https://doi.org/10.48047/AFJBS.6.8.2024.3201-3215

African Journal of Biological Sciences
Journal homepage: http://www.afjbs.com
Research Paper Open Access

# Economic Perspective in Adopting Corn (*Zea mays*) Agroforestry Patterns to Increase Income: Lessons Learned from Women Forest Farmers

**Raden Roro Ilma Kusuma Wardani**
Masters in Development Extension, Master
SebelasMaret University
Ir. SutamiStreet No.36, Jebres, Surakarta City, Central Java 57126, Indonesia
https://orcid.org/0000-0003-3370-5819
**Widiyanto**
PhD in Agricultural Communication Extension, Associate Professor
SebelasMaret University
Ir. SutamiStreet No.36, Jebres, Surakarta City, Central Java 57126, Indonesia
https://orcid.org/0000-0002-3953-0557
**Ismi Dwi Astuti Nurhaeni**
Professor in Social-Political Sciences, Professor
SebelasMaret University
Ir. SutamiStreet No.36, Jebres, Surakarta City, Central Java 57126, Indonesia
https://orcid.org/0000-0003-4090-4146
**Dwiningtyas Padmaningrum**
PhD in Agricultural Communication Extension, Associate Professor
SebelasMaret University
Ir. SutamiStreet No.36, Jebres, Surakarta City, Central Java 57126, Indonesia
https://orcid.org/0000-0001-8059-4678

**Article History**
Volume 6, Issue 8, 2024
Received: 16 May 2024
Accepted : 20 June 2024
Doi:
10.48047/AFJBS.6.8.2024.3201-3215

**Abstract**
Many Indonesian farmers practice agroforestry, including the corn agroforestry system. Corn production in Indonesia has increased over the last ten years, with the most significant production coming from Java. Women's participation is very high in the agricultural sector. This research aims to examine the adoption of women forest farmers in implementing agroforestry systems, how agroforestry patterns and systems are implemented, and how much corn agroforestry contributes to the income level of women forest farmers. Primary data was obtained from interviews with female corn agroforestry farmer respondents. Data processing uses quantitative descriptive analysis by calculating production costs, revenues, and income, as well as the contribution of corn agroforestry to farmers' total income. The research results show that farmers apply agrisilviculture with a simple system: planting corn (*Zea mays*) under forest tree stands. The R/C ratio values in Rembang Regency and Blora Regency, Central Java Province, are 2.74 and 2.88, where the value is >1, meaning that corn agroforestry farming provides profits. The implementation of corn agroforestry contributes significantly to the average income of women farmers, namely IDR 9,292,076 in Rembang Regency and IDR 24,043,918 in

Blora Regency. The development of corn agroforestry is directed at increasing productivity and quality without destroying the shade plants. The policy implications of corn agroforestry development can accommodate the interests of meeting economic needs and conserving natural resources.

**Keywords:** agroforestry, agricultural economics, corn (*Zea mays*), women farmers, income.

## Introduction

The agricultural sector has more opportunities to create jobs than other sectors. The agricultural sector can support the economy in Indonesia, so it has become an essential sector for Indonesian society(Rojun&Nadziroh, 2020). Based on the Ministry of Agriculture's Strategic Plan for 2020-2024, most of the country's economic growth and foreign exchange come from the agricultural sector with exports of agricultural commodities. This causes many Indonesians to work as farmers to meet the financial needs of their families and the food needs of the country(Wibowo &Estiningrum, 2021). Based on 2023 agricultural census data, 13.26% of Indonesians work as farmers.

The sustainability of the agricultural sector is determined by human resources as drivers and the availability of arable land(Sidharta et al., 2021). It is hoped that the management of agricultural products can be utilized optimally by the Indonesian people, especially workers in the farming sector. Still, the increasingly advanced development of the industrial sector is causing a reduction in agricultural land(Prayitno et al., 2021). The Ministry of Agrarian Affairs and Spatial Planning (ATR/BPN) said that based on the 2019 recalculation, the area of raw rice fields in Indonesia only remained 7,463,948 hectares. As many as 650,000 hectares of raw rice fields shrink yearly, as per the Ministry of Agriculture publication in 2020. Legally, the conversion of agricultural land is regulated in Law No. 41/2009 concerning the Protection of Sustainable Food Agricultural Land. However, agricultural activities in Indonesia are not only carried out in rice fields; people who live in forests also use land in the forests for farming activities.

Forests are one of the determinants of the life support system and a source of people's welfare. Their existence must be optimally preserved, and their carrying capacity must be maintained sustainably(Soraya, 2019). Forests are a natural resource that has many benefits. Forest management is carried out carefully to prevent problems, one of which is environmental problems. Forest management is one of the efforts to manage natural resources sustainably, which can create sustainable development(Yamamoto & Matsumoto, 2022). Fair and optimal forest management (Prins et al., 2023)can have social, ecological, and economic benefits(Mando et al., 2020). Forest management has many challenges, especially related to the efficiency of forest management while still paying attention to nature conservation(Idris, 2019). Apart from this, forests in Indonesia also experience problems in the form of land deforestation.

Based on data from the Ministry of Environment and Forestry (KLHK) in 2022, the land area owned by the entire Indonesian landmass is 96.0 million ha or 51.2% of the total land area, of which 88.3 million ha is in forest areas. Indonesia's deforestation in 2021-2022 decreased by 8.4% compared to monitoring results in 2020-2021. Indonesia's net deforestation in 2021-2022 is 104 thousand ha. Meanwhile, Indonesia's deforestation in 2020-2021 was 113.5 thousand ha. This shows that the various efforts made by the Ministry of Environment and Forestry have demonstrated significant results. One of the efforts made to overcome deforestation is agroforestry. Agroforestry is an integrated land use system with social and ecological aspects, realized through a combination of trees with agricultural plants and livestock (animals), together or in turn so that vegetable and animal products can be obtained from one unit of land. Optimally and sustainably(Safitri et al., 2023). Agroforestry can provide economic and ecological benefits, namely long-term environmental preservation (Helida et al., 2021).

Farmers in Indonesia widely practice agroforestry because it is suitable for small areas of land and dry or dry land. Apart from its sustainable production in plantation or agricultural products as weekly/monthly output and wood products as annual output, it is also used for environmental sustainability. The presence of woody plants (trees) in agroforestry has a role; the first is that woody plants can maintain crop production and positively influence environmental food, significantly slowing down energy loss and pests and preventing damage caused by wind and air. Second, trees benefit the economy(Saufi& Saleh, 2021). The implementation of agroforestry has an impact on improving the community's economy. This happens because the combination of several types of plants on one land can increase crop productivity and people's income(Helida et al., 2023).

