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The optimation of cow-calf beef cattle and paddy farming integration on farmer household

T. Ekowati*, E. Prasetyo and M. Handayani
Faculty of Animal and Agricultural Sciences, Diponegoro University,
Tembalang Campus, Semarang 50275 - Indonesia
**Corresponding E-mail : tiekowati@yahoo.co.id*

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ABSTRAK

Rumah tangga petani umumnya berusahatani pada sub-sektor pertanian tanaman pangan dan sub-sektor peternakan yang belum dilaksanakan dengan baik, sehingga kondisi optimal usahatani belum dicapai. Penelitian bertujuan untuk menganalisis optimasi integrasi sapi potong dan padi, simulasi perubahan harga input dan penggunaan sumberdaya terhadap model optimal. Metode survey digunakan dalam penelitian di Kabupaten Grobogan, dengan menentukan Kecamatan Wirosari dan Kecamatan Purwodadi. *Quota sampling method* digunakan untuk menentukan jumlah sampel peternak sapi potong induk-anak dan petani padi tanpa menghitung jumlah populasi sebagai *sampling frame*. Jumlah responden setiap kecamatan adalah 40 petani sehingga total responden 80 petani. Data dianalisis dengan linear programming. Hasil penelitian menunjukkan bahwa kondisi optimum skala usaha integrasi sapi potong induk-anak dan padi dicapai pada luas lahan 0,45 ha, pemeliharaan induk sapi potong 2,75 UT dengan maksimum pendapatan Rp 52.112.440/tahun. Hasil simulasi perubahan penggunaan input menunjukkan bahwa penambahan luas lahan 0,25% memberikan peningkatan skala usaha sapi potong 0,018% dan pendapatan 14,78%, Kesimpulan optimasi integrasi sapi potong induk-anak dan padi dicapai pada luas lahan 0,45 ha dan induk sapi potong 2,75 UT dan simulasi solusi optimal menunjukkan bahwa petani mempunyai kemampuan untuk mengembangkan usahataninya.

Kata kunci : integrasi, optimasi, padi, pendapatan, sapi potong

ABSTRACT

Farmer households generally operate food crops and livestock subsectors that have not fully implemented well, so an optimal farming has not been achieved. This study aimed to analyze optimation of cow-calf beef cattle and paddy farming integration and simulation changing in input prices and the usage of resources to the optimal model. Survey method was used in the research in Grobogan Regency by determining Wirosari District and Purwodadi District. Quota sampling method is used to determine the number of respondents without counting the population as a sampling frame. The number of respondents in each district was 40 farmers so the total respondent was 80 farmers. Data were analyzed using linear programing. Results showed that optimum conditions of integration were achieved in 0.45 ha land, 2.75 AU of cow-calf beef cattle with maximum income of IDR 52,112,440/year. The simulation results regarding in changing in input usege indicated that the addition of 0.25% land area gives a change in scale of cow-calf beef cattle by 0.018% and income of 14.78%. In conclusion, integration optimation was achieved on 0.4 5ha land, 2.75 UT cow-calf beef cattle and optimal solution simulations indicated that farmers have the ability to develop their farming.

Keywords: beef cattle, integration, income, optimation, paddy

INTRODUCTION

Beef cattle and paddy farmings are forms of farm activity pursued by many people in Central Java. The meaning contained in these farm activities is how beef cattle and paddy farming are run by farm households to get better results, both in terms of farm scale and income. The policy regarding beef cattle and paddy farming development is basically has a correlative and synergistic relationship, considering that agricultural waste is substantially raw material (feed) for livestock farm. Farmer households use integrated farming system in developing agriculture, considering that besides providing economic benefits, this pattern also provides benefits in land conservation and land productivity. This is in line with Soedjana (2007) and Hutasoit (2008) that the reason why farmers choose mixed farming or integration is because of habits (tradition), to maximize revenue from limited resources, and increase benefits of correlation between integrated farming patterns in the food crop sub-sector and livestock sub-sector, which will encourage the development of food crops especially paddy and livestock and create investment opportunities. This is also supported by Basuni *et al.* (2010), Mukhlis *et al*. (2015) and Ponnusamy and Devi, 2017 that the integration of farming systems can provide both ecological and economic benefits because the waste from each commodity can be used as an input factor, so that it can save the use of cost and can increase income. Another research by Darith *et al*. (2016) indicated that activities carried out by farmers in the integration model can increase farmer income which in turn can increase investment in farming

