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Income optimization of rice paddy farmers in the narrow fields during the covid-19 pandemic in South Sumatra province

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ABSTRACT

This study aims to analyze the amount of income through business diversification as well as scenarios for increasing income in business diversification during the Covid-19 pandemic. The research method used is the survey method, the sampling method used is a snowball and the number of respondents is determined by purposive sampling with 100 respondents. The study results show that the amount of optimization of the income of lowland rice farmers during the Covid-19 pandemic at a business diversification of 1 Rp. 29,130,500.00, business diversification 2 Rp. 19,007,006.29, business diversification 3 Rp. 8,301,257.48, business diversification 4 Rp. 14,877,500.00. The amount of farmer's income after the scenarios for business diversification 1 is carried out with additional capital of Rp. 1,870,000 so that the optimal allocation result will be an increase in income of Rp. 2,871,644.88 or 9.86%. Business diversification 2 is carried out with additional capital of Rp. 750,000 and a reduction of the workforce by 5 JOK so that the optimal allocation result will be an increase in income of Rp. 1,472,001.57 or 7.74%. Business diversification 3, it is carried out with additional capital of Rp. 370,000 and the addition of 4 JOK workers so that the optimal allocation result will be an increase in income of Rp. 978,173.65 or 11.78%. Business diversification 4 is carried out by increasing the land area by 0.25 so that it becomes 1 hectare and increasing capital by Rp. 500,000 so that the optimal allocation of income increases by Rp. 733,061.37 or 4.93.

Keywords: diversification, optimization, paddy, income, Covid-19

INTRODUCTION

Indonesia is also located in a tropical area with a climate suitable for extensive agricultural business so that Indonesia is an agricultural country [1]. The production of agricultural products for the provision of food, feed, industrial raw materials, and exports, as well as its role in the formation of GDP, employment, and sources of public income, make up the agricultural sector in Indonesia one of those that significantly contribute to the country's development [2]. Agriculture is one of the agribusiness industries that is regarded as an economic activity [3]. Agriculture is a process of producing food, livestock and agro-industrial products. Subsistence farming, who farms a small area with limited resource inputs, and produces only enough food to meet the needs of his/her family. Indonesia is a country with a fairly high vulnerability. One of the reasons is that the agricultural sector is a sector that is quite large in influencing this vulnerability [4].

East OKU Regency is the main central rice area in South Sumatra Province and is a national food barn supported by technical irrigation. One of the agricultural enterprises that demands advanced growing methods is the rice field system. The area of rice paddy fields in 2019 was 638,198.79 ha with a production of 575,340.17 GKG and productivity of 62.24 %, the highest in South Sumatra Province. Meanwhile, East Buaymadang District is an area of East OKU Regency with the highest contributor to rice production, considering that this area has a very good area of irrigated rice fields. Rice farm is a source of livelihood and food security for a large proportion

of rural families. The domestic policies of the Indonesian governments have sought to achieve self-sufficiency in rice because they recognize the significance of rice in ensuring both household and global food security as well as its relevance as a key source of income for small-scale subsistence farmers [5].

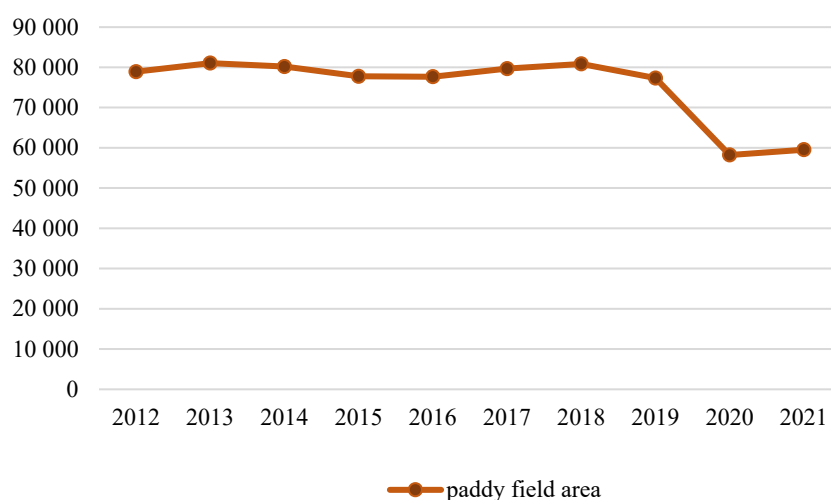


Figure 1 Development of changes in the area of paddy fields in East OKU Regency.

