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Analysis Of The Income Proportion Of Lowland Rice Farmers In Areas Surrounding Community-Based Mining Sites In Pohuwato Regency

Indriyani Saidi
Universitas Negeri Gorontalo
Mahludin H. Baruwadi
Universitas Negeri Gorontalo
Ria Indriani
Universitas Negeri Gorontalo

Corresponding Author: *indriyanisaidi2810@gmail.com*

Abstract

Agricultural production plays an important role not only in fulfilling household food needs but also in promoting economic development. One example is Gorontalo Province, which continues to face socioeconomic challenges, particularly among farming households, as reflected in the Farmer Terms of Trade (FTT), which declined by 2.62%. A decline in the FTT weakens farmers' purchasing power, thereby increasing their vulnerability in meeting food needs and potentially threatening regional food security stability. Consequently, many farmers have diversified their income sources by engaging in artisanal gold mining activities. The sampling technique employed the Lemeshow formula with a 95% confidence level, a proportion value of 0.5, and a 10% margin of error, resulting in a minimum sample size of 97 respondents. Data were analyzed using the Simpson Index of Diversification (SID), based on the Simpson income diversification formula. The results indicate that farming households rely more heavily on non-farm income sources. Income from lowland rice farming accounted for 27.64%, while non-farm income contributed 72.36%. The Simpson Index of Diversification value of 0.400 indicates a moderate level of income diversification among farming households. This value reflects a household income structure derived from multiple sources, including lowland rice farming and non-farm activities. However, the distribution remains unbalanced, as the contribution of mining income is substantially greater than that of agricultural income.

Keywords: Income; Agriculture; Mining.

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INTRODUCTION

Agriculture is a fundamental source of livelihood for communities, as agricultural production enables individuals to meet their basic needs, particularly food consumption. Beyond its role in fulfilling household food requirements, agricultural production also plays a significant role in promoting economic development, particularly in Gorontalo Province. Currently, Gorontalo Province continues to face socioeconomic challenges, including extreme poverty, which reflects the severe limitations experienced by certain segments of the population in accessing and fulfilling their basic needs, such as clothing, food, housing, healthcare, and education (Akib et al., 2025). The poverty rate in Gorontalo Province has remained a significant concern in regional development over the past several years. The average poverty rate in the province stands at approximately 2.90%, indicating that a proportion of the population continues to face limited access to economic resources, particularly in rural areas where the agricultural sector serves as the primary source of income (Pomalingo et al., 2025). The agricultural sector serves as a backbone of the economy and represents the primary source of income for communities, particularly farmers living in rural areas (Intani et al., 2021). One of the key indicators used to assess farmers' welfare is the Farmer Terms of Trade (FTT), which reflects farmers' ability to meet their living needs through income generated from their farming activities (Lusiana et al., 2021). However, according to data from Statistics Indonesia (BPS, 2025) the Farmer Terms of Trade (FTT) in Gorontalo Province declined by 2.62% in April 2025 compared to the previous month, decreasing from 117.13 to 114.07. Changes in the FTT are highly sensitive to fluctuations in agricultural input and output prices. When the FTT declines, farmers' purchasing power weakens, increasing their vulnerability in meeting household food needs and potentially threatening regional food security stability. The decline in the FTT indicates that income generated from agricultural activities has not been sufficient to optimally meet farmers' living needs, as reflected in their declining purchasing power for household consumer goods and services (Hasan & Djakaria, 2021). Ultimately, the decline in the Farmer Terms of Trade (FTT) has become a significant concern, as many individuals working in the agricultural sector have begun diversifying their income sources through artisanal mining activities. Income diversification through mining activities is particularly relevant in the context of Pohuwato Regency, one of the major agricultural centers in Gorontalo Province, which is also currently experiencing artisanal gold mining activities.