Farmer households can be seen as a unit of farm activity consisting of production, activities and labor services activities. All of these activities are a unity, so that farmer's household cannot be seen as a pure consumer because there is a portion of the production that is consumed and partly sold as capital. Likewise in the labor use, farmers-breeders, labor can come from within the family or outside the family. Thus, farmer households can be said to be producers and consumers (Priyanti, 2007).

Integration of beef cattle and paddy based on the scale of farm that the number of livestock and land area can provide some form of integration (Matin *et al.*, 2016). Integration can take the form of an exchange relationship between livestock and paddy which can be in the form of fertilizer and forage (Regan *et al*., 2017)

Integrated farming systems, in Grobogan, which is managed by farmer's household generally consist of beef cattle, especially cow-calf rearing, and paddy farm. Farm households usually face constraints on land and cow-calf resource constraints. These constraints are in accordance with by Basuni *et al*. (2010) statement that in West Java, the integration of beef cattle and paddy is contained in land boundaries and livestock numbers. Therefore, the optimal allocation of resource use in the integration of cow-calf and pady needs to be assessed.

Allocation of resource use controlled by farmers is very important, because non-optimal resource use means a cost for farming management. As a result, the profits generated for farmer as farming manager becomes are optimal (Masayasu *et al*., 2018). Allocation of the use of production factors that provide optimal results can be analyzed by linear programming.

Analysis using linear programming can provide information for agricultural policy makers regarding: (a) the structure of related relationships and the costs of comparative advantage in agricultural sector; (b) production potential; (c) job opportunities; (d) consistency of every alternative agricultural policy. (Minh *et al*., 2007)

Linear programming is a method that is more systematic and mathematically rigorous for determining the optimum combination of farm sectors or contributions such as revenue maximization or cost minimization with limited available resources (Darith *et al*., 2016). From the study results, it is expected that an allocation model for an optimal use of production factors can be created, so that it can benefits for farmers. Based on the bacground, the objective of the study were to develop an optimation for beef cattle and paddy farm integration and simulate changes in input prices and resources use to optimal model.

MATERIALS AND METHODS

The study was conducted by using a survey method to determine the condition of farmer households, especially cow-calf cattle farming and paddy farming in managing their farm integration. Survey method is a method of taking respondents by determining a sample of the existing population. (Morissan, 2012)

Purposive method was used to determine the study location based on potential of the most populated area by beef cattle and paddy production in Central Java. Based on data on Agricultural and Animal Husbandry Statistics in 2018, it is known that Grobogan is regency with a potential combination of beef cattle, paddy farming from the planting area and paddy production aspects as well as the raising of beef cattle in Central Java. Based on regency location, there were 2 districts purposively selected where two villages were taken in each district based on several indicators such as number of beef cattle population, paddy production and farmer group activities. Based on the purposive results, districts selected for the study were Wirosari District, consist of Karangasem Village and Sambirejo Village, and Purwodadi District with Nambuhan Village and Genuksuran Village.

Quota sampling method was conducted to determine the sample number of cow-calf cattle and paddy farmers without counting the population as a sample frame. The sample number of cow-calf beef cattle and paddy farmers from each village were 20 farmers, so the total number of respondents was 80 farmers households. The reason for determining the number of respondents is 20 farmers per village because the characteristics of farmers are relatively homogeneous in the context of farm scale and rearing management

The method used to analyze the objectives was linear programming and descriptive analysis. From this model, cow-calf beef cattle and paddy farmers can be considered as cow-calf beef cattle and paddy producers that produce livestock and paddy supply continuously from optimal allocation of resources. Thus, the objective function in this linear programming research model was to maximize household income in term of integration cow-calf beef cattle and paddy farming.

