AGRISOCIONOMICS
Jurnal Sosial Ekonomi dan Kebijakan Pertanian

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 10 (1): 71- 87, March 2026

The Influence of Farm Road Construction on Agriculture in Banjarnegara Regency

Diah Setyorini Gunawan[1], Icuk Rangga Bawono[2*], Rifda Naufalin[3], Hery Awan Susanto[4], Anzar Alfat Firdaus[1]

[1] Department of Economics and Development Studies, Faculty of Economics and Business, Universitas Jenderal Soedirman, Purwokerto, Central Java, Indonesia
[2]Department of Accounting, Faculty of Economics and Business, Universitas Jenderal Soedirman, Purwokerto, Central Java, Indonesia
[3]Department of Food Technology, Faculty of Agriculture, Universitas Jenderal Soedirman, Purwokerto, Central Java, Indonesia
[4]Department of Civil Engineering, Faculty of Engineering, Universitas Jenderal Soedirman, Purwokerto, Central Java, Indonesia
Correspondence Email: icuk.bawono@unsoed.ac.id

Submitted 23 June 2025; Approved 30 September 2025

ABSTRACT

Farm roads are essential infrastructure that support agricultural business activities by improving access and transportation efficiency. This research aims to assess the impact of farm roads on agricultural productivity and to explore the related challenges and opportunities in Banjarnegara Regency. The study employs both primary and secondary data, with primary data collected through survey methods. Respondents were rice farmers from eight sub-districts in Banjarnegara Regency, providing diverse insights into local farming conditions. The data were analyzed using the Wilcoxon test. The findings reveal a significant difference in farmer productivity prior to and following the construction of Farm Roads. The majority of respondents (60.34 percent) experienced an increase in productivity, indicating the presence of farm roads in Banjarnegara Regency has a beneficial effect on the local agricultural community. However, 13.79 percent of respondents reported a decline in productivity, while 25.87 percent had no change in productivity. The challenges and potential related to Farm Roads in the surveyed areas are largely representative of those in other areas of Banjarnegara Regency. This issue warrants attention from relevant local government agencies, as adequate Farm Roads are essential for farmers. These roads are not only vital for accessing farmland but also for transporting agricultural inputs and harvests. Improved access and transportation can significantly enhance agricultural productivity in Banjarnegara Regency.

Keywords: *Agricultural Infrastructure, Agricultural Sector, Farm Roads, Farmer Productivity*

BACKGROUND

Farm Road (Jalan Usaha Tani, or JUT) is a critical infrastructure for agricultural activities (Lestari et al., 2023; Makbul et al., 2019; Rendrarpoetri et al., 2024). The presence of Farm Roads

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 10 (1): 71- 87, March 2026

facilitates agricultural operations, ultimately contributing to the improvement of farmers' welfare (Jimoh et al., 2024; Lei & Yang, 2024; Liu et al., 2025). Farm Road is characterized as a rural pathway situated amidst rice paddies, typically measuring between 2 to 2.5 meters in width, with its length adapted to the specific local conditions and resources available (Dinas Ketahanan Pangan dan Pertanian Kabupaten Bojonegoro, 2019).

The establishment of Farm Road represents a strategic initiative aimed at advancing agricultural areas, with the expectation that these roads will streamline the distribution of agricultural products (Haque et al., 2024; Ohashi et al., 2024; Puška et al., 2024). The direct impact of these roads includes fostering the economic growth of farmers, while indirectly benefiting regional development. Additionally, the existence of Farm Road frequently results in a rise in the value of nearby land. This is related to the conversion from agricultural to non-agricultural uses (Saqib et al., 2024, 2024; S. Wang et al., 2025). These roads can stimulate the growth and development of other built-up land functions. In this context, government policies are necessary for the implementation and oversight of Farm Road to control land-use conversion (Ercan, 2024; Nie et al., 2024; Wei et al., 2025). If this issue is left unchecked, it could threaten the long-term viability of the agricultural sector in that area (Suminar, 2018).

The availability of farm roads, which facilitates smoother farming operations, is anticipated to enhance agricultural productivity (Raihan et al., 2024; Sethi et al., 2024; Yamashita et al., 2024). This improvement supports broader initiatives to increase agricultural output in Banjarnegara Regency, located in Central Java Province. Banjarnegara Regency has made significant progress in improving Farm Roads and supporting facilities, which has positively impacted agricultural activities. Farm Roads are strategic infrastructure that is greatly needed by farmers in Banjarnegara Regency to support the smooth running of agricultural activities, from the distribution of production facilities to the transportation of harvested produce. However, further development is needed to ensure all farmers have access to reliable infrastructure to optimize agricultural productivity.

Based on data from Department of Agriculture, Fisheries and Food Security of Banjarnegara Regency in 2023, the Banjarnegara Regency Government built 33 Farm Roads spread across several sub-districts in Banjarnegara Regency. The length of Farm Roads in each village ranges from 344-519 meters. Batur District has the largest number of Farm Roads in Banjarnegara Regency. Batur District is located in the northern part of the mountainous area and the majority of its area is agricultural land and plantations that require Farm Roads. Farm Roads are needed to facilitate the transportation of agricultural production facilities and agricultural products and facilitate community activities. In 2025, the Banjarnegara Regency Government plans to build Farm Roads in 48 agricultural areas in Banjarnegara Regency. With the increasing number of Farm Roads, it is hoped that agricultural activities in Banjarnegara Regency can run smoothly.

The agricultural sector serves as a major contributor to the Gross Regional Domestic Product (GRDP) of Banjarnegara Regency. According to data from the Central Statistics Agency of Banjarnegara Regency, the agricultural sector contributed 30.58% to the GRDP in 2020. In the following years, its share slightly declined to 29.88% in 2021 and 29.56% in 2022. The agricultural sector's contribution differs considerably from that of the manufacturing sector, which ranks second in terms of contribution to Banjarnegara Regency’s GRDP. The manufacturing sector contributed

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 10 (1): 71- 87, March 2026

15.16% in 2020, and 15.56% and 15.73% in 2021 and 2022, respectively (Badan Pusat Statistik Kabupaten Banjarnegara, 2023).