But on the other hand, the research results [6] show that tropical agriculture is an area that experiences a lot of fragmentation of paddy fields so that the existing land is narrow lands with an average of fewer than 0.5 hectares. Land is the main asset of farming, which tends to be narrower, affecting the production system and decreasing farm income. Consequently, we require a farming system that uses polyculture farming to maximize land use. Residential construction has supplanted agriculture [7].

Urban regions' growing populations impact the requirement for housing. So many people exploit agricultural land and forests for houses and shelter to meet these needs. Construction of homes has been done on agricultural land [8]. Due to changes in regional spatial planning, population growth, and other factors, land factor, which has historically been the primary asset of farming, tends to drop over time. Indonesia's predominant farming system features are small farmers with a limited land ownership level [9]. Farmers in rural areas with small plots of land simultaneously put various plants there [10].

The data in the field shows that small land farmers continue to make changes to the sengon farming business because the land around them has been planted with sengon so when farmers persist in sugarcane farming. This change continues to be made because their sugar cane will die and not get results, so they follow the change to sengon. When small land farmers switch to sengon farming, it is hoped that they will get better results with their narrow land. Small land farmers will continue to follow changes in sengon farming carried out by large land farmers because it is considered that the shift in sengon farming will be more profitable than staying in sugar cane farming which experiences price fluctuations every year and experiences the risk of loss. The informant's statement supports this statement: "My land is only narrow, if there is no one track sugar cane, the result is at least 10 bunches with a yield of less than 1.5 million, the maintenance costs have not been deducted, fortunately sengon is 4 years and it can be 15 million [11].

Even though East OKU Regency is the capital city of South Sumatra, land fragmentation has occurred, with only 0.38 ha of available land per farmer. Rice farmers carry out their farming twice a year (IP 200), but the results obtained are still insufficient to meet the needs of the farmers. The implication of this shrinking land has an impact on decreasing the income of rice farmers so that farmers diversify their businesses to increase farmers income. [12] stated that based on research and discussion, the social capital of small land farmers is fulfilling household livelihoods. Small land farmers take advantage of their social capital. With this social capital, smallholder rice farmers are can other income alternatives outside of farming activities, thereby reducing the difficulty of living to fulfill household livelihoods. Rice farmers in Kolomayan Village carry out various income alternatives to fulfill household income by utilizing their social capital, such as raising livestock, taking debt, and working together on agricultural land. The capacity of farmers is influenced by the ability of agribusiness planning [13].

In addition, the global condition is the COVID-19 pandemic, resulting in an economic crisis [14], [15]. This pandemic does affect not only the health and education sectors but also the socioeconomic conditions of society. The COVID-19 pandemic also disrupted economic activity in all lines of business, including the agricultural

sector. One of the impacts that must be anticipated regarding the impact is food availability for all people [16]. The COVID-19 pandemic has triggered problems, especially in agriculture, such as low community productivity and also external problems, namely in the form of market and climate aspects that are difficult for farmers to overcome [17], [18], [19]. Impacts of the COVID-19 epidemic on farming households are significant [20]. It is destroying the agricultural production sector, which is the root of food system [21]. This reduces the welfare of farmers. For this reason, a mature strategic plan is needed to overcome problems and increase farmers' production and selling power [22], [23].

During the Covid-19 pandemic, small-land rice farmers in Buaymadang District, Ogan Komering Ulu Timur Regency, also experienced a significant impact in decreasing income due to restrictions on economic activities. This is in line with the findings [24], who concluded that the Covid-19 pandemic significantly impacted all aspects of human life, including agriculture, due to government policies aimed at economic and non-economic development. As a result, one of the most important strategies is business diversification. Utilizing sustainable farming methods can increase productivity and farmer income [25].