The mathematical form of the Linear Programing model that maximizes the objective function in general (Minh *et al*., 2007) is

$$\text{Maximum } Z = C_1X_1 + C_2X_2 + C_3X_3 + C_jX_j \; .... \; - \; .... + C_nX_n \text{ or } Z = \sum_{j=1}^{n} C_jX_j \quad ....\ (1)$$

With constraint:

$$a_{11}x_1 + a_{12}x_2 + \dots a_{1j}x_j + \dots a_{1n}x_n \leq b_1$$
$$a_{21}x_1 + a_{22}x_2 + \dots a_{2j}x_j + \dots a_{2n}x_n \leq b_2$$
$$a_{31}x_1 + a_{32}x_2 + \dots a_{3j}x_j + \dots a_{3n}x_n \leq b_3$$
$$.. \quad .. \quad .. \quad ..$$
$$a_{m1}x_1 + a_{m2}x_2 + \dots a_{mj}x_j + \dots a_{mn}x_n \leq b_m$$

$$\text{or } \sum_{j=1}^{n} aijXj \leq bi \quad .... \quad (2)$$

Explanation:
i = 1, 2, 3 … m is the number of limitation factors; j = 1, 2, 3 … n is the number of production activity.
Activity was not negative: xj ≥ 0 for all j

Z = objective function which is the income of maximized cow-calf beef cattle farmers and paddy

C = production prices (C) and input prices (-C)

xj = production and consumption activities carried out by households of cow-calf beef cattle and paddy farmers

aij = input coefficient of each production and consumption activity

bij = value of constraints or the available resource limits

Referring to the research objectives the are basic components can be formulated as follows:

1. Objective function
   The objective function (Z) in this study is to maximize the income of cow-calf beef cattle and paddy farmers from various alternative activities with existing resource constraints.
2. Alternative Activity Model
   Some of activities carried out in this study include: (1) farming - livestock production activities; (2) purchasing production facilities; (3) hiring of workers; (4) sales of products; (5) consumption expenditure (food and non-food)

RESULTS AND DISCUSSION

Overview of Grobogan Regency

The livelihood of Grobogan residents are generally dominant in agriculture. This is due to the potential of Grobogan Regency which mostly dominated by agricultural land. Based on the results of population in 2017, it was noted that the population working in the agricultural sector amounted to 52.5%. One of the main capital in the development is labor. In line with the ongoing demographic process, the number and composition of the labor will continue to change.

(BPS Grobogan Regency, 2018).

In Grobogan Regency, land conversion from agricultural to non-agricultural land is increasing, but the potential of agricultural sector until now is still dominant in supporting the economic sector of Grobogan Regency. In 2018, about 84.91% of the total area in Grobogan Regency was used for agricultural activities. The production of lowland paddy of Grobogan Regency in 2017 experienced a significant increase compared to the previous year. This year, the production of lowland paddy reached 786,040 tons with a harvested area of 123,446 ha. While for upland paddy, the production reached 13,267 tons with a harvested area of 3,489 hectares. On the other hand, corn production reached 700,941 tons with a harvest area of 112,700 ha. The population of livestock in Grobogan Regency in 2017 generally increased compared to the previous year. The population of livestock consisted of 365 dairy cows, 178,555 beef cattle, 2,457 buffaloes, and 494 horses. Many livestock in Grobogan Regency are sent out of the area to meet the demand of other regions. In 2018, the number of livestock sent out from Grobogan Regency reached 30,108 cattle and 3,634 buffaloes (Table 1)

Respondents were majority consisted of farmers in their productive age (85%) with 100% working as farmers and 57.50% of them were primary school with the farm experience was 34% around 20 years; while the average land tenure was 0.45 ha and averagedly the livestock ownership was 1.54 animal unit (AU). This condition can affect production, both in cow-calf and paddy farming (Table 2)

Increasing education is the most important factor in Indonesian development, if it seen from the population perspective, both as the object of development as well as the subject of development. The success of the development in an area can be indicated by the high level of education of its population. This is surely correlated to the educational facilities available in the area. The livelihoods of residents in Grobogan Regency are still dominant in agriculture.This is due to the potential area of Grobogan Regency which still dominated by agricultural land. Based on the results of population projection in 2015, it was noted that the population working in the agricultural sector amounted to 56.0 percent, trade 17.5 percent, transportation 8.6 percent, and the rest worked in the services, plantation, industry, fisheries, and other sectors (BPS Grobogan Regency, 2018).

