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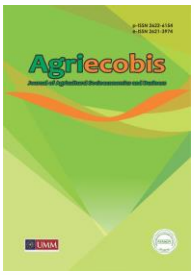

*Research Article*

# Functional Change of Agricultural Land in Tabanan Regency,Bali (Case Study in Subak Jadi, Kediri District)

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ABSTRACT

Tabanan Regency as a rice barn in Bali has also experienced land conversion, particularly rice fields area. The rapid financial expansion requires the development of various infrastructures so that the demand for agricultural land is more enormous. Kediri sub-district is one of the regions that experienced the conversion of agricultural area to non-agricultural which is adequately high in Tabanan Regency. The purpose of this study is to determine the development of the land conversation in the Tabanan Region, differences in farmer's income that have done the land conversion and those who have not done it, and the components that influence land conversion. The sampling technique is taken by proportional sampling with 40 people. The analysis techniques used are trend analysis, average difference test analysis, and logistic regression models. The result of the study concludes that the development of agricultural land conversion in Tabanan Regions is proceeding to extend. Based on the results of the t-test there is no significant difference between the average income of farmers who have done the land conversion and those who have not. Factors that influence the land conversion at the agricultural level are labor, number of dependents, irrigation systems, and surface area.



## INTRODUCTION

Time is changing and this forces society to boost its productivity in the field of infrastructures, economy, and intellectuality. The need for land as a platform for every community activity will continue to increase in line with the development of population and economic growth. This leads to competition in land use and a shift in land use from less profitable to more profitable activities. Land use activities in the agricultural sector are often threatened because they are considered less profitable when compared to other economic activities so that the conversion of agricultural land to other uses is difficult to prevent. Competition in land use is prevalent in various parts of Indonesia, one of which is Tabanan Regency as the highest rice provider for the Province of Bali, which continues to change the function of agricultural land, especially rice fields.

The Tabanan Regency is one of nine regencies/cities with an area of 839.33 km$^2$ or 14.90 percent of the area of the province of Bali (Tabanan Regency Office, 2019). As much as 28 percent of the land area in Tabanan Regency is rice fields so that Tabanan Regency is known as an agricultural area. Agriculture in

Tabanan can be said to be the driving force of the regional economy because most of the livelihoods and land use in the Tabanan region are still dominated by agriculture in a broad sense.

The land is a very important resource, both for farmers and agricultural development. The success of the food security program is determined by the availability of agricultural land to carry out all agricultural activities in producing the food needed by every human being daily. But in reality, the available land for food production is very limited and even continues to decline every year.

In general, the rice field area in Tabanan Regency is decreasing every year. From 2014 to 2015, according to the data of the Tabanan Regency office in 2019, the area of rice fields from 21,962 hectares (ha) to 21,714 ha decreased by 248 ha. The depreciation of the rice fields continued until 2018, the highest shrinkage occurred, which was 493 Ha, compared with land area earlier in 2017 from 21,089 ha to 20,596 ha. The total number of rice fields that decreased in a period of 5 years from 2014 to 2018 counted as 1366 ha. The decline in agricultural land, especially rice fields, occurred in all sub-districts in Tabanan Regency from 2014 to 2018. The highest conversion of agricultural to non-agricultural land occurred in Kediri Subdistrict, with the shrinkage of rice fields up to 113 ha and an increase in non-agricultural land covering an area of 127 ha.

The fast economic growth in the Tabanan Regency requires the development of various infrastructures such as housing, roads, industry, offices, and other buildings so that the demand for existing agricultural land is quite large. As a result, a lot of agricultural land has changed its function to meet these needs. In addition, land conversion can also occur due to a lack of incentives or government attention in the agricultural sector, so that people start to switch to other sectors.