According to [26] strategic efforts that must be made are using machinery and reducing labour wages. This can reduce production costs which are quite large, increase the productivity of land to achieve more perfect land, and reduce losses due to loss of yields at harvest and make cooperation in the sale of production. Considering South Sumatra has an area of 87,421.24 km² and an agricultural area of 1,354,847 ha it is divided into 4 cities and 13 regencies. The agricultural sector is one sector that has a very important role in the economy in South Sumatra, this is because the agricultural sector is a job and a source of income for the community. Agriculture is the heart of the economy and rice remains its lifeblood [27]. According to the Central Statistics Agency [28], one of the business fields that play a role in South Sumatra's GRDP is business from the agricultural sector 16.06 % [29].

Recently, the findings of the [30] study in Nigeria, a developing country such as Indonesia, showed that the Covid-19 pandemic also experienced a surge in petitions and food support, leading to a decrease in the number of people living in poverty. The results of the [31] also showed that the COVID-19 crisis caused a surge in economic activity that had not previously occurred for governments around the world, with certain sectors becoming more vulnerable to pandemics. The plight of small migrant farmers in India has shown fault lines not only in the economic sphere but also in the community. Pandemics have changed the status quo. Based on the description, this study analyzed the optimization of narrow land rice farmers' income through business diversification at the time of the Covid-19 pandemic and scenarios of increasing income in business diversification during the Covid-19 pandemic.

Scientific Hypothesis

The study had two hypothesis:

1. The optimal utilization of agricultural resources such as land, capital, and labour increases income.
2. Farming diversification business is proven to increase farmers' income, and highest income is in the paddy-cucumber business diversification.

MATERIAL AND METHODOLOGY

Study Area

This research was conducted from January to February 2021. The research was conducted in two villages, namely Genuksuran Village and Nambuhan Village. Determination of the research location is done by the purposive method based on certain criteria, namely where farmers are fragmented, and currently, the land they own is narrow.

Data Collection

The research method used is a survey method, in which the data collection instrument is a questionnaire. Survey research involves gathering data from a sample and using it to characterize various facets of a population through questionnaires or interviews [32].

Samples

The sampling method used was the snowball sampling method, and the number of respondents was determined by purposive sampling with a total of 100 respondents.