One type of plant planted on agroforestry land is corn. Corn is one of the leading food commodities after rice. Corn is a substitute for rice, a raw material for the food, feed, and fuel industries(Sahara et al., 2020). Corn production in Indonesia in 2022 will be 25.18 million tons. The most significant corn production in 2022 will come from Java, namely 11.62 million tons. This production increased by 22.76% to 9.47 million tons(Saragih et al., 2023). Central Java Province is the main corn-producing area(Rahayu, 2019). BPS data support this statement for 2023, where corn production in Central Java reached 2.25 million tons or 15.55% of Indonesia's total corn production in 2023, which reached 14.47 million tons. Rembang and Blora districts are districts in Central Java that produce corn. These data findings show that growing corn is profitable and can be implemented using an agroforestry system.

Agroforestry is based on the Theory of Planned Behavior perspective, which is viewed from subjective norms, attitudes, and behavioral control factors influencing the intentions and behavior of farmers around the forest to plant (Amare &Darr, 2023). Biophysical, socio-economic, and psychological factors influence adoption of agroforestry innovation. This has also been researched and proven in Pakistan (Ahmad et al., 2023), Ethiopia(Amare &Darr, 2023), Indonesia (Cahyono et al., 2020), and Uganda(Buyinza et al., 2020). Social norms, social structures, and communities play an essential role in adopting agroforestry, especially for farmers who lack knowledge about it. Access to conventional knowledge alone is not enough to encourage agroforestry adoption. The research also shows that the positive benefits of agroforestry have become a driving force for the implementation of agricultural innovation.

Agroforestry management requires the support of various parties, including forest women. The role of forest women in forest management includes carrying out forest product collection activities, managing forest products, and protecting forest products(Karmila et al., 2023). Another role is related to the conservation movement (Utami et al., 2019). Women's involvement in various economic activities can help diversify family livelihoods, reduce dependence on one type of activity, and increase financial resilience (Wijewardena et al., 2023). Therefore, this research aims to examine the adoption of women forest farmers in implementing agroforestry systems, how agroforestry patterns and systems are implemented, and how much corn agroforestry contributes to the income level of women forest farmers.

**Literature Review**

The literature review was carried out using a systematic literature review method, which aims to collect, analyze, and present data and findings originating from various other types of research that are still relevant. Based on the literature review, a state of the art can be created from this research. According to(Ntawuruhunga et al., 2023) and (Gori Maia et al., 2021), agroforestry is an effort to achieve a land use system with integrated technology to optimize yields through a sustainable approach and increase opportunities for socio-economic optimization. According to people living around forests, agroforestry is considered a more robust food security system. It offers a sustainable increase in community income through product diversification and an ecology that supports soil fertility, water

quality, and biodiversity in the long term, as well as reducing carbon emissions compared to other cropping systems(Elevitch et al., 2018; Prabawani et al., 2024). The types and planting patterns managed by agroforestry can be economically beneficial and become essential to climate change mitigation and adaptation schemes (Nagar et al., 2021).

Farmers adopt agroforestry patterns to increase agricultural productivity, adapt to climate change, improve ecological and environmental functions, and fulfill cultural norms and personal values (Gebreegziabher et al., 2020; Tafere&Nigussie, 2018). The positive impact of agroforestry in the medium to long term on agricultural productivity and profits has been researched in several literature. Farmers' adoption decisions are determined by the high fixed and management costs associated with adoption in the short term(Do et al., 2020; Hadera & Tadesse, 2023) and, subsequently, income. Gebremedhin et al. (2023) highlight the increasingly important role of integrated agroforestry in creating synergies for increasing welfare.

Agroforestry management can also involve women farmers who live around the forest. Several previous studies examined the role of women living around forests in agroforestry management, including research byAhmaliun et al. (2022)andLispiani et al. (2022)found that the role of forest women in the agroforestry system is viewed from three aspects, including business governance, areas, and institutions. This involvement can be seen in planning, implementation, maintenance, harvesting, and marketing. Nhem & Lee (2019)researched local stakeholders' perceptions of women's involvement in sustainable forestry and the challenges faced by women. Research conducted by Desmiwati et al. (2021)discusses the contribution of agroforestry to farmers' income from household structure through income analysis.

**Materials and Methods**

The research was conducted in Central Java Province, Indonesia, with two regencies, Rembang and Blora Regencies. The development of the livestock sector, supported by the feed and food industry, which uses corn as raw material, has caused domestic demand for corn to continue to increase. This condition is an opportunity for Rembang and Blora Regencies as the largest corn production centers in Central Java Province, with an average annual production of 600 thousand tons or 60 percent of the total corn production in Central Java. Also, Blora and Rembang Regencies have land availability and supportive climate conditions. Determining respondents in this study used probability sampling techniques with the proportionate stratified random sampling method. Proportionate stratified random sampling is a data collection method used if the population has members or elements that are not homogeneous and proportionally stratified (Amin et al., 2023). This method was chosen using sampling based on predetermined characteristics, namely based on gender. The selected respondents were female farmers.

The types of research data are primary and secondary data. Primary data was obtained by researchers directly from respondents, which included respondent characteristics, expenses, selling prices, and income. Secondary data is obtained from other sources to strengthen research results and complement information in the field. This data was obtained from literature studies through books, related research document reports, and other data sources that support research. Secondary data collected includes regional maps, previous research, and research-related journals. The contribution of agroforestry is obtained by calculating the percentage of income from agroforestry to farmers' total revenue. Production costs total production costs are obtained by adding up fixed costs and variable costs with the following formula (Idris, 2019):

$$KN = \frac{N}{Pt}\ x\ 100\% \qquad (1)$$

Note:

KN = Agroforestry contribution,

N = Agroforestry income (IDR/year),

Pt = Farmer's total income (IDR/year).

Total production costs are obtained by adding up fixed costs and variable costs with the following formula (Khalifatullah et al., 2022):

$$TC = TFC + TVC \quad (2)$$

Note:
TC = Total Cost,
TFC = Total Fixed Cost,
TVC = Total Variable Cost.