Analysis of Costs and Income of Cow-Cal Beef Cattle and Paddy Farming

The use of production factors on farming will cause a cost, both variable costs and fixed costs. Costs for variable input expenditures include seeds, fertilizers, pesticides, non-family labor, and other costs such as irrigation costs, farmer group fees and loan interest. In addition, farmers also pay fixed costs such as land rent, tractor rent, depreciation of capital goods (hoe, hand sprayer, sickle, and *sosrok*), and land tax. All costs are stated in rupiah, the amount of which is based on the price at the time the transaction takes place (Table 3)

Farmers with 1.54 AU of cow-calf beef cattle operations require a production cost of IDR. 8,095,927.19 per year with the highest cost of IDR. 3,760,560 (46.45%) allocated for forage cost. Labor cost is also incurred by many farmers, considering the scarcity of family labor, so it is necessary to allocate this cost, which amounted to IDR. 3,274,875.00 (40.45%). The highest cost in paddy farming was the labor cost. Today, agricultural labor is an important asset, given the number is increasingly scarce in the countryside. This is what makes the high wages of labor so that farmers have to pay more for labor costs (Maryanto *et al*., 2015). The production cost of paddy farming per hectare was IDR. 15,584,121.5, - per year where farmers cultivated paddy crops two times in one year.

Revenue for cow-calf beef cattle was IDR. 6,680,937.5 and livestock value added was IDR. 2,436,037.5. Thus, the income of cow-calf was IDR. 9,116,975,-/year with the cost incurred of IDR. 8,095,927.19 and income of IDR. 1,041,860.32/year/1.54 AU or IDR. 86,821.69/month/1.54 AU. It's a very small value to support the farmer's daily life. Whereas, revenue of paddy farming in the form of harvested dried rice for a year with 2 planting seasons was 6,187.5 tons/ha harvest. the price of paddy was IDR. 4,000,-/kg then farmer's revenue was IDR. 24,750,000/0.45 ha/season, or IDR. 49,500,000/ ha/year, with an income of IDR. 33,915,878/ha/year or IDR 2,826,323.2/ha/month. Based on the farm income, the profitability of cow-calf beef cattle and paddy farm were 1.2% and 217.63%, respectively. This showed that the farmer's household is more supported by the results of paddy farming, as Mukhlis *et al*. (2018) said that integrated of beef cattle and farming system can increase income and profitability of farmer's household which paddy farm is dominant

Table 1. The Agriculture Potential Commodities in Grobogan Regency*

Commodity	Harvested area (ha)	Production (tons)
Paddy		
- Lowland	123,446	786,040
- Upland	3,489	13,267
Corn	112,700	700,941
	Population (head)	
Beef cattle	178,555	
Dairy cows	365	
Buffaloes	2,457	
Horses	494	

*BPS-Central Bureau of Statistics of Grobogan Regency (2018)

for household income.

Optimation Analysis

The results of optimization analysis will illustrate the results of optimal solutions by using resources describing the optimal solution of linear programming analysis which incude: (1) validation of optimal solution values, 2) farm household income from optimal solutions, (3) optimal allocation of farmer's household resources and cow-calf beef cattle farm activities as wel as the level of constraints and shadow prices of resources. (Mukhlis *et al*., 2018 and Ryschawy *et al*,. 2017).