The agricultural production data for Banjarnegara Regency encompasses the yields of food crops. Table 1 presents the agricultural production of food crops in Banjarnegara Regency.

Table 1. Agricultural Production of Food Crops in Banjarnegara Regency (in Tons)

Year	Rice	Corn	Cassava	Sweet Potato	Soybeans	Peanuts
2018	154,288	52,943	79,007	2,020	2,958	1,287
2019	170,542	50,645	84,910	2,139	661	583
2020	171,146	63,108	102,655	2,268	838	9,890
2021	169,204	51,950	130,274	3,047	635	1,404
2022	171,559	40,132	124,402	2,991	356	1,113

Source: Banjarnegara Regency Central Statistics Agency, 2023

As shown in Table 1, rice is the primary agricultural crop in Banjarnegara Regency. Rice production leads the rankings, with cassava production in second place and corn production in third. During the 2018-2022 period, the production of rice and other food crop commodities experienced fluctuations. In this regard, efforts are needed to establish cooperative partnerships or collaborations between farmers and agricultural input providers, provide counseling on proper farming practices, and improve agricultural infrastructure, including the development of Farm Roads (Mapiye & Dzama, 2024; Mihret et al., 2025; Sanusi et al., 2025).

The beneficial effect of Farm Roads on boosting agricultural productivity is illustrated by a study conducted by Windani & Sukmawati (2023). Their study demonstrates that the development of farm roads has a positive effect on agricultural productivity among farmers in Dangiang Village, Garut Regency. The rise in productivity among farmers is linked to how Farm Road aids in the transportation of agricultural inputs and outputs (Adamopoulos, 2025; Z. Wang et al., 2024; Zhang et al., 2024).

Studies specifically focused on Farm Road remain relatively limited. Most studies have not exclusively examined Farm Road, instead broadly addressing agricultural infrastructure. Previous studies, such as those conducted by Ishak et al. (2019) as well as Melati & Mayninda (2020), fall into this category. The study by Ishak et al. (2019) revealed that the presence of rural infrastructure fosters the growth of agricultural regions in the Oba Tengah Sub-district of Tidore Islands City, North Maluku Province. These findings align with those of Melati & Mayninda (2020), whose study emphasized the need for local governments to consistently focus on improving farmer productivity in East Java Province by providing adequate agricultural infrastructure.

The findings from studies on agricultural infrastructure conducted in Indonesia align with studies carried out abroad. Among these studies are those conducted by Ebewore (2021) and Benavides (2021). Ebewore (2021) study indicates the necessity of infrastructure improvements to enhance agricultural production in Nigeria, while Benavides (2021) shows that advancing rural infrastructure has a notable effect on agricultural productivity in China.

Previous studies have predominantly concentrated on examining the relationship between rural infrastructure, particularly roads, and the productivity of farmers in specific regions. These studies

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 10 (1): 71- 87, March 2026

have provided valuable insights into how road development can affect agricultural output, but often focus on a singular aspect of the issue. In contrast, this research goes beyond merely assessing the impact of farm roads on farmer productivity in Banjarnegara Regency. It also delves into the broader challenges and potential opportunities that the presence of farm roads presents for farmers in the area. By exploring both the positive and negative aspects of farm road infrastructure, to provide a more comprehensive understanding of the role of farm roads in agricultural development.

The findings are expected to offer valuable recommendations for local policymakers and government authorities involved in the management, maintenance, and enhancement of farm road infrastructure in Banjarnegara Regency. Furthermore, the results may serve as a foundation for strategic decision-making concerning the expansion or further development of farm roads in the region, ensuring that infrastructure investments are aligned with the needs of the farming community and support sustainable agricultural growth.

RESEARCH METHODS

This study employed a quantitative research approach, characterized by the systematic collection of structured data using measurement tools such as questionnaires or organized observations. This method facilitates the acquisition of standardized and accurate data, which can be statistically analyzed to produce objective and measurable results. Through this approach, the study aims to obtain a clear understanding of the impact of the examined factors and to identify potential relationships or patterns among the relevant variables (Gunasena et al., 2024; Lim, 2024). This research employed survey responses from participants and applied statistical techniques for analysis. This research was conducted from May 2024 to August 2024.

The data utilized in this study were obtained from both primary and secondary sources. Primary data consisted of reports provided by individual farmer respondents regarding their agricultural production output, the land area per farmer respondent, as well as the challenges and benefits associated with the Farm Road in Banjarnegara Regency. The indicator of agricultural production output is volume of agricultural production produced by each farmer (the unit is tons), while the indicator of land area is the area of agricultural land owned by each farmer (the unit is hectares). Agricultural production output data and land area data are used to calculate farmer productivity. Secondary data encompassed information on the agricultural sector's contribution to the Gross Regional Domestic Product (GRDP) of Banjarnegara Regency, as well as the manufacturing industry's share in the GRDP. The study also included data on food crop production in Banjarnegara Regency.

The survey was conducted to gather the necessary primary data and information. Respondents in this study were rice farmers from several sub-districts: Purwanegara (represented by farmers from Kalipelus and Danareja villages), Bawang (represented by farmers from Majalengka and Masaran villages), Wanadadi (represented by farmers from Kasilib and Kandangwangi villages), Madukara (represented by farmers from Gunung Giana and Dawuhan villages), Punggelan (represented by farmers from Sawangan and Sidarata villages), Karangkobar (represented by farmers from Sampang and Ambal villages), Pagentan (represented by farmers from Metawana and Kalitlaga villages), and Kalibening (represented by farmers from Kertosari village). The selection

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 10 (1): 71- 87, March 2026

of respondents for this study was carried out based on recommendations from Planning, Research, and Development Agency of Banjarnegara Regency and Department of Agriculture, Fisheries, and Food Security of Banjarnegara Regency. The recommendation is that the survey areas represents both highland and non-highland areas in Banjarnegara Regency. A total of 116 respondents from seven different sub-districts participated in the study, ensuring a diverse representation of the local farming community. The chosen survey locations were strategically selected to include sub-districts from highland and non-highland areas in Banjarnegara Regency, providing a comprehensive overview of the agricultural landscape across various geographical areas. Initially, 15 respondents were planned for each sub-districts. However, due to field limitations, data were only obtained from 116 respondents for a total of 8 sub-districts. The study utilized secondary data obtained from the Central Statistics Agency of Banjarnegara Regency, which was accessed through their official website to ensure the data's accuracy and reliability.