The acceptance formula is:

$$TR = P \times Q \quad (3)$$

Note:
TR = Total Revenue,
P = Price,
Q = Quantity
The amount of income can be determined using the formula:

$$\pi = TR - TC \quad (4)$$

Note:
$\pi$ = Income,
TR = Total Revenue,
TC = Total Cost.
According to(Marpaung et al., 2022), R/C compares revenue and total costs.
R/C = Total Revenue (TR)/Total Cost (TC) (5)
Note:
Revenue = The amount of revenue obtained.
Cost = The amount of expenses incurred.
There are three criteria in the calculation, namely:
a. If R/C > 1, it means the farming is profitable.
b. If R/C = 1, it means the farm is breaking even.
c. If R/C < 1, it means the farming is making a loss.

## Results and Discussion

### *A. Adoption of the Corn Agroforestry System*

The majority of people in Central Java Province earn their living by farming. Apart from agriculture, people also raise cattle and goats. The availability of forage for cattle is critical to maintain. Corn plants are separated from their production in the form of corn, and forage from corn plants is essential for feed availability for cattle and goats.

There is currently a problem for some corn farmers: most do not have the land to carry out corn farming due to the limited land owned by farmers in the district. Therefore, Perhutani, through the Kebonharjo Forest Service Unit as a partner, offers a system of cooperation with local farmers, namely carrying out agroforestry farming with an agrisilviculture pattern. Farmers in Indonesia widely practice agroforestry because it is suitable for small areas of land and dry or dry land. Apart from its sustainable production in plantation or agricultural products as weekly/monthly output and wood products as annual output, it is also used for environmental sustainability (Saufi& Saleh, 2021). Opportunities for land use through a location-specific approach are starting to be developed by looking at the potential

available in the forestry sector. The available land between forestry crops can be used to deal with increasingly narrow agricultural land, resulting in a combination of agricultural and forestry components that form an agroforestry system. The land use pattern using an agroforestry system is a critical farming model for farmers who generally have limited agricultural land, where with this system, land productivity can increase so that agricultural intensification in terms of corn is expected to be achieved through this system.

Agroforestry refers to agricultural activities carried out by communities in forest areas(Mukhlis et al., 2022)that can utilize forest land owned by PerumPerhutani as farming land for growing seasonal crops. Planting is carried out on forest land previously cut down and processed into land ready for planting. Planting is carried out by farmers in empty fields among replanted tree seedlings to preserve the forest. The management community is responsible for maintaining and caring for tree seedlings planted on agroforestry land as compensation for cultivating the land. The plants planted on agroforestry land do not require much water, including corn, cassava, and nuts. Figure 1. Shows a plot of village forest land used by farmers for agroforestry purposes.

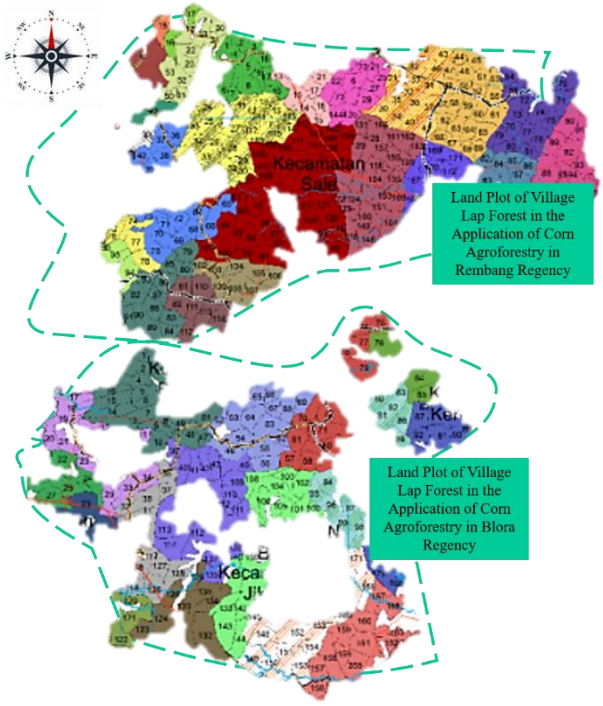


**Figure 1.** Map of Corn Agroforestry Land Plots

**Note:** Map of village forest plots used by farmers as corn agroforestry land

**Source:** Researcher Data Analysis

An agroforestry system that is developed appropriately by prioritizing the principles of sustainable forests and protecting the ecosystem will increase people's income and improve environmental quality. Agroforestry aims to achieve sustainable and optimal land management. By integrating intercalary crops that provide quick results and main crops with long-term benefits, agroforestry planting systems can increase land productivity by producing various results such as agricultural products, wood, and non-wood products. The agroforestry planting system is also the primary source of livelihood for farmers without private land, so it can improve community welfare. Apart from that, an agroforestry planting system can also preserve forests and natural ecosystems.

***B. Agroforestry Land Area***

Agroforestry land consists of areas managed for plantation forest cultivation, agriculture, and livestock. According to(Hemel et al., 2024), an environmentally friendly land management strategy, agroforestry can combine agriculture, forestry, and livestock to provide various ecosystem services. The aim of agroforestry land management is also conservation, which prevents the emergence of land conversion problems, such as drought, floods, soil erosion, decreased soil fertility, and loss of biodiversity. According to (Octavia et al., 2023), land management using an agroforestry system aims to maintain land productivity so that it has the potential to provide ecological, economic, and socio-cultural benefits for the community.

Agroforestry land management emphasizes the usefulness of the types of plants cultivated. The intended use is that it can provide benefits to the forest environment, production results, and economic value. Based on Presidential Regulation No. 83 of 2006 concerning the Food Security Council, the Ministry of Forestry is one of the sectors partly responsible for food security. Food security is measured by considering the number of meals per day and the contribution provided by an agroforestry land management system at the household level, and one example is agroforestry land management on small islands (Alfatikha et al., 2020).

Some data regarding the agroforestry land in Blora Regency and Rembang Regency have been considered in this research. The area of agroforestry land in Blora Regency, precisely in Gandu Village, is 27.3125 Ha, while in Rembang Regency, precisely in Tegaldowo Village, it is 2033.65 Ha. Based on the area of agroforestry land cultivated by these farmers, it can be seen that farmers in Tegaldowo Village, Rembang Regency, have more forest land to use as agroforestry than farmers in Gandu Village, Blora Regency. The size of the cultivated land owned by each farmer can be seen in Figure 2.

