |
| LR test | | 2.73 | | | 104.47 | |
| Prob. LR test | | 0.04 | | | 0.00 | |

Note: $^{***}$ significant at 0.01; $^{**}$ significant at 0.05; $^{*}$ significant at 0.1

Table 4. Balancing test of Java and outside of Java models

| Infrastructure and government support | Pseudo $R^2$ (p-value) | LR $chi^2$ (p-value) | Total % \|bias\| reduction |
|---|---|---|---|
| Java model | | | |
| TWT | 0,00 | 0,02 | 88,40 |
| WPP | 0,00 | 0,00 | 99,20 |
| UPS | 0,00 | 0,00 | 99,00 |
| Outside of Java model | | | |
| FWT | 0,03 | 0,02 | 66,40 |
| PND | 0,00 | 0,00 | 99,90 |
| UPS | 0,00 | 0,00 | 95,40 |

The propensity score distribution shows that Java and outside of Java models fulfil the overlapping assumptions. Regarding the amount of data treated, off support is very small and thus indicates the accuracy of the impact evaluation analysis results (Figure 1).

Impact evaluation analysis shows that the provision of the TWT in Java has a positive impact on increasing the farmers' welfare (Table 5). The provision of the WPP has a positive impact on increasing the ToT value by 3.94. However, the UPSUS PAJALE decreases the ToT value by 1.25. In the model outside of Java, the ToT value increased by 2.86 when the FWT program was given. Furthermore, the PND increased the farmers' welfare by 3.74. Nonetheless, UPS has not had an impact on increasing farmers' welfare.

Table 5. Impact evaluation results for Java and outside of Java models

| Infrastructure and government support | Impact evaluation (Difference after matching) | t-statistic |
|---|---|---|
| Java model | | |
| TWT | 7.02 | 6.41*** |
| WPP | 3.94 | 2.99*** |
| UPS | -1.25 | -1.31* |
| Outside of Java model | | |
| FWT | 2.86 | 1.58* |
| PND | 3.74 | 1.92** |
| UPS | -2.64 | -1.84** |

*** Significant at 1% alpha (t-table= 2.37); * Significant at 10% alpha (t-table= 1.29)

## 5. Discussion

The determinant factors of the farmers' welfare in Java are URE, TWT, WPP, and UPS, while the URE, FWT, PND, and UPS have effects on the farmers' welfare outside of Java. Urea fertilizer ensures the availability of nitrogen in the soil, allowing for optimal plant growth (Giordano, Petropoulos, & Rouphael, 2021). The urea fertilizer helps the process of forming chlorophyll and plant photosynthesis (Razaq, Zhang, Shen, & Salahuddin, 2017).

The use of urea fertilizer is important for agriculture in Java because the soil quality has decreased due to massive land use for a long time, and the soil structure has been degraded by erosion, seawater intrusion, and chemical deterioration (Sembiring *et al.*, 2020). Meanwhile, most of the soil structures outside of Java are similar to Java because they are located in tropical areas. Several agricultural areas outside of Java, especially Kalimantan and Sumatra, are dominated by peatlands with low nitrogen content. Therefore, these require additional urea fertilizer to become productive agricultural land and increase farmers' welfare (Dettmann, Kraft, Rech, Heidkamp, & Tiemeyer, 2021).

Even so, the Indonesian government must be vigilant because chemical fertilizer subsidies have been proven to cause farmers' reliance on subsidies. Furthermore, subsidized fertilizers are frequently in lack of supply in Indonesia during certain seasons. Excessive urea fertilizer use can damage agricultural ecosystems (Weerahewa & Dayananda, 2023).

Consider the tractor assistance for farmers both in Java and outside of Java. A study in Sub-Saharan Afric and Pakistan shows that the use of tractors and harvesters increases agricultural productivity (Djoumessi, 2021). The application of agricultural mechanization makes farming activities more efficient and the farmers' welfare increases.