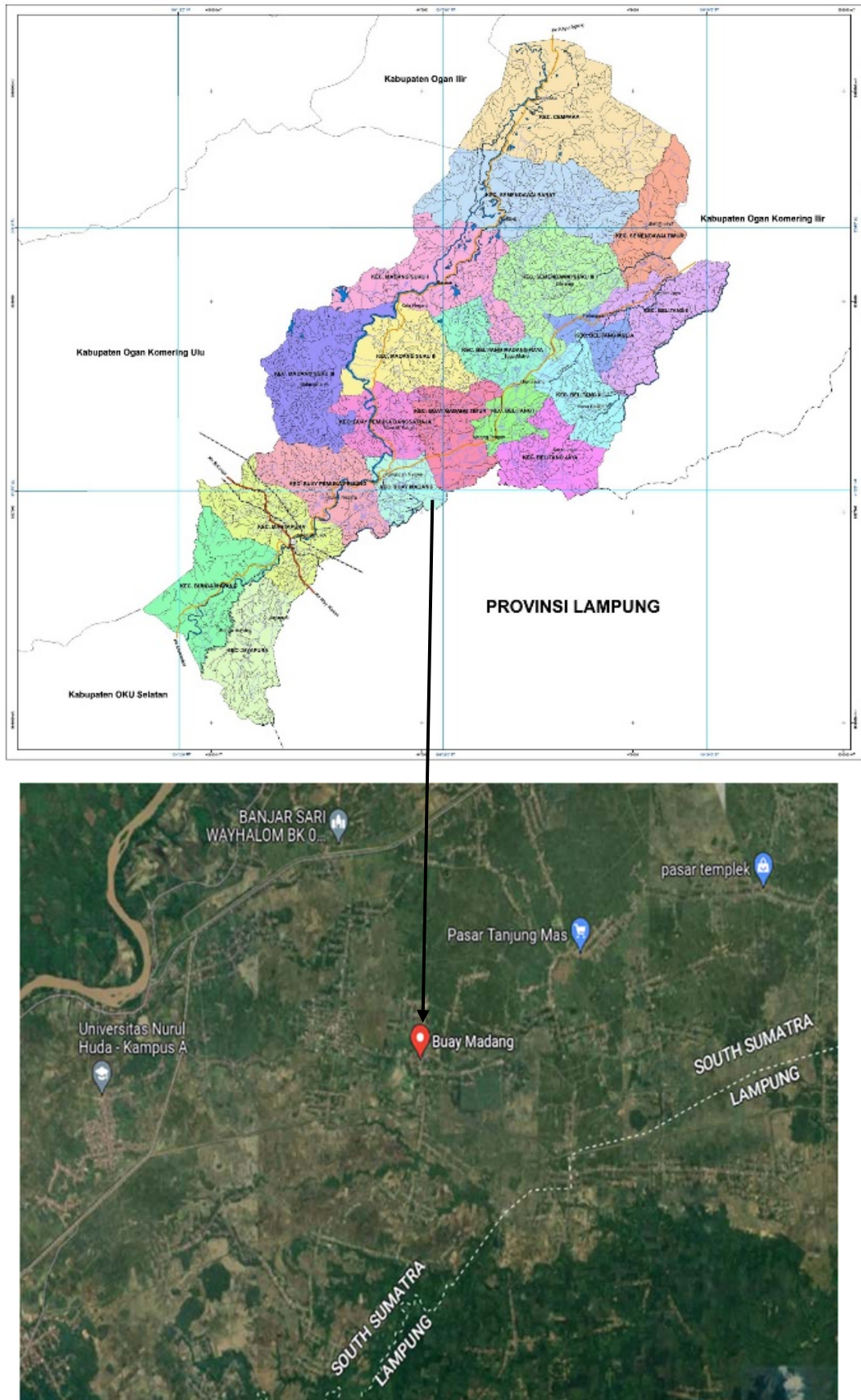


Figure 2 Map of research locations in Buay Madang East OKU District.

Statistical Analysis

The data was collected in the form of primary data and secondary data. The software used for data analysis in the study was the LINDO (Linear Interaktive Discrete Optimizer) software version 6.1. LINDO software was developed by a software development company called LINDO system Inc. in Chicago, Illinois. LINDO is software that can be used to find solutions to linear programming problems. Data processing is done using the following formula:

$$Z = \sum C_j \times X$$

Where:

Z = Purpose function; C_j = Objective function parameters to-j; X_j = Activity level to j n.

$$\text{Maximum } Z = C_1X_1 + C_2X_2 \dots + C_jX_j - \dots + C_nX_n \text{ or } Z = \sum C_j X_j \text{ j=1}$$

With a constraint:

$$\begin{aligned} a_{11}x_1 + a_{12}x_2 + \dots + a_{1j}x_j + \dots + a_{1n}x_n &\leq b_1 \\ a_{21}x_1 + a_{22}x_2 + \dots + a_{2j}x_j + \dots + a_{2n}x_n &\leq b_2 \\ a_{31}x_1 + a_{32}x_2 + \dots + a_{3j}x_j + \dots + a_{3n}x_n &\leq b_3 \\ \dots & \dots \\ a_{m1}x_1 + a_{m2}x_2 + \dots + a_{mj}x_j + \dots + a_{mn}x_n &\leq b_m \text{ or } \sum_{j=1}^n a_{ij} X_j \leq b_i \end{aligned}$$

Where:

i = 1, 2, 3 ... m is the number of limiting factors; j = 1, 2, 3 ... n is the number of production activities; activity is not negative: x_j ≥ 0 for the whole j.

Where:

Z = objective function, which is farm income which is maximized; C = prices of production (C) and prices of inputs (-C); x_j = production and consumption activities carried out by households farmer; a_{ij} =input coefficient of each production and consumption activity; b_j =constraint value or available resource limit.

RESULTS AND DISCUSSION

Optimizing the available resources is very important. Land area, labour and capital, if able to be optimized, can generate optimal income.

Optimal Income: Based on the results of the analysis with Linear Programming through computerization of optimal income, business diversification for each activity is obtained as in Table 1.

Table 1 Optimal income, business diversification for each activity.

Activity	Optimal Income (Rp/th)
Business diversification 1	Z = 29,130,500.00
Business diversification 2	Z = 19,007,006.29
Business diversification 3	Z = 8,301,257.48
Business diversification 4	Z = 14,877,500.00

Note: Sources: Analysis results.