Optimation of cow-calf beef cattle farming and paddy describes the farm system with the farm household approach. The farm household approach is implemented because the farmer-breeder’s livelihood is not independent as farmers or breeders alone, but both activities are integrated in one household. On one hand, farmers can be seen as producers and on the other hand as consumers. Farmers-breeders as producer means that farmers-breeders will maximize income from a number of activities, while as consumer, farmers-breeders will consume goods

Table 2. Number and Percentage of Farmer’s Household Profile

No.	Profile	Number	Percentage (%)
1.	Age (year)		
	▪ ≤ 17	0	0.00
	▪ 18 – 60	68	85.00
	▪ ≥ 61	12	15.00
2.	Main livelihood		
	▪ Farmer	80	100.00
	▪ Village Officials	0	0.00
	▪ Entrepreneur	0	0.00
3.	Education		
	▪ Primary School	46	57.50
	▪ Junior High School	22	27.50
	▪ Senior High School	12	15.00
4.	Farming Experience (year)		
	▪ 6 – 10	12	15.00
	▪ 11 – 20	32	40.00
	▪ > 20	36	45.00
5.	Land tenure (ha)		
	▪ < 0.25	5	6.25
	▪ 0.25 – 0.5	48	60.00
	▪ > 0.5	27	33.75
6.	Number of Cattle (head)		
	▪ < 0.3	10	12.5
	▪ 3-4	55	68.75
	▪ > = 5	15	18.75

Table 3. Income of Cow-Calf Beef Cattle and Paddy Farming

Components	Beef Cattle Farming Income (IDR/1.54 AU/year)	Rice Farming Income (IDR/ha/year)
Revenue	9,116,975.00	49,500,000.00
Cost	8,095,927.19	15,584,121.50
Income	1,041,860.32	33,915,878.50

either from their own production or purchased for family consumption. Results of research showed that optimal condition of cow-calf beef cattle and paddy integrated farming system were 2.75 AU of local cow s of the year 1, 1.48 AU of non local livestock raising pattern and 0.45 ha land harvested of paddy. In maximizing income was IDR 52,122,440 in 3 years. In this term, farmers are faced with challenges on land, labor, and capital. This is consistent with Rohaeni *et al.* (2014) and Tawaf *et al.* (2017) that the farmer's problems in the application of optimation of agricultural patterns are capital, land, labor, and price fluctuation.

Validation the Value of The Optimal Solution

Model validation is the first step that needs to be done in the analysis of optimization of household resource allocation. The results of the validation of linear programming models are conducted to determine whether the model used in the analysis is valid. The results of model validation showed the optimal conditions of the state of the resource or household activities of farmers. The optimal analysis model is valid if the optimal value is at the confidence interval. The results of the validation of the model of household resources of farmers are presented in Table 4.

The results of the validation of the optimization model it was known that the resources and activities carried out by the household are in a confidence interval, namely the optimal conditions for cow-calf beef cattle was 2.75 located between 2.612 - 2.887 at the confidence interval, while the land optimal condition was achieved at 0.45 with the confidence interval was 0.428 - 0.473. It means that the model used is valid. If there is a change in resources or activities outside the confidence interval, it will cause changes in optimal conditions. Conversely, if the change is still at a confidence interval, it certainly will not change the optimal conditions. Based on the results of the linear program, it was known that rearing of local cow-calf beef cattle and non-local cow-calf cattle and also paddy farming obtained optimal values and are in confidence intervals. The optimum capital use was achieved in year 1, which is IDR 4,500,000. While the use of agricultural land for paddy commodities is known to be optimal conditions in year 1, 2 and 3. The use of family labor labor showed optimal use and results are within the confidence interval. The use of an optimal workforce showed that if farmer households need labor, the workforce must be met from outside the family. Food and non-food consumption has also shown optimal conditions and is at the dividend interval. It met with Maryanto *et al.*, 2015 that there was relationship between production decisions, allocation of labor farming and consumption decisions in households of integrated farming systems of beef cattle and paddy. After the optimation analysis is carried out, the answer to the hypothesis is that the main source of livestock, land and labor has been allocated optimally. Therefore, these resources can be said to be a limiting factor/farm constraints because the resources used are used up (Table 4).
The validation results of optimal analysis model on farmers household activities in Grobogan Regency showed that the optimal condition for cow-calf beef cattle of 2.75 AU and agricultural land use was 0.45ha. From cow-calf beef cattle and paddy farming activities, the optimal labor was achieved at 80.415 work day and capital for each period of IDR. 4,500,000,- The results of income maximization obtained by farmers-breeders households amounted to IDR. 52,122,440,- per year.