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These mining activities have contributed to river sedimentation disturbances, prompting some farming households to shift their primary income-generating activities from lowland rice cultivation to artisanal gold mining. This shift is associated with reduced water discharge entering agricultural irrigation channels, as the available water supply has become increasingly limited and contaminated with sediment. Consequently, agricultural activities, particularly lowland rice farming, have been affected. Examining the income proportion of farming households in areas surrounding artisanal mining sites in Pohuwato Regency is therefore essential. The urgency of this research lies in the fact that food security constitutes one of the fundamental pillars of national stability, while income distribution plays a crucial role in determining farmers' welfare. Farmers' welfare is a key factor in maintaining the sustainability of food production in rural areas. Therefore, this study is particularly relevant, given the limited number of studies that comprehensively examine the income proportions of farming households in relation to food security and rural welfare amid ongoing mining activities. This research adopts an approach that takes into account the specific socioeconomic conditions of communities in Pohuwato Regency.

TINJAUAN PUSTAKA

Income

Income refers to the total economic receipts earned by a household from various sources, both agricultural and non-agricultural sectors. According to Rauf et al., (2021), net farm income represents the returns received by farming households from the utilization of their own or hired labor, management, and capital invested in farming activities. This concept is used to assess farm performance without complicating comparisons by including interest on capital as a cost. Meanwhile, non-farm income refers to income generated from activities outside the agricultural sector. In the present context, this source of income is predominantly derived from the mining sector, particularly in areas endowed with gold resources, where extraction activities are carried out by local communities. Artisanal mining has become a major alternative source of income because it offers relatively rapid financial returns.

Agriculture

According to the Food and Agriculture Organization (FAO), the agricultural sector encompasses activities related to crop cultivation, livestock farming, forestry, and fisheries, which aim to meet food needs and improve community welfare. Meanwhile, according to *Badan Pusat*

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Statistik, (2024) the agricultural sector is defined as an economic sector comprising food crop farming, horticulture, plantations, livestock, forestry, and fisheries, with outputs intended for consumption as well as further production processes.

Mining

According to (Wongnaa et al., 2024) mining refers to activities involving the exploration, exploitation, processing, and utilization of mineral and coal resources contained within the Earth. Mining activities are extractive in nature and generally require large-scale land clearing, substantial water consumption, and generate both solid and liquid waste. These activities may reduce the availability of agricultural land due to land-use conversion. The conversion of productive agricultural land into mining areas has the potential to decrease the production of local food commodities. Therefore, research analyzing the income proportions of farming households amid artisanal mining activities is necessary to examine the extent to which income derived from lowland rice farming and artisanal gold mining contributes to the livelihoods of local communities, particularly farming households.

RESEARCH METHODS

Research Location

This study was conducted in Pohuwato Regency, Gorontalo Province, considering its agrarian characteristics and the fact that the majority of rural communities in the regency are engaged in lowland rice farming. The selection of the research location was based on the research objectives and preliminary field observations, which identified income diversification through artisanal gold mining activities. These activities have contributed to disruptions in agricultural irrigation systems, thereby affecting farming activities in the surrounding areas.

Types and Sources of Data

The data used in this study consisted of primary and secondary data. These data included information on lowland rice production, total population, and the number of lowland rice farmers in the areas with the highest rice production in Pohuwato Regency.

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Sampling Technique

The sampling technique employed in this study was based on a total population of 7,564 farmers. Using the Lemeshow formula with a 95% confidence level, a proportion value of 0.5, and a margin of error of 10%, the minimum required sample size was determined to be 97 respondents. Subsequently, the sample was proportionally distributed across each research location to ensure that the representation of respondents corresponded to the population size in each area.