The development of the Tabanan Regency in terms of population, with a population of 445,700 registered until 2019, implies that the conversion of agricultural land is quite high. This increase in population was caused by uncontrolled population growth and population movement. In addition, economic activity, especially in the tourism sector, which continues to develop is also a factor in the occurrence of changes in land use. The tourism sector is a fairly high foreign exchange contributor for the Province of Bali, including Tabanan Regency. Supporting natural conditions and promising investment attracts investors to invest in hotels and other tourism services. Along with the development of tourism, there is a phenomenon, namely the reduction of rice fields due to land conversion in Bali, which is an average of 750 ha/year (Windia, et al., 2016). This is part of the challenges/threats to the existence of subak (water management (irrigation) system for rice fields on Bali island) which are directly or indirectly caused by the development of tourism in Bali (Windia, 2012).

The limited available land in an area will increase the value of land in the area, which can disrupt the balance between land value and certain land uses. As a result, there arises the desire of the landowner to change the use of his land to suit the price level of the land. High land prices make farmers tempted to transfer their agricultural land ownership to investors. This was due to an economic motive that pressured farmers so that eventually land conversion occurred.

Based on these issues, it is necessary to conduct research on "Changes of Function of Agricultural Land in Tabanan Regency (Case Study in Subak Jadi, Kediri District)". This study aims to determine the development and projection of the conversion of agricultural land in Tabanan Regency, the differences in the income of farmers that change and do not change the function of the land, as well as the factors that affect the conversion of land functions at the farm level.

## METHOD

This research was conducted in Tabanan Regency. The choice of the research location was carried out purposively (deliberately) because of the consideration that Tabanan Regency is a district that has experienced the highest conversion of agricultural land in Bali Province according to the SI (Statistics Indonesia) of Bali Province in 2019. In addition, Tabanan is also the largest rice producer in Bali and most of its residents earn their livelihood as farmers. The case study was conducted in Subak Jadi, Banjar Anyar Village, Kediri District. This location was chosen as Kediri Subdistrict had the highest conversion of agricultural land to non-agricultural land in Tabanan Regency. SubakJadi is one of the subaks in the Banjar Anyar Village with the highest conversion of rice fields in Kediri District (BPN Tabanan, 2019). Data collection was carried out using interview and documentation methods. Sources of data used in this study are primary and secondary data.

This study involved 78 landowners in Subak Jadi. Riduwan and Akdon (2009) state that if the population size is approximately 100, the sample size is at least 50 percent of the population size. If the population size is more than 1000, the sample size is at least 15 percent. Based on this opinion, 40 farmers were recruited in this study. The sampling technique in this study is probability sampling using proportional sampling. The number of sample members is carried out by proportional sampling with the proportional allocation formula.

N = Population Class /Total Population x Number of Samples Specified

Then the number of sample members obtained for farmers who change land functions and who do not change land functions are as follows:

1. Farmers who change the function of land
   47/78 x 40 = 24 people
2. Farmers who do not change land functions
   31/78 x 40 = 16 people

The data analysis in this study is detailed based on the research objectives, as follows:

The first objective analysis is to determine the rate of conversion of agricultural land functions and *projections* of conversion of agricultural land functions in the next few years. According to Sutani (2009) in Puspasari (2012), in calculating the rate of conversion of agricultural land functions, the land function conversion equation is used. The rate of partial land-use change can be explained as follows:

$$V=(Lt-L(t-1))/L(t-1) \times 100\%$$

Where:

V = Rate of land conversion (%)
Lt = Land area in year t (ha)
Lt-1 = Land area before t (ha)

The projection of the conversion of agricultural land to non-agricultural land in the next few years uses the Trend Analysis, forecasting model. The use of time series analysis for the purpose of this study means the use of past data as a component for making future projections (Gujarati and Porter, 2009).

The second objective analysis is to determine the difference in income of farmers who change and do not change land functions using the two-mean difference approach. This test is performed using the t-test to test the sample data as a whole. The t-test equation used is as follows:

$$t=(X1-X2)/(((n1-1)S12+(n2-1)S22) / (n1+n2-2)\times(1/n1+1/n2))$$

Where:

$X_1$ = The average income of farmers who do not change the function of land
$X_2$ = The average income of farmers who change the function of land
$n_1$ = Number of respondents who do not change land functions
$n_2$ = Number of respondents who change land functions
$s_1$ = Standard deviation that does not change land functions
$s_2$ = Standard deviation which changes land function

Hypothesis:

$H_0 = X_1 = X_2$

$H_1 = X_1 \neq X_2$

If $t_{count} < t_{table}$, then $H_0$ is accepted and $H_1$ is rejected, which means there is no difference in income between farmers who do not change land functions and farmers who change land functions. Meanwhile, if $t_{count} > t_{table}$, then $H_0$ is rejected and $H_1$ is accepted, which means that there is a difference in the income of farmers who do not change land functions and farmers who change land functions.