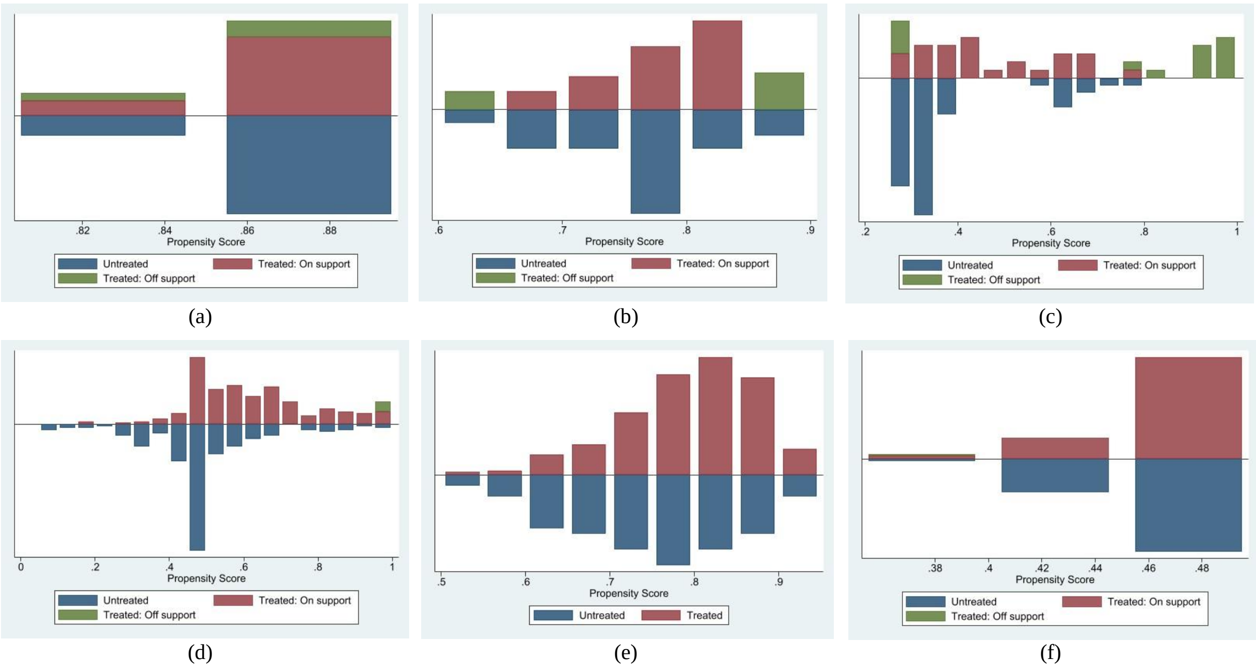


Figure 1. (a) Propensity score distribution for TWT in Java, (b) propensity score distribution for WPP in Java, (c) propensity score distribution for UPSUS in Java, (d) propensity score distribution for FWT outside of Java, (e) propensity score distribution for PND outside of Java, and (f) propensity score distribution for UPSUS outside of Java

TWT has a positive and significant regression coefficient in Java but is insignificant outside of Java. The impact evaluation analysis also revealed that the group with the TWT assistance program outperformed the control group in terms of ToT. The TWT assistance is effective in Java due to the scarcity of agricultural land. The high rate of conversion and fragmentation of agricultural land in Java causes farmers to have only narrow agricultural land with the average of 0.17 hectares (Indonesian Central Statistical Bureau, 2022). In addition, farmers on Java are dominant in cultivating food crops in the agricultural lands that have boundaries on each side. In this type of land, the mobility of TWT makes it more effective than an FWT.

The FWT has a positive impact in the outside of Java model, but it is not significant in Java. The impact evaluation results show that the FWT has a positive impact on increasing farmers' welfare outside of Java. This is due to the expansion of agricultural land outside of Java (Juniyanti, Purnomo, Kartodihardjo, & Prasetyo, 2021). In addition, agricultural land outside of Java is dominated by plantations which have no boundaries making the use of FWT more effective than TWT.