Data Analysis

This data analysis technique measures the intensity of income diversification among rural households using the Simpson Index of Diversification (SID). The Simpson income diversification formula is employed to determine the extent to which households in artisanal mining areas, particularly farming households, rely on more than one source of income to meet their livelihood needs. The Simpson Index of Diversification (SID) reflects the degree of diversity and proportional distribution of income sources available to a household or rural community. An index value approaching one indicates a higher level of income diversification, suggesting that households do not rely solely on a single source of income. Conversely, an index value approaching zero indicates a lower level of income diversification, in which the majority of household income is derived from a single primary source. The formula for the Simpson Index of Diversification (SID) is as follows:

$$SID = 1-\left\{\left(\frac{C1}{T1}\right)^2 +\left(\frac{On1}{T1}\right)^2 + \left(\frac{Of1}{T1}\right)^2\right\}$$

Description:

C1 = *Corn Income* (Pendapatan padi sawah)

On1 = *Other Onfarm Income* (Pendapatan diluar usahatani padi sawah)

OfI = *Other Off-Farm Income* (Pendapatan diluar pertanian)

T1 = Total *Income* (Total keseluruhan pendapatan)

This index is used to examine the extent to which farming household income is distributed across several income sources, namely income from lowland rice farming, other on-farm activities apart from lowland rice farming, and non-farm activities. An SID value approaching zero indicates that household income remains concentrated in a single primary source, whereas an increasingly higher value indicates greater diversity and a more balanced distribution of income sources.

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RESULTS AND DISCUSSION

Respondent Characteristics

The general characteristics of respondents describe the demographic and socioeconomic profiles of the individuals participating in this study, particularly those residing in areas surrounding artisanal mining sites in Pohuwato Regency. The respondents' characteristics were analyzed using univariate analysis and are presented in the following subsections.

1. Gender

Table 1. Gender of Lowland Rice Farmers in Areas Surrounding Artisanal Mining Sites in Pohuwato Regency

No	Gender	Farmers	
		Persons	%
1	Male	97	97.00%
2	Female	3	3.00%
Total		**100**	**100.00%**

Source: Processed Data, 2026

Based on the table above, the characteristics of lowland rice farmer respondents in areas surrounding artisanal mining sites in Pohuwato Regency are predominantly male, accounting for 97 respondents (97.00%), while female farmers represent only 3 respondents (3.00%) of the total 100 respondents. The high proportion of male farmers may also reflect the division of labor within farming households, in which men tend to assume the primary role in managing farming activities. Although the number of female farmers is relatively small, their presence demonstrates women's involvement in agricultural activities, both as farm managers and as household decision-makers.

2. Main and Secondary Occupations

The demographic characteristics of farmers in areas surrounding artisanal mining sites in Pohuwato Regency, based on their primary and secondary occupations, are presented in Table 2 below:

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Table 2. Primary and Secondary Occupations of Lowland Rice Farmers in Areas Surrounding Artisanal Mining Sites in Pohuwato Regency

No	Primary Occupation	Farmers		Secondary Occupation	Miner	
		Persons	%		Persons	%
1	Farmers	100	100.00%	Miner	100	100.00%
Total		**100**	**100.00%**	**Total**	**100**	**100.00%**

Source: Processed Data, 2026

Based on the table above, all respondents, totaling 100 individuals (100.00%), identified lowland rice farming as their primary occupation and mining as their secondary occupation. This condition indicates that farming households in areas surrounding artisanal mining sites in Pohuwato Regency adopt a dual livelihood strategy, maintaining lowland rice farming as their primary economic activity while engaging in mining activities as an additional source of income.

3. Age

Age is associated with farmers' physical capabilities, experience, productivity, and ability to manage and develop their farming activities. The age distribution of farmers in areas surrounding artisanal mining sites in Pohuwato Regency is presented in Table 3 below.

Table 3. Age Distribution of Lowland Rice Farmers in Areas Surrounding Artisanal Mining Sites in Pohuwato Regency

No	Farmers' Age	Farmers	
		Orang	%
1	26-35 Years	16	16,00%
2	36-45 Years	29	29,00%
3	46-55 Years	38	38,00%
4	56-65 Years	17	17,00%
Total		**100**	**100,00%**
Avarage		**47**	

Source: Processed Data, 2026

Based on the table above, the age distribution of lowland rice farmers in areas surrounding artisanal mining sites in Pohuwato Regency is dominated by the 46–55 age group, comprising 38 respondents (38.00%). This is followed by the 36–45 age group, with 29

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respondents (29.00%), and the 56–65 age group, with 17 respondents (17.00%). Meanwhile, the 26–35 age group represents the smallest proportion, consisting of 16 respondents (16.00%).