The third objective analysis is to determine the factors that affect the conversion of agricultural land at the farm level by using logistic regression analysis. The logistic regression model equation to determine the factors that affect land conversion at the farm level is as follows:

$$\ln Pi/(1-Pi)=Zi=\alpha+\beta1\ X1+\beta2\ X2+\beta3\ X3+\beta4\ X4+\beta5\ X5+\beta6\ X6+\varepsilon$$

Where:

Z = Opportunity for land conversion (1) and not land conversion (0)
α = Intercept
βi = Regression coefficient
$X_1$ = Labor Factor
$X_2$ = Farming Experience Factor
$X_3$ = Proportion Factor of Farming Income
$X_4$ = Factor Number of Dependent Farmers
$X_5$ = Irrigation Network Factor
$X_6$ = Farmer Ownership Area Factor
ε = Error term / Residual

**Table 1.** Variables and Research Measurement Indicators

| No | Variable | Indicator | Measuring scale |
|---|---|---|---|
| 1 | The decision of the farmer to change the function of the land (Y) | Farmers' decisions are measured by 1 for farmers who change land functions, and 0 for farmers who do not change land functions | Nominal |
| 2 | Labor ($X_1$) | Labor is measured by 1 when labor is hard to find and if labor is not difficult to find | Ordinal |
| 3 | Farming experience ($X_2$) | The length of time a person is engaged in farming (years) | Ratio |
| 4 | The proportion of income from farming ($X_3$) | Percentage of farm income compared to total farmer income | Ratio |
| 5 | Number of dependents of farmers ($X_4$) | The number of people that the farmer (person) must bear his needs | Ratio |
| 6 | Irrigation network ($X_5$) | The irrigation network is measured 1 for farmers who experience irrigation network problems and 0 for those who do not | Ordinal |
| 7 | Farmer's land area ($X_6$) | The area of land owned by the respondent farmer (square meters) | Ratio |

*Source: Primary Data*

## RESULTS AND DISCUSSION

### Rate and Projection of Change of Function of Agricultural Land in Tabanan Regency

The conversion of agricultural land to non-agricultural land in Tabanan Regency continues to occur every year, especially in rice fields. These land changes generally become land for settlement, industry, as well as facilities and infrastructure. The rate of land conversion can be seen in Table 2.

**Table 2.** Area and Rate of Transfer of Functions of Rice Fields in Tabanan Regency, 2011-2018

| Year | Rice area (Ha) | Converted Rice Area | Land conversion rate (%) |
|---|---|---|---|
| 2011 | 22,435 | - | - |
| 2012 | 22,388 | 47 | 0.21 |
| 2013 | 22,184 | 204 | 0.91 |
| 2014 | 21,962 | 222 | 1.00 |
| 2015 | 21,714 | 248 | 1.13 |
| 2016 | 21,452 | 262 | 1.21 |
| 2017 | 21,089 | 363 | 1.69 |
| 2018 | 20,596 | 493 | 2.34 |

*Source: Agriculture Office of Tabanan Regency, 2019*

Table 2 shows that the number of rice fields in the Tabanan Regency has changed. The rate of conversion of agricultural land to non-agricultural functions has tended to increase annually over the past eight years from 2011 to 2018. The decrease in rice field area that occurred during that period reached 8.20 percent with a reduced total land area of 1,839 ha with an average rate of conversion of 1.17 percent annually.