This study aims to investigate the influence of farm road infrastructure on agricultural productivity among farmers in Banjarnegara Regency. In addition, the research explores the challenges faced by farmers in relation to road access and identifies potential opportunities that can be leveraged through improved rural infrastructure. The evaluation is conducted by analyzing changes in productivity before and after the development of farm roads, thereby providing a comparative perspective on their impact (Acheampong et al., 2018; Gebru et al., 2020). To evaluate the extent of this influence, the study employs a quantitative approach that involves measuring and comparing productivity levels at two distinct points in time—before and after the construction of farm roads. The concept of farmer productivity is operationalized using a standard formula, where productivity is defined as the ratio of total production output to the area of land cultivated (Dinas Pertanian dan Pangan Kabupaten Kulonprogo, 2023):

$$\text{Farmer productivity} = (\text{Total production}) / (\text{Land area})$$

In this research, the unit of measurement for total production is tons and the unit of measurement for land area is hectares so that the unit of measurement for farmer productivity is tons per hectare.

The data gathered were subjected to a difference test analysis to detect any statistically significant variations in productivity between the two periods. Such analytical techniques are widely used to evaluate the effectiveness of rural development programs and infrastructure interventions (Acheampong et al., 2018; Gebru et al., 2020). Through this comparative analysis, the study aims to generate empirical evidence on whether the construction of farm roads contributes meaningfully to enhancing agricultural productivity in the region. Furthermore, this research contributes to the broader discourse on rural infrastructure by emphasizing the importance of context-specific assessments. By focusing on Banjarnegara Regency, the study provides localized insights that can inform policymakers, development practitioners, and stakeholders involved in agricultural and infrastructural planning. In sum, the application of difference testing not only quantifies the effect of farm roads but also supports evidence-based decision-making aimed at promoting sustainable agricultural development.

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 10 (1): 71- 87, March 2026

Before performing the difference test analysis, it is crucial to conduct a normality test on the dataset to select the appropriate statistical method. This preliminary step is essential to ensure that the assumptions required for parametric tests are satisfied. Parametric tests, which are commonly employed to compare means, assume that the data follows a normal distribution. When this assumption is violated indicating that the data is not normally distributed nonparametric methods must be applied, as they do not rely on the assumption of normality and are more appropriate for analyzing skewed or irregular data distributions.

To assess the normality of the data, the Kolmogorov-Smirnov test is utilized, particularly when the sample size exceeds 100 respondents. This test measures the extent to which the sample distribution deviates from a normal distribution. The interpretation is based on the resulting p-value: a p-value greater than 0.05 indicates that the data follows a normal distribution, thereby supporting the use of parametric tests. In contrast, a p-value less than 0.05 suggests a deviation from normality, necessitating the application of nonparametric tests for subsequent analysis. Verifying the normality of the data is a critical step in ensuring the accuracy and reliability of the research findings, as it guides the selection of appropriate statistical methods based on the distributional characteristics of the dataset (BINUS University School of Accounting, 2024).

Following the normality test, the subsequent step involves performing the difference test analysis. This analysis is performed using the following tests (Sujarweni, 2015):

a. Parametric difference test (if the data is normally distributed).
b. Nonparametric difference test (if the data is not normally distributed).

Before performing the difference test, a normality test was carried out to assess the dataset's suitability for parametric analysis. The Kolmogorov-Smirnov test was employed to determine whether the data conformed to a normal distribution. The results of this normality test, which informed the choice of the appropriate statistical technique, are presented in Table 2.

Table 2. Results of the Kolmogorov-Smirnov Normality Test

Variable	Statistic Value	Sig. Value
Farmer productivity before the construction of Farm Road	0.23	0.00
Farmer productivity after the construction of Farm Road	0.22	0.00

Source: Processed data, 2024

Based on the results presented in Table 2, it can be concluded that the Kolmogorov-Smirnov test statistics for farmer productivity—both before and after the construction of the Farm Road—are significant at the $\alpha = 0.05$ level. Specifically, the significance values are below 0.05, indicating that the data do not follow a normal distribution. These findings confirm that the assumption of normality is not met.

Given the violation of normality assumption, a nonparametric approach was employed to conduct the difference test analysis. The Wilcoxon Signed Rank Test was selected as the appropriate nonparametric method for this study.

The Wilcoxon test, a nonparametric method, is used to compare two related datasets. To carry out this test, the Z-value is calculated in the following way:

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 10 (1): 71- 87, March 2026

$$Z = \frac{T - \frac{1}{2}n(n+1)}{\sqrt{\frac{1}{24}n(n+1)(2n+1)}}$$

Hypotheses:
H_0 = there is no difference in farmer productivity before and after the construction of the Farm Road.
H_a = there is a difference in farmer productivity before and after the construction of the Farm Road.

If the calculated Z-value exceeds the critical Z-value or is lower than the negative critical value, the null hypothesis (H_0) is rejected. This result suggests a statistically significant difference in farmer productivity before and after the construction of the Farm Road.

The presence of the Farm Road is evaluated through the Wilcoxon test, which measures the change in farmer productivity across two time periods—prior to and following road construction. The underlying hypothesis in this analysis asserts that there is a significant difference in farmer productivity between the two periods, indicating that the Farm Road has had a measurable impact on agricultural output.

In order to gain a deeper understanding of Farm Road in Banjarnegara Regency, during the survey, researchers also interviewed farmers about the challenges and opportunities associated with Farm Road in their areas. This information revealed the issues and potential of farm roads in Banjarnegara Regency. The identification process relies on respondents' feedback regarding the challenges and opportunities associated with the Farm Road in the regency. Respondents provided their opinions on the issues and potential they perceived regarding the Farm Road in their respective areas.