4. Number of Dependents

The demographic characteristics of farmers in areas surrounding artisanal mining sites in Pohuwato Regency, based on the number of household dependents, are presented in Table 4 below:

Table 4. Number of Dependents of Lowland Rice Farmers in Areas Surrounding Artisanal Mining Sites in Pohuwato Regency

No	Number of Dependents	Farmers	
		Persons	%
1	1-3 Persons	47	47,00%
2	≥ 4 Persons	53	53,00%
Total		**100**	**100,00%**
Average		**4**	

Source: Processed Data, 2026

Based on the table above, the number of household dependents among lowland rice farmers in areas surrounding artisanal mining sites in Pohuwato Regency is predominantly four or more persons, accounting for 53 respondents (53.00%). Meanwhile, 47 farmers (47.00%) have between one and three dependents. This distribution indicates that farming households have an average of four dependents. A larger number of household dependents may increase household expenditure requirements, particularly for food, education, healthcare, housing, and other daily necessities.

5. Highest Level of Education

The higher the level of education attained, the greater the expected ability of farmers to acquire and process information that can support improvements in productivity and household welfare. The demographic characteristics of lowland rice farmers residing in areas surrounding artisanal mining sites in Pohuwato Regency, based on their highest level of education, are presented in Table 5 below.

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Table 5. Highest Level of Education of Lowland Rice Farmers in Areas Surrounding Artisanal Mining Sites in Pohuwato Regency

No	Education	Farmers	
		Persons	%
1	Elementary School or Equivalent	91	91.00%
2	Junior High School or Equivalent	9	9.00%
3	Senior High School or Equivalent	0	0.00%
4	Higher Education	0	0.00%
Total		**100**	**100.00%**

Source: Processed Data, 2026

Based on the table above, the educational attainment of lowland rice farmers in areas surrounding artisanal mining sites in Pohuwato Regency is predominantly at the elementary school or equivalent level, comprising 91 respondents (91.00%). Meanwhile, only 9 farmers (9.00%) had completed junior high school or an equivalent level. No respondents had completed senior high school or an equivalent level, or pursued higher education. This composition indicates that the level of formal education among farmers in the study area remains relatively low. Such conditions may affect farmers' ability to understand technical information, access knowledge resources, maintain farm business records, calculate production costs and income, and adopt more modern agricultural technologies. This finding is consistent with the results of (Tran et al., 2023) in their study entitled *"Education and Agricultural Household Income: Comparative Evidence from Vietnam and Thailand,"* which examined agricultural households in Vietnam and Thailand. The study found that education was positively associated with income from crop production and livestock farming, but negatively associated with income derived from natural resource extraction activities.

6. Landholding Size

The size of cultivated land is associated with farmers' capacity to manage production activities, utilize farm inputs, and determine the amount of production output and income generated. The demographic characteristics of farmers residing in areas surrounding artisanal mining sites in Pohuwato Regency, based on landholding size, are presented in Table 6 below.

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Table 6. Landholding Size of Lowland Rice Farmers in Areas Surrounding Artisanal Mining Sites in Pohuwato Regency

No	Land Area (Hectares)	Farmers	
		Persons	%
1	< 0.50	5	5,00%
2	0.50 Ha - 1.00	87	87,00%
3	> 1.00	8	8,00%
Total		**100**	**100,00%**
Avarage		**1**	