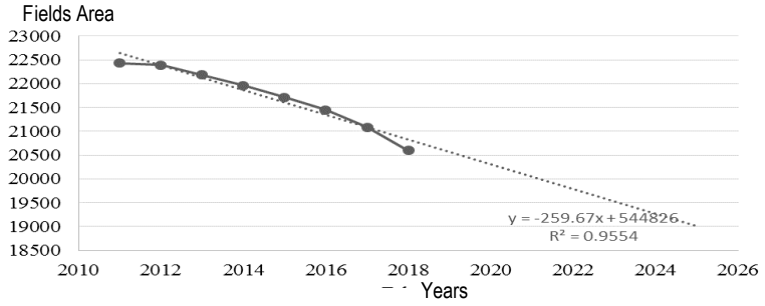


**Figure 1.** Rate of Rice Field Area in Tabanan Regency in 2011-2018
Source: Tabanan Regency Agriculture Service 202

Figure 1 shows that the graph of the rice field area in Tabanan Regency decreases every year. By looking at the trend of data movement in the previous period, a model is formed which can then be used to forecast the future conversion of agricultural land in Tabanan Regency. The dotted line in Figure (1) is a linear line from trend analysis so the following equation is obtained:

**Y = 544.826 - 259,67 x**

The rate of conversion of agricultural land in the next few years can be predicted using this equation. The projection of the rice field area in Tabanan Regency in 2019 - 2025 can be seen in Table 3.

**Table 3.** Projection of Rice Field Area in Tabanan Regency in 2019-2025

| Year | Rice area (Ha) | Converted Rice Area | Land conversion rate (%) |
|---|---|---|---|
| 2019 | 20,552 | 44 | 0.21% |
| 2020 | 20,293 | 259 | 1.26% |
| 2021 | 20,033 | 260 | 1.28% |
| 2022 | 19,773 | 260 | 1.30% |
| 2023 | 19,514 | 259 | 1.31% |
| 2024 | 19,254 | 260 | 1.33% |
| 2025 | 18,994 | 260 | 1.35% |

*Source: Secondary Data (processed)*

Based on Table 3, the projection of the development of the rate of conversion of agricultural land in Tabanan Regency has increased, so that at the end of the year the forecast for the total land conversion in 2025 will reach 1,602 ha, where the remaining rice fields are 18,994 ha. The rate of land conversion that occurred during this period was 1.15 percent annually. Certainly, these figures do not show actual figures. However, it has been confirmed that the conversion of agricultural to non-agricultural land continues to increase. There is no definite measure regarding the height of land conversion, but the high land-use changes can threaten food availability and the existence of the Tabanan Regency as a rice granary in Bali.

**Differences in Income of Farmers that Do and Do Not Change Land Functions**

Farmers' income is basically divided into two, namely farm income and non-farm income. Farming income is income received from the agricultural sector, while non-farm income is an income received outside the agricultural sector. In this study, the respondent's farming income calculated only lowland rice farming because it is the main commodity.

**Table 4.** Comparison of Average Income of Farmers who Do and Do not Change Land Functions (per month)

| Respondents Average Income | Farming | | Non-Farming | | The Average Total Income | |
|---|---|---|---|---|---|---|
| | IDR | % | IDR | % | IDR | % |
| Not Transfer Function | 2,250,000 | 62% | 1,363,333 | 38% | 3,613,333 | 100% |
| Transfer Function | 1,204,167 | 42% | 1,675,556 | 58% | 2,879,723 | 100% |
| Differences | 1,045,833 | | 312,223 | | 733,610 | |

*Source: Primary Data (processed)*

Table 4 shows that there is a difference in the average farm income of farmers who do not and farmers who do change land functions. The average total income of farmers who do not change land functions and carried out land functions were IDR 3,613,333 and IDR 2,879,723, respectively.

**Table 5.** Independent Samples Test

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | |
|---|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference |
| Total Income | Equal variances assumed | .422 | .520 | 1.489 | 38 | .145 | 733611.0625 |
| | Equal variances not assumed | | | 1.443 | 28.797 | .160 | 733611.0625 |

*Source: Primary Data (processed)*

Based on the t-test in Table 5, it is known that the Sig. Levene's Test for Equality of Variances is 0.520 > 0.05, so it can be interpreted that the data variant between farmers who changed land functions and did not change land functions was homogeneous or the same. Sig value. (2-tailed) of 0.145 > 0.05 means that there is no significant (real) difference between the average income of farmers who change land functions and do not change land functions. This is because the livelihoods outside the farm for farmers who have changed the function of land do not affect the farmers' income.