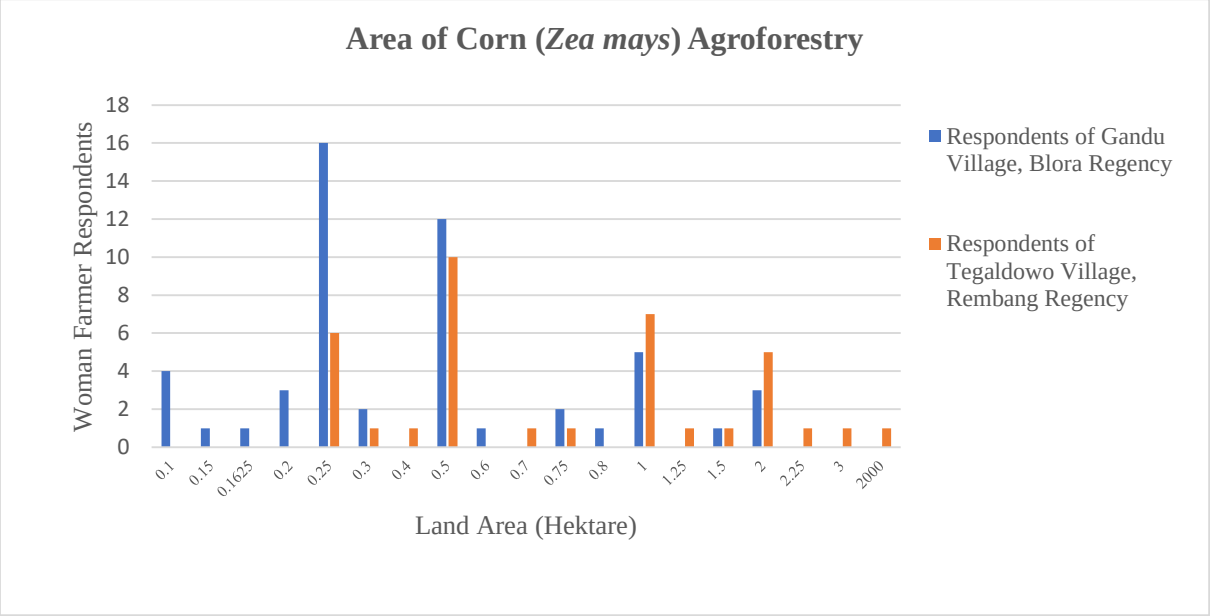


**Figure 2.** Graph of Land Area Cultivated by Corn Agroforestry by Women Farmers

**Note:** The graph is blue: the number of respondents in Gandu Village, Blora Regency, based on land area, and the Graph is orange: The number of respondents in Tegaldowo Village, RembangRegency, based on a land area

**Source:** Researcher Data Analysis

In Gandu Village, Blora Regency, the narrowest land area cultivated by farmers is 0.1 Ha, while the largest land area is 2 Ha. Compared with Gandu Village, Blora Regency, the narrowest land area cultivated by farmers in Tegaldowo Village, Rembang Regency, is 0.3 Ha, while the largest land area is

2,000 Ha. Differences in land ownership exist based on the area of forest managed using an agroforestry system in a region, such as Rembang Regency, which has a higher agroforestry land area than Blora Regency. The government strives to improve the welfare of communities around the forest by giving them access to managed land in the forest. This is expected to increase people's income and standard of living.

***C. Corn Agroforestry Planting Patterns***

The majority of the forms of agroforestry in the Rembang and Blora Regencies are the agrisilviculture agroforestry system, namely land management, which combines corn and forestry crops on the same plot of land simultaneously. The planting technique for corn farming using agroforestry is a rectangle with a plant spacing of 10 m x 7 m so that corn can be planted in the middle, with a planting distance of 0.25 m x 1 m. The aim is to increase biodiversity in dealing with pests and diseases, reduce risks, and utilize organic waste to create a sustainable balance of energy cycles (especially nutrients) and for the benefit of soil and water conservation.

Woody and annual plant components in the agroforestry system also create competition for resources above and within. One approach to understanding the dynamics of resources both above ground and below ground is the response of annual plants in capturing and utilizing resources, expressed in yearly plants' growth. The dynamics are based on a zoning system in the agroforestry system, which divides the planting area into two parts based on proximity to trees as boundary plants to determine resource trends.


**Figure 3.** Differences in Agroforestry Planting Patterns with the annual teak plant (*Tectona grandis*) and the annual corn plant (*Zea mays*) between Rembang and Blora Regencies

**Note:A.** Agrosilviculture pattern (combination of annual teak plants with annual corn crops) in Blora Regency; **B.** Agrosilvicultural patterns in Blora Regency; **C.** Regular planting distance between annual crops and annual crops carried out by women farmers in Rembang Regency; **D.** Irregular planting distances between annual plants under stands carried out by female farmers in Gandu Regency

**Source:** Researcher's Personal Documentation

The planting pattern in the agroforestry system alternates the main crop with intercropping. The planting period on agroforestry land is five years, divided into two years of land clearing and three years of planting. In the first year of land clearing, the primary plants that are ready to be cut will be

marked and then treated to kill the plants before they are cut down. Main crops such as Jati Plus Perhutani (JPP) are generally cut down after 10-15 years old.Budiadi et al. (2023) state that harvesting JPP trees should be done when the trees are over ten years old, considering the limited basic properties of the wood compared to conventional teak.

Furthermore, in the second year of land clearing, the dead trees will be cut down, and the land will be cleaned to be ready to plant intercrops. In the third year, the planting of alternate crops begins and is followed by the planting of new seeds for the main crop. Planting of alternate crops is carried out until the fifth year before the agroforestry stops planting with alternate crops because the main crop has grown, so the productivity of the alternate crops has decreased.

PerumPerhutani issued a standard operating procedure (SOP) for alternating planting between main crops and alternate crops in agroforestry systems, one of which is setting plant spacing. Based on Figure 3. in figures A and C, farmers from Rembang Regency plant corn by arranging the planting distance according to predetermined rules to look neat. Setting the planting distance between corn plants and between corn plants and teak trees aims to provide suitable growing space without experiencing a lot of competition for water, nutrients, and sunlight. So, it is hoped that the production and productivity of corn and teak trees can be maximized.

In contrast to figures B and D in figure 3, farmers from Blora Regency plant corn without paying attention to plant spacing, which looks sloppy. Farmers think spreading corn seeds as much as possible will increase production and productivity. According to (Kantikowati et al., 2022), plantingdistance and number of seeds per planting hole can influence the production and productivity of corn plants. Plant density greatly influences crop yield or production. Thus, an agroforestry system is developed appropriately by prioritizing the principles of sustainable forests and protecting the ecosystem.