Based on Table 1 It shows that the highest income is in the rice-cucumber business diversification and the lowest is Padi-Kale. If we look further, the income from business diversification that farmers have carried out is a form of farmers' strategy of narrow land in increasing income. Low-land tropical and subtropical agriculture frequently employs many crops as a method of managing land use [33], [34]. The primary benefit of employing a multiple cropping system is that it entails combining crops while making better use of both space and labor [35], [36]. Which is still far from the level of welfare, therefore farmers also still take advantage of their free time outside of farming to look for additional jobs, namely as farm labourers in other places. These results are in line with research [37], showing that small land farmers, due to their fragmentation, still have a lot of free time. Farmers use this free time as farm labourers [38]. This is in accordance with research [39] that the land use will be maximized if you pay attention to the type of plant and performance of farmers. With access to cash and optimal land usage, the land will be more productive and promote food security [40].

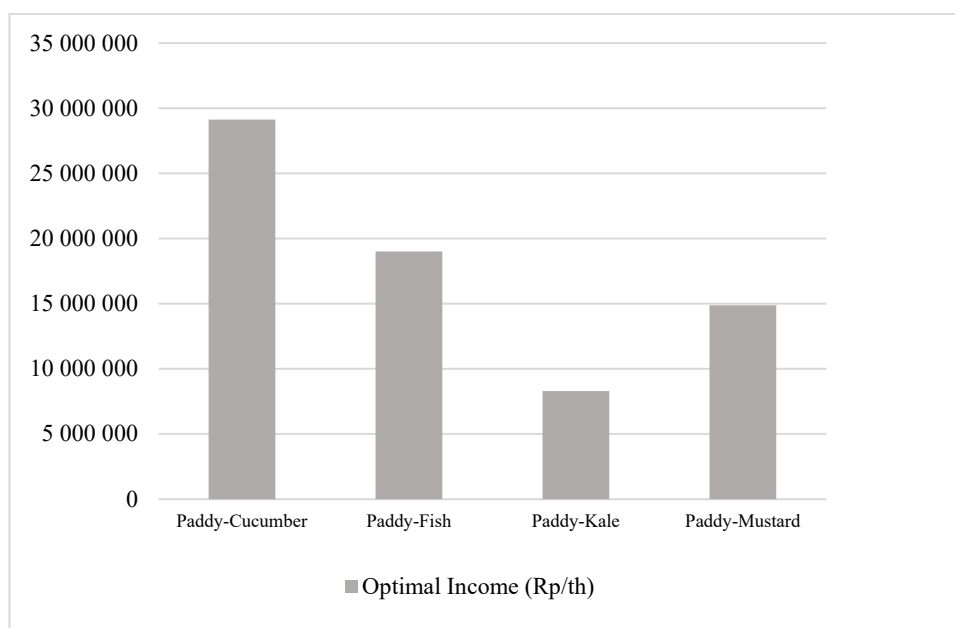


Figure 3 Optimal income based on diversification business variations.

Identification of Linear Programming Model: Business diversification carried out by land farmers during the COVID-19 pandemic in East Buay Madang District consisted of several business diversification activities. A small portion of the rice fields, rice field bunds, the yards of rice fields, or other land that is not planted with rice is taken in order to plant some of these plants [41]. Diversified farms have proven to be more crisis-resistant and able to handle the pandemic than other types of specialized farms [42]. In line with research [43], [44] Agricultural diversification is done by intentionally adding functional biodiversity to cultivation agriculture and multiple cropping can enhance agricultural systems' efficiency and lessen the occasionally negative environmental effects of crop production. Increasing agricultural diversity is a key method being studied to improve agricultural systems' resilience to shocks and variability [45], [46].

Table 2 Business diversification carried out by land farmers during the COVID-19 pandemic.