**Table 6.** Distribution of Farmers by Source of Income

| Source of Income | Respondents (Percent) |
|---|---|
| Traders | 12,50 |
| Factory workers | 12,50 |
| Construction workers | 15,00 |
| Private employees | 17,50 |
| Breeder | 22,50 |
| Other | 20,00 |
| Amount | 100,00 |

*Source: Primary Data (processed)*

Table 6 shows that 80 percent of the respondent farmers do other non-agricultural work, such as trading, are factory workers, construction workers, private employees, and breeders. Meanwhile, the other 20 percent are elderly farmers who only rely on the agricultural sector as their source of income.

**Factors Affecting the Transfer of Function of Agricultural Land at Farmers Level**

The study of this case on the factors affecting the conversion of agricultural land functions at the farm level was conducted in SubakJadi, Kediri District, Tabanan Regency. Logistic regression analysis is used to determine the factors that influence the decision of farmers to change land functions. The results of data processing by the Enter method are presented in Table 7.

**Table 7.** Estimation Results of Factors Affecting Farmers in Transferring Agricultural Land Functions

| Variable | Coefficient | *Sig.* | *Exp (β)* | Information |
|---|---|---|---|---|
| Labor ($X_1$) | 2.479 | 0.066 | 11.932 | Have a significant impact* |
| Length of time of Farming ($X_2$) | -0.020 | 0.834 | 0.980 | Do not have significant effect |
| Farming Income Proportion ($X_3$) | -0.001 | 0.969 | 0.999 | Do not have significant effect |
| Dependents of the Family ($X_4$) | 1.573 | 0.083 | 4.819 | Have a significant impact* |
| Irrigation Network ($X_5$) | 2.148 | 0.052 | 8.567 | Have a significant impact* |
| Land Area ($X_6$) | -0.074 | 0.022 | 0.929 | Have a significant impact* |
| *Constant* | -1.338 | 0.787 | 0.262 | - |

*Source: Primary Data (processed)*
Information: * significant at the level of 10%

Based on Table (7), it is known that of the six independent variables that are thought to affect the farmer's decision to change land functions, only four appear to have a significant impact. The variables that have a significant effect on farmer decisions are labor, number of dependents, irrigation networks, and land area ownership. The significant or insignificant effect of the variable can be seen from the Sig value in Table 6 which is less than the real level used, over 10 percent. Other variables have a Sig value that is greater than the real level of 10 percent. This means that the length of farming and the proportion of farm income do not significantly affect the opportunities for farmers' decisions to sell their land.

The workforce variable has a Sig amounting to 0.066. This means that labor has a significant effect on the opportunities for land conversion by farmers at the real level of 10 percent (0.066 < 0.100). The coefficient of results obtained is positive (+) and the value of Exp *(β)* or the odds ratio obtained is 11.932. This means that farmers who have difficulty finding labor have the opportunity to change land functions 11.932 times higher than farmers who do not have difficulties in finding labor. The more difficult it is to find labor the higher the chance for the farmer to change land functions.

The working force is an important factor to determine the success of farmers in farming. Each production requires an adequate workforce and the number of workers needs to be adjusted according to the needs so that the number is optimal. The workforce variable in this study is the farmer family workforce as the successor of farming activities. Based on the results of the interviews, most of the children of farmers were reluctant to follow in the footsteps of their parents as farmers and chose to work in other sectors. The biggest challenge in the agricultural sector comes from the farmers themselves, namely there is no regeneration. One of the factors for the lack of young people who are interested in the agricultural sector, especially in Bali, is the lack of knowledge about agriculture, especially the subak system (Windia, et al, 2017). The young generation's perception of the peasant profession is not much different from the perception of the urban community, namely that the farmer profession is a dirty, miserable, and less prestigious job. As a result of this change in perspective, the image of farmers in their minds has declined. Thus, agricultural land is no longer a mere social asset, but more used as an economic asset or working capital if they change occupation outside of agriculture (Ilham, 2005).