### *D. Economic Perspective of Corn Agroforestry on Farmer Income*

In international trade, corn entrepreneurs cannot be separated from government intervention through policies, such as subsidies, taxes, and changes in the rupiah exchange rate. The impact of government policies often causes differences in input and output prices from corn agroforestry farming, affecting farmers' financial and economic calculations. An agricultural business analysis was carried out to determine the competitiveness of corn agroforestry commodity entrepreneurs in Central Java Province.

The land processing system using agroforestry can contribute to farmers' income. The plant commodities cultivated on agroforestry land are food crops, vegetables, and secondary crops, which are daily basic needs. The production results from the commodities grown also include food, which is always needed on the market, so selling prices tend to be stable or adjust to market conditions. The production results from agroforestry certainly affect farmers' income based on the types of commodities grown. According to(Soputan et al., 2021), a farmer's income level depends on production, selling price, and production costs incurred during production. Agroforestry income is the net income from production process activities within a certain period. Farming income (income) is gross receipts (revenue) minus costs or with the formula: $I = R – C$(Yusuf &Qomariyah, 2021).

Farmers in Blora Regency and Rembang Regency manage agroforestry land with corn as a commodity. Farming with corn as a commodity is carried out for three growing seasons. The selling price of corn produced by farmers in Tegaldowo Village, Rembang Regency, is consistently stable during the three planting periods, namely IDR3,500 per kilogram. In contrast to Gandu Village, Blora Regency, the selling price of corn during the three planting periods does not tend to be stable; namely, during the first planting period, the price is IDR3,500 per kilogram, two planting periods for IDR3,500 per kilogram, and the third planting period costs IDR 2,800 per kilogram. The selling value of corn at each planting period influences farmers' income. The selling price and the cultivated land area related to the production amount can also affect farmers' income. Also, differences in sales locations easily accessible to middlemen affect the selling price.

The farmer's income for three planting periods can be added to determine yearly income. The total annual income of respondents from Gandu Village, Blora Regency, is IDR 759,730,000, while from Tegaldowo Village, Rembang Regency, it was IDR 1,361,550,000. This income can be calculated again into total net income per year by subtracting the total income per year from the total cost. The total cost respondents use in Gandu Village, Blora Regency, is IDR 276,542,000, so the annual net income is IDR 483,188,000. In contrast, the total yearly cost for respondents from Tegaldowo Village, Rembang Regency, is IDR 471,925,000, so the net annual income is IDR 889,625,000.

Based on the income received by farmers, the percentage of profit from corn agroforestry from each region can be determined. The profit percentage is found by calculating the net income and receipts from farmers in Blora and Rembang Regencies, then dividing and multiplying by 100%. The average revenue in Gandu Village, Blora Regency, is IDR 14,610,192 with an average net income of IDR 9,292,076, then divided between net income and receipts and multiplied by 100% to get a profit percentage of 63.5%. In Tegaldowo Village, Blora Regency, it is known that the average income is IDR 36,798,648, with an average net income of IDR. 24,043,918, then divided between net income and receipts and multiplied by 100% to get a profit percentage of 65.3%. The two regions have different profit percentages, namely Tegaldowo Village, Rembang Regency, which has a higher presentation rate than Gandu Village, Blora Regency. By implementing a cropping system in the form of intercropping, corn agroforestry can increase the percentage of agroforestry profits in these two regions. According to (Nugraheni&Tinaprilla, 2022), using this intercropping system can benefit farmers in several aspects, such as managing the risk of falling commodity prices to anticipate a decrease in income due to other commodities.

**Table 1.** Comparison of Average Corn (*Zea mays*) Agroforestry Income by Female Forest Farmers in Blora Regency and Rembang Regency, Central Java Province

| No | Village Pangkuan Forest Area (Agroforestry Land) | Average Revenue per year (IDR/year) | Average Net Income per year (IDR/year) | Corn Agroforestry Profit Percentage |
|---|---|---|---|---|
| . | Gandu Village, Blora Regency | IDR 14,610,192 | IDR 9,292,076 | 63.5% |
| . | Tegaldowo Village, Rembang Regency | IDR 36,798,648 | IDR 24,043,918 | 65.3% |

**Source:** Researcher Data Analysis

R/C Ratio (Revenue Cost Ratio) is a ratio calculation to determine the feasibility of a farming business; if the farming experience makes a profit and there is a loss, then it is worth returning. The feasibility of farming can be determined by the R/C Ratio value > 1. According to(Zakiatulyaqin et al., 2017), the calculation of the Revenue Cost Ratio is the ratio between business revenues and business expenses. The R/C ratio value can be calculated by dividing the annual income by the total annual costs, so it can be seen that the R/C ratio for farming in Gandu Village, Blora Regency, is 2.74. Tegaldowo Village, Rembang Regency is 2.88, which means the R/C value The C ratio for the two villages is more than 1, so the corn farming carried out is worth continuing.

**Table 2.** Comparison of R/C Ratio (Renevue Cost Ratio) of Corn (*Zea mays*) Agroforestry by Women forest farmers in Blora Regency and Rembang Regency, Central Java Province

| No | Village Pangkuan Forest Area (Agroforestry Land) | Acceptance Average | Average Total Cost | R/C *Ratio* |
|---|---|---|---|---|
| | Gandu Village, Blora Regency | IDR 14,610,192 | IDR5,318,115 | 2.74 |
| | Tegaldowo Village, Rembang Regency | IDR36,798,648 | IDR12,754,729 | 2.88 |

**Source:** Researcher Data Analysis

The adoption of the agroforestry system as a type of land use will generally be decided by individual women farmers based on estimated economic benefits. Thus, the agroforestry system and further development must be explicitly designed based on regional conditions, considering local land use. Therefore, there needs to be seriousness in implementing agroforestry development so that environmental sustainability can be achieved and also to be able to accommodate the interests of meeting economic needs and conservation of natural resources and the environment, which are equally crucial so that the concept of " Sustainable Forests and Prosperous Communities" can be realized in the sense which is actually as in the idea in Figure 4.