Another variable in the Java model, the WPP, has a positive and significant impact. These findings suggest that the higher the WPP assistance on Java, the higher the likelihood of farmers' welfare. Nonetheless, the WPP outside of Java has a non-significant impact. Meanwhile, the PND variable has no significant effect on farmers' welfare in Java, but it has a positive and significant impact outside of Java.

Infrastructure development in Java has been carried out since the beginning of independence (1945) through the rice centre program. The infrastructure development includes repairing irrigation canals, building reservoirs, and extending farm roads (Hamilton-Hart, 2019). Furthermore, strategic agricultural infrastructure development continued through the green revolution program to achieve food security (White, Graham, & Savitri, 2023). During the administration of President Joko Widodo (Jokowi), infrastructure development began to focus outside of Java to reduce social inequality. This fact demonstrates that the irrigation infrastructure in Java is fully operational. As a result, farmers require more continuous water distribution to agricultural land. Foster, Brozović, and Butler (2015) has revealed that the use of water pumps is essential for the agricultural land that is close to water sources. This implies that farmers in Java require pumps to facilitate water distribution and increase agricultural land productivity.

In contrast to Java, farmers outside of Java need more agricultural infrastructure, such as agricultural ponds, to ensure the sustainability of their farming. Pond construction is critical outside of Java due to the high average annual rainfall. The average rainfall outside of Java is 2,217.79 mm per year and higher than in Java (2,063.12 mm) (Indonesian Central Statistical Bureau, 2022). In addition, the vast agricultural land outside of Java causes it to be located far from water sources. Agricultural land that is far from water sources requires an infrastructure for water storage and distribution to agricultural land.

The UPS program has a negative and significant regression coefficient in the Java and outside of Java models, meaning that the farmers' welfare is lower during the program. These findings are consistent with the findings of the impact evaluation analysis, which show that the UPS program harms the farmers' welfare. In fact, the UPS program is one of the strategic programs of the Indonesian Ministry of Agriculture. The program includes farmer mentoring programs on best agricultural practices for rice, corn, and soybean. Nonetheless, the UPS program's implementation is regarded as ineffective, as the assistance of agricultural tools and machinery is not location specific and overrides other aspects outside the UPS program that affect agricultural competitiveness (Setiyanto, Pabuayon, Quicoy, Camacho, & Depositario, 2021). In addition, this program only focuses on increasing agricultural production so it pays little attention to the farmers' welfare.

The development of agricultural infrastructure and government support in the agricultural sector plays a vital role in improving the farmers' welfare, both in Java and outside of Java. However, farmers must be encouraged to become self-sufficient business players to avoid dependence on government support. This will accelerate agricultural development in Indonesia (Anzia, Jares, & Malhotra, 2022; Purnawan, Brunori, & Prosperi, 2021).

## 6. Conclusions and Implications

Our study found that efforts to improve farmers' welfare in Java and outside of Java require different infrastructure developments and government support. The farmers' welfare in Java can be increased through increasing urea fertilizer subsidies, two-wheeled tractor assistance, and water pump assistance. Meanwhile, the farmers' welfare outside of Java can be increased through increasing urea fertilizer subsidies, four-wheeled tractor assistance, and pond infrastructure.

One thing that surprised us was that the implementation of Indonesia's food self-sufficiency program, UPSUS PAJALE, harms the farmers' welfare. However, this strengthens our opinion that agricultural development programs must be bottom-up. Meanwhile, UPSUS PAJALE is a more top-down approach that focuses on increasing food production while paying little attention to farmers' welfare. Even though the analysis's findings highlight the need of government support in providing diverse agricultural infrastructure and services, farmers must be directed to become self-sufficient business players so that they are not overly reliant on government support. They are expected to have initiatives to address problems and limitations, particularly the scarcity of agricultural production factors and infrastructure development delays.

The findings of this study can be used to inform future research on agricultural infrastructure development and government support in the agricultural sector. This is because agricultural development is a long-term effort with long-term consequences. As a result, future study should focus on employing larger data sets and taking into account local community factors.

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