RESULT AND DISCUSSION

Characteristics of the Respondents

The characteristics of the respondents are viewed from their age, the land area owned by the respondents, and the commodities produced. Table 3 shows the characteristics of the respondents in terms of their age, Table 4 shows the characteristics of the respondents based on the land area owned by the respondents, and Table 5 shows the characteristics of the respondents based on the commodities produced.

Table 3. The Characteristics of the Respondents in terms of their Age (in Year)

Classifications	Number of Respondents	Percentage
21 – 30	8	6.89
31 – 40	18	15.52
41 – 50	32	27.59
51 – 60	38	32.76
61 – 70	12	10.34
71 – 80	8	6.89

Source: Processed data, 2024

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 10 (1): 71- 87, March 2026

Based on Table 3, most respondents (82.76 percent) are under 61 years old. 10.34 percent of respondents are aged 61–70 years, and 6.89 percent are aged 71–80 years. The oldest respondent is 75 years old.

Table 4. The Characteristics of the Respondents Based on the Land Area Owned by the Respondents (in Hectar)

Classifications	Number of Respondents	Percentage
0 – 0.99	99	85.34
> 0.99	17	14.66

Source: Processed data, 2024

Based on Table 4, the majority of respondents (85.34 percent) own land less than 1 hectare. Only 14.66 percent of respondents have land larger than 0.99 hectares. The largest land area owned by a respondent is 4.5 hectares.

Table 5. The Characteristics of the Respondents Based on the Commodities Produces

Classifications	Number of Respondents	Percentage
Rice	83	71.55
Vegetables	16	13.79
Snake Fruit	12	10.34
Coffee	3	2.59
Banana	2	1.72

Source: Processed data, 2024

Based on Table 5, the majority of respondents (71.55 percent) produce rice commodities. The other respondents produce commodities such as vegetables, snake fruit, coffee, and banana.

Identification of the Impact of Farm Road Presence on Farmer Productivity in Banjarnegara Regency

To evaluate the impact of Farm Road development on farmer productivity in Banjarnegara Regency, a difference test analysis was conducted. The concept of farmer productivity is operationalized using a standard formula, where productivity is defined as the ratio of total production output to the area of land cultivated (Dinas Pertanian dan Pangan Kabupaten Kulonprogo, 2023). This formula measures how efficiently a farmer utilizes land to produce output. A higher ratio indicates higher productivity, meaning more output is generated per unit area of land.

The findings from the Wilcoxon test reveal a notable and statistically significant difference in farmer productivity when comparing the period before and after the construction of the farm road. This conclusion is reinforced by the statistical significance of the test results, which were observed at the $\alpha = 0.05$ level, indicating a high degree of reliability. To provide a more comprehensive overview, the detailed outcomes of the Wilcoxon analysis are organized across several tables: Table 6 provides the descriptive statistics, offering a summary of the data characteristics; Table 7 presents the specific results of the Wilcoxon Signed Rank Test, highlighting the differences between the paired observations and Table 8 offers a concise summary of the hypothesis testing, summarizing the conclusions drawn from the statistical analysis.

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 10 (1): 71- 87, March 2026

Table 6. Descriptive Statistics

Variable	N	Mean Value	Minimum Value	Maximum Value
Farmer productivity before the construction of Farm Road	116	6,04	0,03	50,00
Farmer productivity after the construction of Farm Road	116	8,23	0,12	53,33

Source: Processed data, 2024

As presented in Table 6, the descriptive statistics illustrate the farmer productivity levels before and after the construction of the Farm Road. The mean productivity prior to road construction was 6.04, which is notably lower than the post-construction mean of 8.23. This increase in average productivity reflects the positive contribution of the Farm Road to the agricultural sector in Banjarnegara Regency.

In addition to the mean values, the descriptive statistics highlight substantial differences in the minimum and maximum productivity values across the two periods. Before the road was built, the minimum productivity recorded was 0.03, suggesting considerable variability in farmers' outputs during that time. After the Farm Road was constructed, the minimum productivity rose to 0.12, indicating a possible improvement in baseline productivity. Likewise, the maximum productivity value increased from 50.00 before the road construction to 53.33 afterward, further demonstrating the road's potential role in enhancing agricultural performance. The finding of this study is consistent with the research conducted by Bachewe et al. (2018); Asher & Novosad (2018); and Milasari (2022). The study by Bachewe et al. (2018) revealed that the rapid advancement of Ethiopia's agricultural sector was significantly driven by the expansion and improvement of road infrastructure. Enhancements in road networks were instrumental in facilitating better market access, lowering transportation costs, and thereby supporting increased agricultural productivity and sectoral growth. Similarly, Asher & Novosad (2018) found that rural roads facilitated agricultural activities in India. This aligns with the findings of Milasari (2022), which showed that improvements in infrastructure positively impacted the value added to the agricultural sector in Paser Regency, East Kalimantan Province.

Table 7. Results of the Wilcoxon Signed Ranks Test

	N
Positive Differences	70
Negative Differences	16
Number of Ties	30

Source: Processed data, 2024

Table 7 presents the results of the Wilcoxon Signed Rank Test, which indicates that 70 respondents experienced an increase in productivity following the construction of the Farm Road, as evidenced by the positive ranks (N = 70). This result suggests a measurable improvement in farmer productivity, attributed to the farm road development. Conversely, 16 respondents reported a decrease in productivity, corresponding to the negative ranks (N = 16). In addition, 30 respondents showed no change in productivity, as reflected in the number of ties (N = 30). These outcomes suggest a statistically significant difference in productivity levels before and after the Farm Road's

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 10 (1): 71- 87, March 2026

development. The analysis of the impact of Farm Road presence on farmer productivity in Banjarnegara Regency was conducted comprehensively without distinguishing the analysis by district area. The results of the analysis can provide a general overview of the impact of Farm Road on farmer productivity in Banjarnegara Regency.