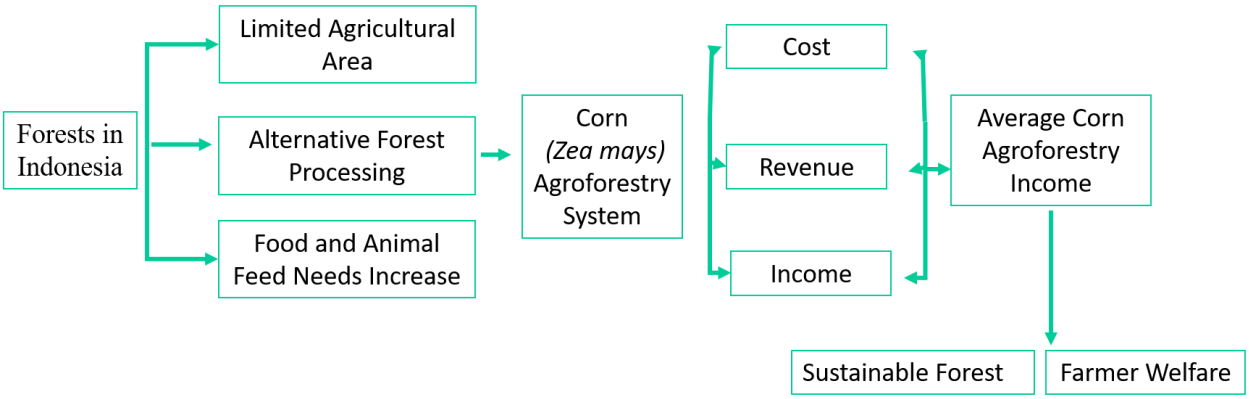


**Figure 4.**The concept of corn agroforestry in Indonesia for farmer welfare and forest sustainability

**Note:** Background to the development of corn agroforestry and the impact of agroforestry on the economy and ecology

**Source:**Researcher Data Analysis

Forest management by the community through agroforestry has become an agricultural activity. It has become a culture for the communities around the forest, where the community uses forests belonging to PerumPerhutani or the state as arable land to meet their living needs. Planting is carried out in empty spaces between trees so that the trees are preserved so farmers do not cut them carelessly. The plants planted using this agroforestry system are plants that do not require a lot of water, including corn. Agroforestry has become a cultural tradition that has taken root in communities around forests in Central Java.

## Conclusions

The economic aspect of the agroforestry system is the most critical factor in land users' adoption of the system, in this case, women farmers. Farmers in Rembang Regency and Blora Regency are developing agroforestry with types of plants and agro silviculture planting patterns with annual plants, namely teak (*Tectona grandis*) and annual plants, namely corn (*Zea mays*), which they consider good as an alternative for their meetings daily needs. The calculation results found that the average cost of corn agroforestry by female farmers in Rembang Regency was IDR 12,754,729, and revenue was IDR 36,798,648. Meanwhile, the average cost of corn agroforestry by female farmers in Blora Regency is IDR 5,318,115, and revenue is IDR 14,610,192. From the results, the R/C ratio for Rembang Regency was 2.88, while for Blora Regency, it was 2.74. This means that farming is profitable and worthy of cultivation. There needs to be seriousness in implementing agroforestry development so that environmental sustainability can be achieved and also to be able to accommodate the interests of meeting economic needs and conservation of natural resources and the environment, which are equally

crucial so that the concept of "Sustainable Forests and Prosperous Communities" can be realized in its true sense.

**Acknowledgments**
The author would like to thank the Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia and the Indonesia Environment Fund for financial support. The author also expressed his gratitude to all parties involved in this research: supervisors, the Public Forestry Company of the Republic of Indonesia, and all research respondents.

**Conflict of Interests**
None.

**References**
[1] Ahmad, S., Xu, H., & Ekanayake, E. M. B. P. (2023). Socioeconomic Determinants and Perceptions of Smallholder Farmers towards Agroforestry Adoption in Northern Irrigated Plain, Pakistan. *Land*, *12*(4). https://doi.org/10.3390/land12040813
[2] Ahmaliun, L. De, Arafah, N., Bana, S., Hasani, U. O., Arniawati, Gandri, L., Kabe, A., Fitriani, D., & Nur, H. (2022). Peran Perempuan DalamAplikasiSistemAgroforestri Di KelurahanLalodatiKecamatanPuuwatu Kota Kendari (The Role of Women In Agroforestry System Application In Lalodati Village Puuwatu District Kendari City). *JurnalKehutanan Indonesia*, *3*(2), 181–190. http://ojs.uho.ac.id/index.php/CELEBICA
[3] Alfatikha, M., Herwanti, S., Febryano, I. G., &Yuwono, S. B. (2020). IdentifikasiJenisTanamanAgroforestriUntukMendukungKetahananPanganRumahTangga Di DesaPulauPahawang Identification of Plants Species In Agroforestry To Support Household Food Security In Pahawang Island. *Goronatlo Journal of Forestry Research*, *3*(2), 55–63.
[4] Amare, D., &Darr, D. (2023). Farmers' Intentions Toward Sustained Agroforestry Adoption: An Application of the Theory of Planned Behavior. *Journal of Sustainable Forestry*, *42*(9), 869–886.
[5] Amin, N. F., Garancang, S., &Abunawas, K. (2023). KonsepUmumPopulasi Dan SampelDalamPenelitian. *Jurnal Pilar: Jurnal Kajian Islam Kontemporer*, *14*(1), 15–31.
[6] Budiadi, Wiyono, Lestari, L. D., Sofiyulloh, M., & Suyanto. (2023). *Tumpangsari Dan Hutan RakyatDinamikaBudidaya Kayu Dan PanganPetaniJawa*,*2* World Agroforestry (ICRAF).
[7] Buyinza, J., Nuberg, I. K., Muthuri, C. W., & Denton, M. D. (2020). Assessing smallholder farmers' motivation to adopt agroforestry using a multi-group structural equation modeling approach. *Agroforestry Systems*, *94*(6), 2199–2211. https://doi.org/10.1007/s10457-020-00541-2
[8] Cahyono, E. D., Fairuzzana, S., Willianto, D., Pradesti, E., McNamara, N. P., Rowe, R. L., & van Noordwijk, M. (2020). Agroforestry innovation through planned farmer behavior: Trimming in pine–coffee systems. *Land*, *9*(10), 1–20. https://doi.org/10.3390/land9100363
[9] Desmiwati, D., Veriasa, T. O., Aminah, A., Safitri, A. D., Hendarto, K. A., Wisudayati, T. A., Royani, H., Dewi, K. H., Raharjo, S. N. I., & Sari, D. R. (2021). Contribution of agroforestry systems to farmer income in state forest areas: A case study of Parungpanjang, Indonesia. *Forest and Society*, *5*(1), 109–119. https://doi.org/10.24259/fs.v5i1.11223
[10] Do, H., Luedeling, E., & Whitney, C. (2020). Decision analysis of agroforestry options reveals adoption risks for resource-poor farmers. *Agronomy for Sustainable Development*, *40*(3). https://doi.org/10.1007/s13593-020-00624-5
[11] Elevitch, C. R., Mazaroli, N. D., &Ragone, D. (2018). Agroforestry standards for regenerative agriculture. In *Sustainability (Switzerland)* (Vol. 10, Issue 9). MDPI. https://doi.org/10.3390/su10093337