Source: Processed Data, 2026

Based on the table above, the majority of lowland rice farmers in areas surrounding artisanal mining sites in Pohuwato Regency cultivate land ranging from 0.50 to 1.00 hectares, accounting for 87 respondents (87.00%). Furthermore, 8 farmers (8.00%) cultivate more than 1.00 hectare, while only 5 farmers (5.00%) cultivate less than 0.50 hectares. This composition indicates that the respondents' landholdings are predominantly concentrated within the range of up to 1 hectare. Landholding size is an important factor in determining production capacity, the need for agricultural inputs, labor utilization, harvest yields, and the potential income generated from farming activities. Consistent with the findings of a study conducted by (Tacconi et al., 2023) Farm Diversification Strategies, Dietary Diversity and Farm Size: Results from a Cross-Country Sample in South and Southeast Asia, which stated that landholding size, particularly holdings of less than 2 hectares, influences agricultural diversification in relation to dietary diversity and household income. These findings further indicate that strategies to increase income and improve welfare cannot be applied uniformly to all farmers, as landholding size and household conditions influence the most appropriate strategies for each farming household.

7. Farming Experince

Farming experience can influence farmers' ability to manage land, determine the use of production inputs, cope with various farming risks, and make decisions related to production activities and the marketing of agricultural products. The demographic characteristics of farmers residing in areas surrounding artisanal mining sites in Pohuwato Regency, based on their farming experience, are presented in Table 7 below.

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Table 7. Farming Experience of Lowland Rice Farmers in Areas Surrounding Artisanal Mining Sites in Pohuwato Regency

No	Years of Farming Experience	Farmers	
		Persons	%
1	1-10 Years	39	39.00%
2	11-20 Years	43	43.00%
3	> 20 Years	18	18.00%
Total		**100**	**100.00%**
Avarage		**15 Years**	

Source: Processed Data, 2026

Based on the table above, the largest proportion of lowland rice farmers in areas surrounding artisanal mining sites in Pohuwato Regency have 11–20 years of farming experience, comprising 43 respondents (43.00%). Furthermore, 39 farmers (39.00%) have 1–10 years of farming experience, while 18 farmers (18.00%) have been engaged in farming for more than 20 years. These data indicate that 61.00% of respondents have more than 10 years of farming experience, with an average farming experience of 15 years. This condition illustrates that most farmers have relatively adequate experience in managing lowland rice farming activities, ranging from land preparation, seed selection, crop maintenance, pest and disease control, to harvesting and marketing agricultural products.

8. Land Tenure Status

Land tenure status indicates farmers' position in farming activities, whether as landowners or as farmers cultivating land owned by others. The demographic characteristics of farmers residing in areas surrounding artisanal mining sites in Pohuwato Regency, based on land tenure status, are presented in Table 8 below.

Table 8. Land Tenure Status of Lowland Rice Farmers in Areas Surrounding Artisanal Mining Sites in Pohuwato Regency

No	Land Tenure Status	Farmers	
		Persons	%
1	Owner-operated	27	27.00%
2	Tenant farmer (sharecropper)	72	72.00%

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3	Leased land	1	1.00%
Total		**100**	**100.00%**

Source: Processed Data, 2026

Based on the table above, land tenure among lowland rice farmers in areas surrounding artisanal mining sites in Pohuwato Regency is predominantly characterized by tenant farmers, accounting for 72 respondents (72.00%). Meanwhile, 27 farmers (27.00%) cultivate their own land, while only 1 farmer (1.00%) cultivates leased land. Tenant farming status may affect net income, as farm proceeds may need to be shared with landowners in accordance with the prevailing agreements. Limited land ownership rights may also affect farmers' autonomy in making long-term investments, improving land quality, and expanding their farming operations. Conversely, farmers who own their land have greater control over land management and the utilization of production outputs.

9. Production per Planting Season

Production per planting season is one of the key characteristics used to describe the farming conditions of farmers residing in areas surrounding artisanal mining sites in Pohuwato Regency. The demographic characteristics of these farmers, based on production per planting season, are presented in Table 9 below:

Table 9. Production per Planting Season of Lowland Rice Farmers in Areas Surrounding Artisanal Mining Sites in Pohuwato Regency

No	Production per Planting Season	Farmers	
		Persons	%
1	≤ 1.000 Kg	67	67.00%
2	1.001 Kg - 2.000 Kg	18	18.00%
3	> 2.000 Kg	15	15.00%
Total		**100**	**100.00%**