Nr.	Business Diversification	Description
1.	Paddy-Cucumber	
	$Z = 9,831,500X_1 + 19,299,000X_2$	
	C1 $0.37X_1 + 0.12X_2 \leq 0.50$	Land
	C2 $3,200,000 X_1 + 11,500,000 \leq 14,700,000$	Capital
	C3 $92X_1 + 15X_2 \leq 107$	Labour
2.	Paddy-Fish	
	$Z = 8,746,000X_1 + 10,297,000X_2$	
	C1 $0.25X_1 + 0.12X_2 \leq 0.37$	Land
	C2 $2,500,000 X_1 + 4,250,000 \leq 6,750,000$	Capital
	C3 $90X_1 + 26X_2 \leq 115$	Labour
3.	Pady-Kale	
	$Z = 5,629,500X_1 + 4,415,000X_2$	
	C1 $0.12X_1 + 0.10X_2 \leq 0.22$	Land
	C2 $1,470,000 X_1 + 1,670,000 \leq 3,140,000$	Capital
	C3 $31X_1 + 16X_2 \leq 47$	Labour
4.	Paddy-Mustard	
	$Z = 10,702,000X_1 + 4,175,500X_2$	
	C1 $0.25X_1 + 0.12X_2 \leq 0.37$	Land
	C2 $5,000,000 X_1 + 2,600,000 \leq 7,600,000$	Capital
	C3 $102X_1 + 11X_2 \leq 113$	Labour

Note: Sources: The results of the analysis of the linear equation programming.

To determine the optimum combination of these activities, it is necessary to do calculations using linear programming techniques and computer aids. The purpose of the linear programming arrangement is to maximize the income obtained by farmers by finding the optimum combination of business diversification carried out by farmers in East Buay Madang District. The results of the analysis of the linear equation programming model are present in Table 2.

Optimal Business Pattern: Optimization analysis using linear programming consists of primal-dual analysis and sensitivity analysis. Primal analysis shows a combination of types of businesses that can provide maximum income, and dual analysis assesses resource use by looking at the level of sensitivity to changes made [47].

Primal-Dual Analysis: Based on the results of data processing analysis with LINDO analysis, it shows that of the six types of existing business activities, only four business activities are selected types of business that can maximize profits with limited resources.

Table 3 Selected business activities in optimizing business patterns in Buaymadang.

Activity	Types of crops	Variable	Value	Reduce Cost
Business diversification 1	Paddy	X1a	1.00	0.00
	Cucumber	X2a	1.00	0.00
Business diversification 2	Paddy	X1b	0.98	0.00
	Fish	X2b	1.00	0.00
Business diversification 3	Paddy	X1c	0.00	3,323,307.48
	Kale	X2c	1.88	0.00
Business diversification 4	Paddy	X1d	1.00	0.00
	mustard	X2d	1.00	0.00

Note: Sources: Data analysis with LINDO Programme.

Based on Table 3 the suggested businesses to be cultivated by farmers in East Buaymadang District are in diversification 1, namely rice (X1a) and cucumber (X2a), in business diversification 2, namely rice (X1b) and fish (X2b), in business diversification 3, namely rice (X1c) and Kangkung (X2c), while in business diversification 4, namely Rice (X1d) and Sawi (X2d). Based on Table 2, shows that in business diversification 3 for the type of rice plant, it is a business that is not recommended or selected, this can be proven from the Reduce Cost value of 3,323,307.48, it can be interpreted that the cultivation of rice plants in diversification 3 will reduce the optimal profit obtained by 3,323,307.48.

Table 4 Use of resources for the optimal solution for smallholder farmers in East Buay Madang District.

Activity	Obstacles	Available	Resource used/ fulfilled	Unused/ not fulfilled
Business diversification 1	Land	0.50	0.00	0.34
	Capital	14,700,000	No limit	0.00
	Labour	107	No limit	0.00
Business diversification 2	Land	0.37	No limit	0.00
	Capital	6,750,000	No limit	3,555,555.55
	Labour	115	1.00	73,706
Business diversification 3	Land	0.22	No limit	0.03
	Capital	3,140,000	1.765.625	3,140,000
	Labour	47	No limit	16,916
Business diversification 4	Land	0.75	No limit	0,00
	Capital	7,600,000	No limit	2,060,784.31
	Labour	113	0.00	80,846

Note: Sources: Analysis result.

Meanwhile, for the use of resources (Table 4), some resources are not used up and resources that are used up. Resources that are not used up in business diversification 1 are 0.340 hectares of land or 68 % of the available land area. In business diversification, 2 resources that are not used up are 0.002 hectares of land or 0.89 % of the

available land area, then capital resources of Rp. 3,555,555.55 or 52.67 % of the total available capital and 64.09 JOK labour resources or 0.74 % of the total available working people.

In business diversification 3 some resources are not used up, namely a land area of 0.037 hectares, then capital resources as much as Rp. 3,140,000, and a workforce of 16,916 JOK. In business diversification 4, some resources are not used up, namely capital as much as Rp. 2,060,784.31 and 80,846 JOK manpower resources.