Table 8. Hypothesis Test Summary

Null Hypothesis	Test	Sig. Value	Decision
The median differences between farmer productivity before and after the construction of Farm Road equals 0	Related-Samples Wilcoxon Signed Rank Test	0,00	Reject the null hypothesis

Source: Processed data, 2024

Based on Table 8, the Wilcoxon Signed Rank Test confirms a significant improvement in productivity associated with the road's presence. The Wilcoxon Signed Rank Test yielded a significance level of $\alpha = 0.05$, leading to the rejection of the null hypothesis (H_0), which stated that there is no difference in farmer productivity before and after the Farm Road construction. This result strengthens the results from Table 6 and Table 7. Based on Table 6, Table 7, and Table 8, there is a significant difference in farmer productivity before and after the Farm Road construction.

Most respondents (60.34%) reported an improvement in productivity, highlighting the beneficial effects of the Farm Road in Banjarnegara Regency. In contrast, 13.79% of respondents noted a decrease in productivity, while 25.87% indicated that their productivity remained unchanged. The decrease in agricultural productivity can be linked to damaged sections of the Farm Road, weather conditions, suboptimal harvesting systems, and the inadequate utilization of technology. Erratic weather patterns, rising temperatures, and natural disasters can have a profound impact on crop yields and overall agricultural productivity, posing significant challenges to the agricultural sector. As a result, it becomes increasingly essential to adopt and implement sustainable farming practices that not only help counteract the negative effects of climate change but also enhance the resilience of agricultural systems. Central to these strategies should be the integration of effective and efficient irrigation systems, advanced soil conservation techniques, and the careful, responsible management of natural resources. These elements play a crucial role in ensuring that agricultural productivity can be maintained and even improved, despite the ongoing challenges posed by climate change.

The advancement of the agricultural sector is crucial for attaining food security both regionally and nationally. Sufficient agricultural infrastructure, including roads, is necessary to promote effective agricultural growth. This infrastructure is anticipated to streamline transportation and lower costs for relocating agricultural inputs and goods. Farm Roads play a vital role in agricultural development by facilitating farming operations, processing, and the marketing of products. The purpose of these roads is to bolster food security, boost agricultural output, and enhance farmers' well-being.

The Farm Road is constructed in agricultural areas to facilitate the transportation of agricultural inputs to farms, enhance the transportation of farming equipment and machinery, as well as facilitate the movement of agricultural products from farms to collection centers, processing plants, or markets (Ghobadpour et al., 2022; Zhou et al., 2021). This can benefit the development of the area, thereby

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 10 (1): 71- 87, March 2026

increasing farmer productivity. The presence of Farm Road in beneficiary areas is expected to reduce agricultural production costs. These costs can be lowered as the Farm Road facilitates farmers to transport agricultural inputs and products (Eshitera et al., 2024; Maryati et al., 2020; Morgan et al., 2019). The development of Farm Road is closely linked to agricultural growth efforts, which helps boost farmer productivity. This road is anticipated to facilitate better access for farmers to agricultural machinery. Modern and independent agriculture relies heavily on the use of such machinery. In this regard, road infrastructure is essential for ensuring that farmers can transport machinery to their rice fields.

Modern agricultural infrastructure is essential to drive productivity growth. The advancement of agricultural systems in a region is not only marked by the use of agricultural machinery but also by increased productivity and farmer welfare. The Farm Road aligns with national development goals, including providing food for all Indonesian people, improving farmer welfare, and promoting agricultural exports. The construction, maintenance, and improvement of the Farm Road are critical and should consistently receive government attention.

Survey results indicate that the majority of farmer respondents in the study area perceive the presence of the Farm Road as having a positive impact on agricultural productivity. Respondents frequently cited improved access to farmland, reduced transportation expenses, and enhanced connectivity to local markets as key factors contributing to increased efficiency and output. This perception underscores a broader understanding that infrastructure development, particularly road construction plays a critical role in boosting agricultural productivity and supporting the livelihoods of farmers in the region. Several key points raised by farmer respondents regarding the presence of Farm Road include:

1. A well-maintained Farm Road improves mobility and access to agricultural land.
2. The Farm Road facilitates the marketing of agricultural products.
3. The Farm Road increases farmers' income, thereby improving their welfare.
4. The Farm Road facilitates farmers to transport agricultural inputs.
5. The Farm Road reduces production costs for farmers in carrying out agricultural production activities.

The responses from farmer respondents in the surveyed area clearly indicate that the presence of the Farm Road in Banjarnegara Regency brings positive benefits for both agricultural development and the improvement of farmer welfare. Farmers have reported that the road has facilitated easier access to markets, reduced transportation costs, and increased the overall efficiency of agricultural activities. These improvements have not only enhanced productivity but also contributed to better livelihoods for farmers, underscoring the importance of infrastructure development in promoting sustainable agricultural growth and welfare in the region. The positive impacts experienced by farmers in the surveyed area indicate that the construction of the Farm Road is recommended to be continued in agricultural areas of Banjarnegara Regency that currently lack such infrastructure.

Based on survey results from farmer respondents in the surveyed area, the issues and potential of Farm Road in Banjarnegara Regency have been identified. The primary issues related to the Farm Road encountered by each village in the surveyed area include damaged roads and roads that are relatively narrow. In addition to these structural challenges, weather conditions, particularly heavy rain, contribute to the deterioration of the roads by making them slippery and increasing the likelihood

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 10 (1): 71- 87, March 2026

of landslides. These combined factors significantly exacerbate the difficulties farmers face in accessing their farms and markets, hindering the full potential of the Farm Road in promoting agricultural productivity and improving farmer welfare. Limited budgets for repairing damaged Farm Road and the incomplete construction of these roads are also significant challenges faced by the villages in the surveyed area. These issues hinder farmers' ability to transport agricultural inputs and harvests, resulting in longer transportation times and increased transportation costs.