Source: Processed Data, 2026

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Based on the table above, the majority of lowland rice farmers in areas surrounding artisanal mining sites in Pohuwato Regency produce no more than 1,000 kilograms of rice per planting season, accounting for 67 respondents (67.00%). Farmers producing between 1,001 and 2,000 kilograms number 18 (18.00%), while only 15 farmers (15.00%) are able to produce more than 2,000 kilograms per planting season. This composition indicates that rice production among respondents is generally concentrated in the low-production category. This condition may be associated with the size of cultivated land, land tenure status, the use of agricultural inputs, labor availability, irrigation conditions, pest and disease infestations, as well as the allocation of farmers' time between farming and mining activities. Low production per planting season may potentially limit farm revenue and the availability of rice for household consumption.

10. Analysis of Income Proportions in Areas Surrounding Artisanal Mining Sites in Pohuwato Regency

The income proportions of lowland rice farmers in areas surrounding artisanal mining sites in Pohuwato Regency are presented in the following table:

Table 10. Income Proportions in Areas Surrounding Artisanal Mining Sites in Pohuwato Regency

No	Aspek	Farmers' Income (Rp)		Farmers' Income Proportion (%)	
		On-Farm Income	Non-Farm Income	On-Farm Income	Non-Farm Income
1	Avarage	9.290.000	27.210.000	27,64%	72,36%
2	Min	2.000.000	3.000.000	4,76%	9,09%
3	Max	30.000.000	60.000.000	90,91%	95,24%
Simpson Indeks Diversification (SID)		**0,400**			
Category		**Moderate Diversification**			

Source: Processed Data, 2026

Based on the income proportions presented in the table, on-farm income contributes an average of only 27.64% to farmers' total income, while non-farm income accounts for 72.36%. The difference of 44.72 percentage points confirms that the respondents' household income

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structure relies more heavily on non-agricultural activities, particularly artisanal mining. The wide range of income proportions indicates considerable differences in economic conditions among households. The proportion of on-farm income ranges from 4.76% to 90.91%, whereas the proportion of non-farm income ranges from 9.09% to 95.24%. This means that some farmers are almost entirely dependent on mining activities, while others still rely primarily on lowland rice farming as their main source of income. This finding is consistent with the study by Meutia et al., (2022) entitled *"Indonesian Artisanal and Small-Scale Gold Mining,"* which found that gold mining income sources are distributed across various regions of Indonesia and provide employment opportunities. Some farming households also rely on mining as their primary source of income to improve their household economic conditions. However, this finding differs from the results of the study *"Rethinking Agrarian Transition in Southeast Asia Through Rice Farming in Thailand"* by Promkhambut et al., (2023) which showed that rice farming remained a primary source of income, although economic structures varied between regions, particularly in the Central Plains. The study also identified a decline in the role of rice farming during the 2000–2019 period, particularly in northeastern Thailand. These differences in Pohuwato Regency are likely influenced by landholding size and tenure status, production levels, access to irrigation water, capital availability, the intensity of farmers' involvement in mining activities, and the extent of environmental disturbances caused by mining operations affecting rice fields. When agricultural water supplies decrease or become contaminated by sediment and mining waste, the potential income from rice farming declines, potentially increasing farmers' dependence on mining activities.

The obtained *Simpson Index of Diversification* (SID) value of 0.400 places the farmers' income structure in the moderate diversification category. This value reflects the fact that household income is derived from more than one source, namely lowland rice farming and non-farm activities. However, the distribution remains relatively unbalanced, as non-farm income contributes substantially more than income from farming activities. With only two primary income sources, this value indicates that farmers have diversified their livelihood sources to a considerable extent, but remain highly dependent on one particular source, namely artisanal mining. This finding differs from the study conducted by Antara et al., (2023) involving 264 lowland rice farming households in Parigi Moutong Regency. Using SID analysis, the study reported an average income diversification index of 0.398. This index indicated that the distribution of household income sources was relatively concentrated among several activities,

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including lowland rice farming, cocoa plantations, chicken and pig farming, and non-agricultural activities such as small-scale retail businesses. Similarly, the study conducted by Ho et al., (2024) Similarly, the study conducted by Ho et al. (2024) found that farming households in the Mekong Delta relied on rice farming as their primary livelihood strategy, accounting for approximately 55.34% of households. Meanwhile, 23.88% of households combined rice farming with non-agricultural employment, while 20.79% combined rice farming with other agricultural activities.