Based on Table 3. for resources that are used up, it shows that if the resource is added by one unit, it will increase the income by the shadow price. In business diversification, 1 resource that is used up is an area of 0.50 hectares, which means that each additional unit of land will increase farmers' income by Rp. 13,113,214.05. Besides that, the resource that is used up is a workforce of 107 JOK, which means that each additional unit of labour will increase farmers' income by Rp. 1,536.

In business diversification, the 2 resources that are used up are 115 JOK, which means that each additional unit of labour will increase farmers' income by Rp. 2,203, in addition to the capital of Rp. 6,750,000 which means that each additional unit of capital will increase the income of Rp. 35,993.70. For business diversification, 3 resources that are used up are capital of 3,140,000, which means that each additional capital of one unit will increase the income by Rp.2,644. Meanwhile, for business diversification, 4 resources that are used up are 113 workers, which means that each additional unit of labour will increase income by Rp. 1,466 besides that, the capital is 7,600,000, which means that each additional capital of one unit will increase the income of Rp. 33,052.80. According to [48] that to optimize income, it is necessary to increase the area and reduce labour costs so that this research is in line with previous research studies. In line with research according to [49], [50] increasing crop productivity per hectare and per labor unit, as well as the efficiency of the agri-food sector at all organizational levels, has been the primary agricultural challenge.

The excess resources, except for land and capital resources in diversification 1, capital and labour resources in diversification 2, capital resources in diversification 3, and capital and labour resources in diversification 4, can be allocated to other uses to contribute to farmers' income. An increase in the stability of farm revenue is correlated with expanding agricultural activity diversity, lowering input intensity, and earning larger rewards from agri-environment programmes [51]. By choosing a variety of crops with low or negative productivity correlations and nutritional importance for the household diet, diversification in agricultural activities lowers the overall production risk [52].

Table 5 Shadow Price Resource use on the optimal allocation of smallholder farmers in East Buaymadang.

Activity	Obstacles	Resource	Slack/ Surplus	Shadow Price
Business diversification 1	C1a	Land (0,5 ha)	0.00	13,113,214.05
	C2a	Capital (Rp/0,5)	0.00	1,536
	C3a	Labour (JOK)	0.00	0.00
Business diversification 2	C1b	Land (0,375 ha)	0.00	0.00
	C2b	Capital (Rp/0,375)	0.00	2,203
	C3b	Labour (JOK)	0.00	35,993.70
Business diversification 3	C1c	Land (0,225 ha)	0.00	0.00
	C2c	Capital (Rp/0,225)	0.00	2,644
	C3c	Labour (JOK)	0.00	0.00
Business diversification 4	C1d	Land (0,5 ha)	0.00	0.00
	C2d	Capital (Rp/0,5)	0.00	1,466
	C3d	Labour (JOK)	0.00	33,052.80

Note: Sources: Analysis result.

Sensitivity Analysis: Sensitivity analysis will provide information about how many changes (increase or decrease) in prices or activity costs are allowed so as not to change optimal results and how many changes (increase or decrease) the number of resources that are still allowed so that optimal results do not change.

Table 6 Sensitivity analysis of the resource objective function on the optimal allocation of land farmer narrow.

Activity	Commodity	Decrease	Present value	Increase
Business diversification 1	Paddy	5,370,156.52	9,831,500	No limit
	Cucumber	No limit	19,299,900	35,331,953.12
Business diversification 2	Paddy	6,057,058.82	8,746,000	No limit
	Ikan	2,526,622.22	102,977,000	14,868,200
Business diversification 3	Paddy	No limit	5,629,500	3,886,257.48
	Kale	639,541.83	4,415,000	No limit
Business diversification 4	Paddy	8,029,807.69	10,702,000	No limit
	mustard	1,154,137.25	4,175,500	5,565,040

Note: Sources: Analysis result.

Based on the results in Table 6, for business diversification 1 to 4 all business diversification can be increased from Rp. 3,886,257.48 until the limit is not determined as well as a decrease in income starting from Rp. 1154,137,255 to an indefinite limit.

Table 7 Sensitivity analysis of the right-hand side of the optimal allocation of smallholder farmers.