The variable number of dependents has a Sig value amounting to 0.083. This value means that the number of dependents has a significant effect on the chance of land conversion by farmers at the real level of 10 percent (0.083 <0.100). The outcome coefficient is positive (+) and the Exp *(β)* value or the odds ratio obtained is 4,819. This means that if the number of dependents of the farmer increases by one person, then the opportunity for the farmer to change the function of the land is 4,819 times greater than for not changing the function. The greater the number of dependents of the farmer, the higher the chance for the farmer to change the function of the land.

A farmer's dependents are the number of people whose lives the farmer is still bearing. In the context of economic life, the number of dependents in the family is considered a determining factor for the welfare of a family. The greater the number of dependents, the greater the burden of life is borne by the farmers (Yudhistira, 2013). In the case studies in the research location, 63 percent of farmers have two to four dependents, 7 percent of farmers have no dependents and another 30 percent have only one dependent. The large burden of dependents causes farmers to decide to sell their agricultural land to meet the economic needs of their families.

The irrigation network variable has a Sig value of 0.052. This value means that the irrigation network has a significant effect on the chance of land conversion by farmers at the real level of 10 percent (0.052 < 0.100). The resulting coefficient is positive (+) and the Exp (β) value or the odds ratio obtained is 8.567. This means that farmers who experience problems with the irrigation network are more likely to change land functions by 8,567 times compared to farmers who do not experience problems with the irrigation network.

Government Regulation (PP, Peraturan Pemerintah) No. 20/2006 regarding irrigation explains that irrigation networks are channels, buildings, and complementary structures which constitute one unit required for the provision, distribution, provision, use, and disposal of irrigation water. Data from the General Directorate of Natural Resources (2016) shows the damage to irrigation networks in Indonesia reached more than 50% by 2014, although rehabilitation of irrigation facilities continues, it has not significantly overcome the damage. The irrigation network problems experienced by farmers in the research location were the construction of overhangs that were easily damaged or broken during the rainy season which caused no water flow to enter the subak and leaks in the canal ducts due to poor maintenance. The use of irrigation water decreases due to the rate of damage to the irrigation network which is faster than the rate of repair or

restoration (Rivai et al., 2013). Irrigation networks are one of the factors that affect farm production so that poor network quality can lead to crop failure. The results of research by Damayanti (2012) in the ParigiMoutong Regencyreveal that irrigation can increase the production of lowland rice farming by 3.98%. If irrigation problems occur continuously, it will have an impact on farmers' income and cause farmers to sell their land.

The variable of agricultural land area has a Sig value of 0.022. This value means that agricultural land has a significant effect on the chance of land conversion by farmers at the real level of 10 percent (0.022 < 0.100). If the result coefficient is negative (-) and the value of Exp (β) or the odds ratio obtained is 0.929, then this means that the more land the farmer owns, the smaller the chance for the farmer to change the function of the land. Farmers who have large enough land tend to maintain their land that there is little opportunity for land conversion, and vice versa. This is thought to be due to the fact that land area is closely related to revenue. Farmers who have a wider area of land have a higher yield of production so that the income generated is greater than farmers who have a smaller land area (Puspasari, 2012). The yields from cultivating narrower land are not proportional to the capital issued by the farmers so that it will indirectly affect the income they earn in their daily lives.

## CONCLUSION

The conversion of rice fields in Tabanan Regencykeeps increasing every year. The land conversion rate, which occurred between 2011 and 2018, was 8.20 percent, or 1.17 per year, with an overall decrease in land area of 1,839 ha. The projected development rate of land conversion in Tabanan Regency from 2019 to 2025 has increased with an average shrinkage rate of 1.15 percent per year. Based on the results of the T-test, there is no significant (real) difference between the average income of farmers who change land functions and those who do not change. The factors that influence the conversion of agricultural land, especially rice fields at the farm level, are labor, number of dependents, irrigation system, and a land area of rice field ownership.

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