[12] Gebreegziabher, Z., Mekonnen, A., Kassie, M., &Köhlin, G. (2020). Household Tree Planting in Tigrai, Northern Ethiopia: Tree Species, Purposes, and Tenure Security. *Land Use Policy*, *96*. https://doi.org/10.1016/j.landusepol.2020.104635

[13] Gebremedhin, B., Tadesse, T., Hadera, A., Tesfay, G., &Rannestad, M. M. (2023). Risk preferences, adoption, and welfare impacts of multiple agroforestry practices. *Forest Policy and Economics*, *156*. https://doi.org/10.1016/j.forpol.2023.103069

[14] Gori Maia, A., Eusebio, G. dos S., Fasiaben, M. do C. R., Moraes, A. S., Assad, E. D., &Pugliero, V. S. (2021). The economic impacts of the diffusion of agroforestry in Brazil. *Land Use Policy*, *108*. https://doi.org/10.1016/j.landusepol.2021.105489

[15] Hadera, A., & Tadesse, T. (2023). Risk and ambiguity aversion: Incentives or disincentives for adoption of improved agricultural land management practices? *Agricultural Economics*, *54*(6), 867–883. https://doi.org/10.1111/agec.12788

[16] Helida, A., Hidayat, Y., Ardiansyah, D., &Syachroni, S. H. (2023). PengaruhSistemAgroforestriTerhadapPendapatan Masyarakat Desa Tanjung BeringinThe Influence Of The Agroforestry System On The Income Of The Tanjung Beringin Village Community. *SYLVA: JurnalPenelitianIlmu-IlmuKehutanan*, 40–46.

[17] Helida, A., Hidayat, Y., Soleha, O. S., &Syachroni, S. H. (2021). Income Analysis OfAgroforestry Systems In Iuphhk-Hti Pt. Sumatera Alam Anugerah, Muara Enim District, South Sumatera Province. *SYLVA: JurnalPenelitianIlmu-IlmuKehutanan*, 9–14. https://doi.org/10.32502/sylva.v10i2.4206

[18] Hemel, S. A. K., Hasan, M. K., Akter, R., Roshni, N. A., Sayem, A., Rasul, S., & Islam, M. T. (2024). Delving into Piper chaba- based agroforestry system in northern Bangladesh: ecosystem services, environmental benefits, and potential conservation initiatives. *Trees, Forests and People*, *16*. https://doi.org/10.1016/j.tfp.2024.100523

[19] Idris, A. I. (2019). Pola Dan Motivasi Agroforestry Serta KontribusinyaTerhadapPendapatanPetaniHutan Rakyat Di KabupatenPolewali Mandar. *JurnalHutan Dan Masyarakat*, *11*(2), 92. https://doi.org/10.24259/jhm.v11i2.8177

[20] Kantikowati, E., Karya, &Khotimah, I. H. (2022). Pertumbuhan Dan Hasil Jagung Manis (*Zea Mays*Saccharata Sturt) Varietas Paragon AkibatPerlakuan Jarak Tanam Dan JumlahBenih. *JurnalIlmiahPertanianAgroTatanen*, *4*(2), 1–10.

[21] Karmila, Nonci, H., &Anggraini, D. (2023). Peran Perempuan DalamPengelolaanHutan Adat Di DesaLedanKecamatan Buntu Batu KabupatenEnrekang. *Macora*, *2*(1), 42–52.

[22] Khalifatullah, D., Deliana, Y., & Setiawan, I. (2022). AnalisisKelayakan Usaha Pada Usahatani Kopi Arabika Di Kelompok Tani Hutan Giri Senang Dan Kelompok Tani Sunda Buhun Business Feasibility Analysis Of Arabica Coffee From The Giri Senang Forest Farmer Group And Sunda Buhun Farming Group. *JurnalPemikiran Masyarakat IlmiahBerwawasanAgribisnis*, *8*(2), 725–741. http://disbun.jabarprov.go.id

[23] Lispiani, B. M., Markum, &Hidayati, E. (2022). Peran Perempuan DalamPengelolaanHutan Pada Kelompok Tani HutanPuncakSemaringDesaMekar Sari Kabupaten Lombok Timur The Role Of Women In Forest Management At The SemaringPuncak Forest Farmer Group Mekar Sari Village, East Lombok Regency. *Prosiding Seminar Nasional MahasiswaKehutanan Indonesia E*, *1*(1), 139–147.

[24] Mando, L. O. A. S., Kandari, A. M., &Ardin. (2020). PenerapanFungsiPengelolaanHutan Di Kawasan Taman Hutan Raya Nipa-Nipa (Implementation Of Forest Management Functions In The Nipa-Nipa Park Area). *JurnalKehut Anan Indonesia*, *1*(2), 85–99.

[25] Marpaung, S. S. M., Yunasfi, &Basyuni, M. (2022). PengelolaanHutan Mangrove BerbasisSilvofishery di KecamatanPercut Sei Tuan, Kabupaten Deli Serdang. *Jurnal Pendidikan Tambusai*, *6*(2), 8949–8960.

[26] Mukhlis, I., SyamsuRizaludin, M., &Hidayah, I. (2022). Understanding Socio-Economic and Environmental Impacts of Agroforestry on Rural Communities. *Forests*, *13*(4). https://doi.org/10.3390/f13040556

[27] Nagar, B., Rawat, S., Pandey, R., & Kumar, M. (2021). Variation in specific gravity and carbon proportion of agroforestry tree species of Himalaya. *Environmental Challenges*, *4*. https://doi.org/10.1016/j.envc.2021.100156

[28] Nhem, S., & Lee, Y. J. (2019). Women's participation and the gender perspective in sustainable forestry in Cambodia: local perceptions and the context of forestry research. *Forest Science and Technology*, *15*(3), 93–110. https://doi.org/10.1080/21580103.2019.1595174

[29] Ntawuruhunga, D., Ngowi, E. E., Mangi, H. O., Salanga, R. J., &Shikuku, K. M. (2023). Climate-smart agroforestry systems and practices: A systematic review of what works, what doesn't work, and why. In *Forest Policy and Economics* (Vol. 150). Elsevier B.V. https://doi.org/10.1016/j.forpol.2023.102937

[30] Octavia, A., Gunardi, D. W., Iswandaru, D., & Setiawan, A. (2023). PotensiAgroforestriUntukMendukungBioprospekting (The Potential of Agroforestry To Support Bioprospecting). *JurnalHutan Lestari*, *11*(4), 1068–1079.