Activities	Commodity	Impairment	Present Value	Increase
Business diversification 1	Land	0.16	0.50	0.50
	Capital	14,700,000	14,700,000	No limit
	Labour	107	107	No limit
Business diversification 2	Land	0.37	0.37	No limit
	Capital	3,194,444.44	6,750,000	No limit
	Labour	41.29	115	116
Business diversification 3	Land	0.18	0.22	No limit
	Capital	0.000	3,140,000	4,905,625
	Labour	30.98	47	No limit
Business diversification 4	Land	0.75	0.75	No limit
	Capital	5,539,215.68	7,600,000	No limit
	Labour	32.15	113	113

Note: Sources: Analysis result.

Based on the results in Table 7, the overused resource can be increased to an unspecified extent. In diversification 1 is capital and labour, diversification 2 is land and capital, diversification 3 is land and labour, while diversification 4 is land and capital.

Optimal Business Diversification Scenario: After the data were analyzed primal-dual and sensitivity analysis so that the scenario that had to be done by rice farmers on narrow land with a pattern of farming diversification to obtain an optimal increase in income, in business diversification 1, it was carried out with additional capital of Rp. 1,870,000 so that the optimal allocation of income increases by Rp. 2,871,644.88 or 9.86%. In business diversification 2, the additional capital is Rp. 750,000, and a reduction of the workforce by 5 JOK so that the optimal allocation result will be an increase in income of Rp. 1,472,001.57 or 7.74%. Business diversification 3, it is carried out with additional capital of Rp. 370,000 and the addition of 4 JOK workers so that the optimal allocation result will be an increase in income of Rp. 978,173.65 or 11.78%. Business diversification 4 is done by increasing the land area by 0.25 so that it becomes 1 hectare and increasing capital by Rp. 500,000 so that the optimal allocation result will increase the income by Rp. 733,061.37 or 4.93. In order to increase farmers' revenue and provide for their families, a farming system that can use land as efficiently as possible is required. This relates to the claim made by [53] that, for small and marginal farmers, their farming revenue is essentially insufficient to support their farming family. This is in line with research [54], [55], [56] which says that land optimization can be used as optimally as possible by combining capital and labour input factors so that the income obtained is maximized. Efficiency in the use of inputs is crucial and has a significant impact on the generation of outcomes and profit [57].



Figure 4 Diversification Business Agriculture Paddy-Cucumber.

CONCLUSION

Based on the results of the study, the following conclusions can be drawn:

1. The amount of optimization of the income of lowland rice farmers during the Covid-19 pandemic is:
 - a. For business diversification 1 (Paddy-Cucumber) $Z = 29,130,500$
 - b. For business diversification 2 (Paddy-Fish) $Z = 19,007,006.29$
 - c. For business diversification 3 (Paddy-Kale) $Z = 8,301,257.48$
 - d. For business diversification 4 (Paddy-Mustard) $Z = 14,877,500$
2. The amount of farmers' income after carrying out the scenarios on business diversification, namely:
 - a. In business diversification 1, it is carried out with additional capital of Rp. 1,870,000 so that the optimal allocation result will be an increase in income of Rp. 2,871,644.88 or 9.86%.
 - b. Business diversification 2 is carried out with additional capital of Rp. 750,000 and a reduction of the workforce by 5 JOK so that the optimal allocation result will be an increase in income of Rp. 1,472,001.57 or 7.74%.
 - c. Business diversification 3, it is carried out with additional capital of Rp. 370,000 and the addition of 4 JOK workers so that the optimal allocation result will be an increase in income of Rp. 978,173.65 or 11.78%.
 - d. In business diversification 4, it is carried out by increasing the land area by 0.25 so that it becomes 1 hectare and increasing capital by Rp. 500,000 so that the optimal allocation of income increases by Rp. 733,061.37 or 4.93 In business diversification 2, it is carried out with additional capital of Rp. 750,000 and a reduction of the workforce by 5 JOK so that the optimal allocation result will be an increase in income of Rp. 1,472,001.57 or 7.74%.

The suggestions given based on the results of this study are as follows:

1. Farmers should be more selective in choosing the type of business diversification that will be sought to increase optimal income.
2. The allocation of costs should be improved by reducing excessive costs and shifting to increase the availability of costs that are the main constraint.

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