In addition to the challenges, this study also identified potential possessed by each village within the surveyed area. These include initiatives by farmers to contribute self-fund labor for the development of agricultural infrastructure and collaborative efforts to repair damaged Farm Road. Other potential include active farmer groups in each surveyed village, community support for the presence of Farm Road, the relative ease of acquiring land for road development, access to both natural and human resources, high levels of agricultural output, and the cultivation of more than one agricultural commodity. The presence of Farm Road enhances farmers' mobility and access to agricultural lands. Furthermore, these roads facilitate the transportation of agricultural inputs and harvests, thereby boosting the village economy. This, in turn, leads to increased farmer income and ultimately improves farmers' welfare.

The issues and potential related to Farm Road in the surveyed areas largely reflect those in other parts of Banjarnegara Regency. This matter requires attention from relevant agencies in Banjarnegara Regency, as adequate Farm Roads are crucial for farmers. These roads are not only essential for accessing agricultural land but also for transporting agricultural inputs and harvests. Improved access and transportation can support agricultural productivity in Banjarnegara Regency, positively impacting both the regency's economy and the welfare of farmers in Banjarnegara Regency.

The development of Farm Roads, initiated by the Ministry of Agriculture of the Republic of Indonesia, is intended to improve farmers' accessibility and broaden the distribution network for agricultural products, in addition to easing the transportation of agricultural inputs. Land designated for Farm Road must meet specific criteria, including being clear and clean. The land status must be unambiguous, and there must be beneficiary farmers in accordance with established criteria. The maintenance of the constructed Farm Road is also crucial. Farmer groups are encouraged to participate in maintaining existing roads and to monitor their use to prevent overloading by vehicles such as heavy trucks.

Village development is the main focus in efforts for the welfare of rural communities. Village development and development in the agricultural sector are closely related. Economic growth and infrastructure in the village support increased agricultural production. Progress in the agricultural sector can encourage economic and social development in the village (Devi et al., 2025).

CONCLUSION AND SUGGESTION

The findings of this study reveal a significant difference in farmer productivity prior to and following the construction of Farm Roads. The findings also highlight a shift in farmer productivity following the construction of Farm Roads. A majority of respondents (60.34%) reported improved productivity, reflecting the beneficial role of these roads in Banjarnegara Regency. Conversely, 13.79% experienced a decline, while 25.87% indicated no significant change. Farm Roads are built

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 10 (1): 71- 87, March 2026

within agricultural zones to ease the delivery of farming inputs, improve the movement of agricultural machinery, and facilitate the transport of harvests from the fields to collection points, processing centers, or markets. These functions support regional development and help boost farmers' productivity.

The issues and potential related to Farm Road in the surveyed areas largely reflect those in other parts of Banjarnegara Regency. This matter requires attention from relevant agencies in Banjarnegara Regency, as adequate Farm Roads are crucial for farmers. These roads are not only essential for accessing agricultural land but also for transporting agricultural inputs and harvests. Improved access and transportation can support agricultural productivity in Banjarnegara Regency, positively impacting both the regency's economy and the welfare of its farmers. For future studies, it is recommended to analyze the impact of Farm Road on farmers' welfare. The research results are expected to provide a comprehensive picture of the benefits and challenges of developing Farm Roads, as well as being the basis for policies that support the sustainable improvement of farmer welfare.

REFERENCES

Acheampong, E. O., Sayer, J., & Macgregor, C. J. (2018). Road Improvement Enhances Smallholder Productivity and Reduces Forest Encroachment in Ghana. *Environmental Science & Policy*, *85*, 64–71. https://doi.org/10.1016/j.envsci.2018.04.001

Adamopoulos, T. (2025). Spatial Integration and Agricultural Productivity: Quantifying the Impact of New Roads. *American Economic Journal: Macroeconomics*, *17*(1), 343–378. https://doi.org/10.1257/mac.20200149

Asher, S., & Novosad, P. (2018). Rural Roads and Local Economic Development. *Rural Roads and Local Economic Development*, *110*(3), 797–823. https://doi.org/10.1596/1813-9450-8466

Bachewe, F. N., Berhane, G., Minten, B., & Taffesse, A. S. (2018). Agricultural Transformation in Africa? Assessing the Evidence in Ethiopia. *World Development*, *105*, 286–298. https://doi.org/10.1016/j.worlddev.2017.05.041

Badan Pusat Statistik Kabupaten Banjarnegara. (2023). *[Seri 2010] Distribusi PDRB Kabupaten Banjarnegara Menurut Lapangan Usaha (Persen), 2020-2022*. https://banjarnegarakab.bps.go.id/indicator/158/152/1/-seri-2010-distribusi-pdrb-kabupaten-banjarnegara-menurut-lapangan-usaha.html

Benavides, D. (2021). Influence of Agricultural Infrastructure Construction on Agricultural Total Factor Productivity. *Agricultural Productivity Science*, *1*(1), 14–26. https://doi.org/10.23977/agrfem.2021.040112

BINUS University School of Accounting. (2024). *Memahami Uji Normalitas dalam Model Regresi*. https://accounting.binus.ac.id/2021/08/06/memahami-uji-normalitas-dalam-model-regresi/

Devi, L. P., Suamba, I. K., & Arisena, G. M. (2025). Financial Management in Village and Agricultural Development. *AGRISOCIONOMICS: Jurnal Sosial Ekonomi dan Kebijakan Pertanian*, *9*(1), 1-15. https://doi.org/10.14710/agrisocionomics.v9i1.22743

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 10 (1): 71- 87, March 2026

Dinas Ketahanan Pangan dan Pertanian Kabupaten Bojonegoro. (2019). *Jalan Usahatani (JUT) di Kabupaten Bojonegoro Jatim*. https://dinperta.bojonegorokab.go.id/berita/baca/16

Dinas Pertanian dan Pangan Kabupaten Kulonprogo. (2023). *Produktivitas Padi di KT Tunas Harapan Banjararum Kalibawang dengan Sistem Tanam Jajar Legowo*. https://pertanian.kulonprogokab.go.id/detil/1182/produktivitas-padi-di-kt-tunas-harapan-banjararum-kalibawang-dengan-sistem-tanam-jajar-legowo