[31] Prabawani, B., Hadi, S. P., Fisher, M. R., Warsono, H., Dewi, R. S., &Ainuddin, I. (2024). Socioeconomic perspective of agroforestry development in Central Java. *Environmental and Sustainability Indicators*, *22*. https://doi.org/10.1016/j.indic.2024.100354

[32] Prayitno, G., Dinanti, D., Hidayana, I. I., &Nugraha, A. T. (2021). Place attachment and agricultural land conversion for sustainable agriculture in Indonesia. *Heliyon*, *7*(7). https://doi.org/10.1016/j.heliyon.2021.e07546

[33] Prins, K., Köhl, M., &Linser, S. (2023). Is the concept of sustainable forest management still fit for purpose? *Forest Policy and Economics*, *157*. https://doi.org/10.1016/j.forpol.2023.103072

[34] Rahayu, S. (2019). KetahananPanganBerbasisPemberdayaanPetaniJagung Skala Kecil Di Sekitar Kawasan Hutan. *Jurnal Ekonomi Pembangunan*, *11*(1).

[35] Rojun, M., &Nadziroh, N. (2020). Peran Sektor PertanianDalamPertumbuhan Ekonomi Di KabupatenMagetanThe Role Of The Agricultural Sector In Economic Growth In MagetanDistric. In *Jurnal AGRISTAN*, *2*(1).

[36] Safitri, F. D., Pambudi, M. D., & Haris, A. (2023). PeningkatanKesejahteraanPetanimelalui Program AgroforestriSengon, Jagung dan Kopi di DesaGunungsari, KabupatenKebumen. *Jurnal Dharma Indonesia*, *1*(2), 44–51.

[37] Sahara, D., Kurniyati, E., Oelviani, R., &Jauhari, S. (2020). Kajian KelayakanTeknologiUsahataniJagung di Kabupaten Kendal, Jawa Tengah Feasibility Study of Maize Farm Technology in Kendal District, Central Java. *Pangan*, *29*(2), 105–116.

[38] Saragih, D. Y., Natalia, H., Pradityo, P. S., & Astuti, M. (2023). *PemanfaatanJagungLokal Oleh IndustriPakanTahun 2022* (Vol. 4). DirektoratPakanDirektoratJenderalPeternakan Dan Kesehatan Hewan Kementerian PertanianRI.

[39] Saufi, & Saleh, M. (2021). AnalisisKarakteristik Masyarakat AgroforestriTanamanSengon di HutanProduksi Wilayah KPH Cantung. *JIEP: JurnalIlmu Ekonomi Dan Pembangunan*, *4*(2), 476–485.

[40] Sidharta, V., Tambunan, R. M., Azwar, &Ghaniyyu, A. (2021). SuatuKajian : Pembangunan Pertanian Indonesia. *KAIS Kajian IlmuSosial*, *2*(2), 229–232.

[41] Soputan, N. S., Talumingan, C., &Kapantow, G. H. M. (2021). KontribusiPendapatanUsahatani Padi Sawah TerhadapPendapatanKeluargaPetani Di DesaRasiKecamatanRatahan. *AGRIRUD*, *2*(4), 293–300.

[42] Soraya, E. (2019). Seberapa Luas Hutan Yang Kita Perlukan? *JurnalIlmuKehutanan*, *13*, 4–14. https://jurnal.ugm.ac.id/jikfkt

[43] Nugraheni, S. S., &Tinaprilla, N. (2022). AnalisisPendapatanUsahataniTumpang Sari Kentang Di KecamatanPangalenganKabupaten Bandung. *RisalahKebijakanPertanian Dan Lingkungan*, *9*(2), 123–132.

[44] Tafere, S. M., &Nigussie, Z. A. (2018). The adoption of introduced agroforestry innovations: determinants of a high adoption rate – a case study from Ethiopia. *Forests, Trees and Livelihoods*, *27*(3), 175–194. https://doi.org/10.1080/14728028.2018.1493954

[45] Utami, T., Santoso, B., Nurhaeni, I. D. A., Setyono, P., &Suntoro. (2019). Program KonservasiHutan Dan LahanBerperspektif Gender Dalam Upaya AntisipasiBencanaBanjir Dan Longsor Di Segorogunung, Karanganyar, Jawa Tengah, Indonesia. *Talenta Conference Series: Local Wisdom, Social, and Arts (LWSA)*, *2*(1), 1–8. https://doi.org/10.32734/lwsa.v2i1.639

[46] Wibowo, L. T., &Estiningrum, S. D. (2021). Peran Kelompok Tani Bumi Lestari KedoyoDalamMeningkatkanKesejahteraan Peta. *Proceeding the 5th Annual International Conference on Islamic Education*, 102–116.

[47] Wijewardena, N., Samaratunge, R., Kumara, A. S., & Newman, A. (2023). With the help of the family! Using Sri Lankan informal sector women entrepreneurs' family resources to develop their creative self-efficacy. *Women's Studies International Forum*, *98*.

[48] Yamamoto, Y., & Matsumoto, K. (2022). The effect of forest certification on conservation and sustainable forest management. *Journal of Cleaner Production*, *363*. https://doi.org/10.1016/j.jclepro.2022.132374

[49] Yusuf, D. N., &Qomariyah, S. N. (2021). Kelayakan Usaha UmkmDenganPendekatanFinansial. *Sigmagri*,*1*(2), 112–120.

[50] Zakiatulyaqin, Suswanto, I., Lestari, R., Setiawan, D., & Munir, A. M. S. (2017). Income Over Feed Cost Dan R-C Ratio Usaha TernakSapiMelaluiPemanfaatanLimbahKelapaSawit(Income Over Feed Cost And R-C Ratio of Fattening Cattle Through the by Product Of Palm Oil Feed Utilization). *JurnalIlmiahPeternakanTerpadu*, *5*(1), 18–22.