Moderate diversification can serve as a coping strategy when rice farming income declines due to planting failures, water shortages, reduced productivity, or deteriorating land quality. Income from mining activities can help finance household food consumption, education, healthcare, and the capital requirements for the subsequent planting season. . These findings are supported by the study conducted by Purnomo et al., (2021) . These findings are supported by the study conducted by Purnomo et al. (2021), entitled *"Resistance to Mining and Adaptation of Indonesia Farmer's Household to Economic Vulnerability of Small Scale Sand Mining Activities."* The study found that mining activities not only provide opportunities to generate income but have also become an integral part of rural economic and social life. As communities become increasingly dependent on these activities, changes in the mining sector may potentially affect the socioeconomic conditions of households.

The *Simpson Index of Diversification* value of 0.400 also indicates that household economic resilience has not yet been fully established, as a decline in mining activities or mining-related income could directly reduce a substantial proportion of farmers' total household income. Furthermore, the SID value of 0.400 should be interpreted with caution, as income diversification does not necessarily translate into improved and sustainable household welfare. The involvement of lowland rice farmers in mining activities surrounding artisanal mining sites in Pohuwato Regency represents a response to insufficient agricultural income. However, at the same time, such activities may reduce the time and labor allocated to managing rice fields. The occurrence of mining waste discharge and sedimentation, disruptions to irrigation networks, and water scarcity in rice-growing areas may increase production risks and further encourage farmers to shift toward mining activities. . This finding is consistent with the study conducted by Ardikoesoema & Karuniasa, (2025) which found that environmental capital has a positive and significant relationship with livelihood transformation. This indicates that environmental conditions and opportunities are among the factors associated with changes in community economic activities. If this dependence continues to increase, the livelihood base derived from

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lowland rice farming may weaken, making households more vulnerable to fluctuations in mining output, income instability, occupational safety risks, and the enforcement of mining regulations. Therefore, the moderate level of diversification identified in this study needs to be directed toward a more sustainable form of diversification through irrigation rehabilitation, the control of environmental impacts from mining activities, improvements in rice productivity, stronger agricultural marketing systems, and the development of other more stable non-farm income sources.

DISCUSSION

The income structure of lowland rice farmers in areas surrounding artisanal mining sites in Pohuwato Regency indicates that farming households rely more heavily on non-farm income sources. On-farm income accounts for 27.64% of total household income, while non-farm income contributes 72.36%. The *Simpson Index of Diversification* (SID) value of 0.400 places the farmers' income structure in the moderate diversification category. This value reflects the fact that household income is derived from more than one source, namely lowland rice farming and non-farm activities. However, the distribution remains unbalanced, as non-farm income contributes substantially more than on-farm income. This condition confirms that artisanal mining activities have become an important source of livelihood for supporting household needs, particularly when rice farming income is seasonal, limited, and vulnerable to irrigation disruptions, sedimentation, and declining land productivity.

CONCLUSION

1. The Pohuwato Regency Government needs to establish an integrated program for the protection of rice fields and the control of mining impacts through clearly defined annual targets. Priority measures should include mapping affected rice fields, rehabilitating irrigation networks, establishing buffer zones between mining sites and agricultural land, and allocating specific funding in the Regional Government Work Plan (RKPD).
2. The Department of Agriculture, the Department of Food Security, and the Environmental Agency, in collaboration with the relevant mining authorities, need to strengthen monitoring and supervision of water quality, sedimentation, and waste discharge from mining sites into rice-growing areas in Pohuwato Regency. This collaboration should also aim to develop measurable on-farm income enhancement programs for lowland.

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