Ebewore, S. O. (2021). Farmers' Perception of the State of Infrastructure on Agricultural Production in Delta State, Nigeria. *Rural Society*, *30*(1), 32–44. https://doi.org/10.1080/10371656.2021.1897239

Ercan, O. (2024). Agricultural Land-Based Functional Model for Effective Rural Land Management in Türkiye. *Tarım Bilimleri Dergisi*, *30*(3), 526–545. https://doi.org/10.15832/ankutbd.1342935

Eshitera, A., Esho, L., Njoroge, C. G., & Balan, Y. (2024). The Value of Rural Access Roads: The Case Study of Chepyuk and Mitira Wards in Bungoma and Kirinyaga Counties. *Open Journal of Applied Sciences*, *14*(08), 2249–2266. https://doi.org/10.4236/ojapps.2024.148151

Gebru, K. M., Woldearegay, K., van Steenbergen, F., Beyene, A., Vera, L. F., Gebreegziabher, K. T., & Alemayhu, T. (2020). Adoption of Road Water Harvesting Practices and Their Impacts: Evidence from a Semi-Arid Region of Ethiopia. *Sustainability (Switzerland)*, *12*(21), 1–25. https://doi.org/10.3390/su12218914

Ghobadpour, A., Monsalve, G., Cardenas, A., & Mousazadeh, H. (2022). Off-Road Electric Vehicles and Autonomous Robots in Agricultural Sector: Trends, Challenges, and Opportunities. *Vehicles*, *4*(3), 843–864. https://doi.org/10.3390/vehicles4030047

Gunasena, P., Hapuarachchi, T., Ekanayake, U., Rajapaksha, S., Gunawardana, K., Aluthge, P., Alvis, K., & Gunathilake, S. (2024). *Data Collection Fundamentals: A Guide to Effective Research Methodologies and Ethical Practices*.

Haque, S., Akbar, D., & Kinnear, S. (2024). Identifying Impacts & Adaptation Strategies for Tropical Fruit Farms Affected by Extreme Weather Events in Sub-Tropical Australia: Stakeholders' Insights. *Heliyon*, *10*(4), e26097. https://doi.org/10.1016/j.heliyon.2024.e26097

Ishak, F., Sela, R. L. E., & Sondakh, J. A. R. (2019). Evaluasi Ketersediaan Infrastruktur Perdesaan Dalam Rangka Pengembangan Kawasan Pertanian di Kecamatan Oba Tengah. *Jurnal Spasial*, *6*(3), 872–880.

Jimoh, A. K., Olawuyi, S. O., Balogun, T. A., & Ganiyu, M. O. (2024). Causal Effect of Agricultural Diversification on Smallholder Farmers' Welfare Status in Nigeria. *Research on World Agricultural Economy*, *5*(4), 458–480. https://doi.org/10.36956/rwae.v5i4.1223

Lei, X., & Yang, D. (2024). Cultivating Green Champions: The Role of High-Quality Farmer Training in Sustainable Agriculture. *Journal of the Knowledge Economy*. https://doi.org/10.1007/s13132-024-02014-8

Lestari, P., Rachmansyah, A., Efani, A., & Koentjoro, M. P. (2023). Sustainability Analysis of

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 10 (1): 71- 87, March 2026

Farming Roads for Increased Food Security (Case Study on Woro Village, Kepohbaru Subdistrict, Bojonegoro Regency). *Jurnal Penelitian Pendidikan IPA*, *9*(SpecialIssue), 1316–1327. https://doi.org/10.29303/jppipa.v9ispecialissue.6420

Lim, W. M. (2024). What Is Qualitative Research? An Overview and Guidelines. *Australasian Marketing Journal*. https://doi.org/10.1177/14413582241264619

Liu, J., Yasir, H., Tahir, H., & Awan, A. G. (2025). Full Mechanization: A Path to Increased Farm Income, Food Security, and Environmental Quality in Developing Countries. *Environment, Development and Sustainability*. https://doi.org/10.1007/s10668-024-05720-0

Makbul, Y., Faoziyah, U., Ratnaningtyas, S., & Kombaitan, B. (2019). Infrastructure Development and Food Security in Indonesia: The Impact of the Trans-Java Toll Road on Rice Paddy Farmers' Desire to Sell Farmland. *Journal of Regional and City Planning*, *30*(2), 140–156. https://doi.org/10.5614/jpwk.2019.30.2.4

Mapiye, O., & Dzama, K. (2024). Strengthening Research-Extension-Farmer-Input Linkage System for Sustainable Smallholder Livestock Farming in Africa: Progress and Prospects. *Tropical Animal Health and Production*, *56*(8), 363. https://doi.org/10.1007/s11250-024-04210-9

Maryati, S., Firman, T., Humaira, A. N. S., & Febriani, Y. T. (2020). Benefit Distribution of Community-Based Infrastructure: Agricultural Roads in Indonesia. *Sustainability (Switzerland)*, *12*(5). https://doi.org/10.3390/su12052085

Melati, F. C., & Mayninda, Y. P. (2020). Technical Efficiency of Rice Production Using the Stochastic Frontier Analysis Approach: Case In East Java Province. *Ekuilibrium : Jurnal Ilmiah Bidang Ilmu Ekonomi*, *15*(2), 170. https://doi.org/10.24269/ekuilibrium.v15i2.2774

Mihret, Y. C., Takele, M. M., & Mintesinot, S. M. (2025). Advancements in Agriculture 4.0 and the Needs for Introduction and Adoption in Ethiopia: A Review. *Advances in Agriculture*, *2025*(1). https://doi.org/10.1155/aia/8828400

Milasari, L. A. (2022). Pemetaan Kebutuhan Infrastruktur Jalan Pada Sentra Produksi Pertanian di Kabupaten Paser. *Jurnal Ilmiah MITSU*, *10*(2), 73–82.

Morgan, A. K., Dogbey, E., Arimeyaw, W. A., & Owusu, F. A. S. (2019). Effect of Road Transport Accessibility on Agricultural Produce Marketing and Livelihoods of Farmers in the Kasena-Nankana West District of Ghana. *The Journal of Development Practice*, *5*(1), 39–46. http://journals.dbuniversity.ac.in/ojs/index.php/jdp/article/view/742

Nie, X., Li, X., Lyu, C., Su, Y., & Wang, H. (2024). Can Ecological Compensation Based on the Transfer of Development Rights (TDR) Improve Ecosystem Service Value? A Multi-Scenario Simulation. *Land Use Policy*, *138*, 107024. https://doi.org/https://doi.org/10.1016/j.landusepol.2023.107024

Ohashi, T., Saijo, M., Suzuki, K., & Arafuka, S. (2024). From Conservatism to Innovation: The Sequential and Iterative Process of Smart Livestock Technology Adoption in Japanese Small-Farm Systems. *Technological Forecasting and Social Change*, *208*(August), 123692. https://doi.org/10.1016/j.techfore.2024.123692

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 10 (1): 71- 87, March 2026

Puška, A., Štilić, A., Pamučar, D., Božanić, D., & Nedeljković, M. (2024). Introducing a Novel Multi-Criteria Ranking of Alternatives with Weights of Criterion (RAWEC) model. *MethodsX*, *12*(December 2023). https://doi.org/10.1016/j.mex.2024.102628

Raihan, A., Ridwan, M., & Rahman, S. (2024). Climate Smart Agriculture An exploration of the Latest Developments, Obstacles, and Potential Future Pathways for Climate-Smart Agriculture. *Climate Smart Agriculture*, *1*(2), 100020. https://doi.org/10.1016/j.csag.2024.100020

Rendrarpoetri, B. L., Rustiadi, E., Fauzi, A., & Pravitasari, A. E. (2024). Sustainability Assessment of the Upstream Bengawan Solo Watershed in Wonogiri Regency, Central Java Province, Indonesia. *Sustainability (Switzerland)* , *16*(5). https://doi.org/10.3390/su16051982

Sanusi, M. S., Mayokun, O. M., Sunmonu, M. O., Yerima, S., Mobolaji, D., & Olaoye, J. O. (2025). Transformative Trends: Commercial Platforms Revolutionizing Rice Farming in Nigeria's Agricultural Value Chain. *International Journal of Agricultural Sustainability*, *23*(1). https://doi.org/10.1080/14735903.2025.2473757`

Saqib, S. E., Kaleem, M., Yaseen, M., Yang, S.-H., & Visetnoi, S. (2024). From Green Fields to Housing Societies: Unraveling the Mysteries Behind Agricultural Land Conversion in Pakistan. *Land Use Policy*, *144*, 107256. https://doi.org/https://doi.org/10.1016/j.landusepol.2024.107256

Sethi, L., Puspanjali, B., Biswanath, B., & and Sethi, N. (2024). Unravelling the Role of Renewable Energy, Information and Communication Technology and Agricultural Credit for Sustainable Agricultural Productivity in Developing Countries. *International Journal of Sustainable Development & World Ecology*, *31*(7), 989–1003. https://doi.org/10.1080/13504509.2024.2366474

Sujarweni, V. W. (2015). *Statistik untuk Bisnis dan Ekonomi. Yogyakarta*. Penerbit Pustaka Baru Press.

Suminar, R. E. (2018). Dampak Pengembangan Jalan Usaha Tani (JUT) pada Kawasan Pertanian di Kabupaten Sleman Provinsi Daerah Istimewa Yogyakarta. *Plano Madani : Jurnal Perencanaan Wilayah Dan Kota*, *7*(1), 81–88. https://doi.org/10.24252/planomadani.v7i1a8

Wang, S., Jin, X., Han, B., Liu, J., Song, J., & Zhou, Y. (2025). Understanding the Process and Mechanism of Agricultural Land Transition in China: Based on the Interactive Conversion of Cropland and Natural Ecological Land. *Journal of Environmental Management*, *376*, 124585. https://doi.org/https://doi.org/10.1016/j.jenvman.2025.124585

Wang, Z., Martha, G. B., Liu, J., Lima, C. Z., & Hertel, T. W. (2024). Planned Expansion of Transportation Infrastructure in Brazil Has Implications for the Pattern of Agricultural Production and Carbon Emissions. *Science of the Total Environment*, *928*(November 2023), 172434. https://doi.org/10.1016/j.scitotenv.2024.172434

Wei, J., Yue, W., Li, M., Liu, Y., & Song, Y. (2025). Multi-Scenario Urban Growth Boundaries and Trade-Offs among Land Use Functions. *Cities*, *159*, 105752. https://doi.org/https://doi.org/10.1016/j.cities.2025.105752

Windani, J., & Sukmawati, A. M. (2023). Dampak Ekonomi Pembangunan Jalan Pertanian di Desa

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 10 (1): 71- 87, March 2026

Dangiang, Kabupaten Garut. *Jurnal Perencanaan Wilayah Dan Kota*, *18*(2), 10–20. https://doi.org/10.29313/jpwk.v18i2.2697

Yamashita, R., Kidoguchi, K., Oshima, T., & Ishigaki, A. (2024). Sustainable Paddy Farming in Rural Japan: Leveraging Farmer Integration and Agricultural UAVs for Synergistic Solutions. *Journal of Cleaner Production*, *475*(December 2023), 143685. https://doi.org/10.1016/j.jclepro.2024.143685

Zhang, J., Jabbar, A., & Li, X. (2024). How Does China's Agricultural Subsidy Policy Drive More Commercially Productive Small Farmers? The Role of Farmland Scale, Labor Supply, and Cropping Structural Change. *Land*, *13*(12), 1–16. https://doi.org/10.3390/land13122058

Zhou, Z., Duan, J., Li, W., & Geng, S. (2021). Can Rural Road Construction Promote the Sustainable Development of Regional Agriculture in China? *Sustainability (Switzerland)*, *13*(19). https://doi.org/10.3390/su131910882