Simulation of Optimal Conditions

Optimation analysis model of resource allocation for farmers household showed valid results and optimal conditions are achieved.

Table 4. The Results of The Optimal Validation Model of Household Resources

Activities	Validation Model	
	Optimal Condition	Confidence Interval (α=95%)
Local livestock raising pattern (AU)		
▪ Local cows of the year 1	2.750	2.612 – 2.887
▪ Non Local livestock raising pattern (AU	1.483	1.408 – 1.557
Sale of local female calves		
▪ Sales of local calves in year 1	5.500	5.225 – 5.775
▪ Sales of local calves in year 2	2.750	2.612 – 2.887
▪ Sales of local calves in year 3	2.750	2.612 – 2.887
Sale of local male calves		
▪ Sales of local male calves in year 1	1.483	1.409 – 1.557
▪ Sales of local male calves in year 2	1.483	1.409 – 1.557
▪ Sales of local male calves in year 3	1.483	1.409 – 1.557
Use of agricultural land (ha)		
▪ Paddy in year 1	0.45	0.428 – 0.473
▪ Paddy in year 2	0.45	0.428 – 0.473
▪ Paddy in year 3	0.45	0.428 – 0.473
Capital Requirements in year 1	4,500,000	
Paddy sales (kw)		
▪ Paddy sales in year 1	28.435	27.013 – 29.857
▪ Paddy sales in year 2	28.408	26.987 – 29.828
▪ Paddy sales in year 3	28.435	27.013 – 29.857
Family labor (working day)		
▪ Family workforce in year 1 (working day)	80.415	76.394 – 84.436
▪ Family workforce in year2 (working day)	80.415	76.394 – 84.436
▪ Family workforce in year 3 (working day)	80.415	76.394 – 84.436
Consumption expenditure		
▪ Food consumption in year 1	4,070,545.00	3,867.017.75 - 4.274.072,25
▪ Food consumption in year 2	4,153,825.00	3.946.133,75 - 4.361.516,25
▪ Food consumption in year 3	4,886,500.00	4,642,175.00 - 5,130,825.00
▪ Non-food consumption Year 1	3,516,549.30	3,340,721.55 - 3,692,376.45
▪ Non-food consumption Year 2	3,588,315.60	3,408,899.82 - 3,767,731.38
▪ Non-food consumption Year 3	3,642,960.00	3,460,812.00 - 3,825,108.00
Income in year of 1-3 (IDR)	52,122,440.0	

Note : confidence interval at α=5%

Therefore, a simulation is carried out to find out whether there is a change in the objective function or constraints. This was taken to find out how much there has been a change in farming-cow-calf beef cattle and income of farmers households in order to keep in optimal condition, if there are changes in land resource constraints and input prices.

Cow-calf beef cattle resources are not simulated for changes in increase because the limit value of the cattle resources has reached its optimum condition at 2.75 AU. Thus, if there is any addition made, then other resources will not support it, especially labor. This is because the existing labor has another activity, i.e. paddy farming. Therefore, simulations are carried out on the rising of input prices both for cow-calf beef cattle and paddy farming, with a change of 10% without an increase in output prices. While the increase of input prices was based on field conditions, where the price of animal feed tend to rise with variation in increase around 10%. Changes occured from the simulation results are presented in Table 5.

The simulation results showed that 0.25% addition in land area, namely from 0.45 ha to 0.6 ha gave a change in the scale of livestock farm of 0.018% and income of 14.78%, i.e. from IDR 52,112,440,- to Rp 61,152,910,-. Changes in the optimal solution results of the simulation indicated that farmers have the ability to develop their farms. (Table 6). This is in accordance with Maryanto *et al*. (2015) that if optimal conditions are reached and simulations are carried out with changes in the use of land and price limiting factors then the optimal conditions are reached and farmers are still able to do the integration farming system.

It also can be seen that there is an increase in the area of labor resources needed, meaning that the addition of land area is still possible to be managed by farmers. The increase of input prices with fixed output prices that are counter balanced by an increase in land area results in an optimal change in income solutions, i.e. an increase in income. An increase in income resulting from the

Table 5. Simulation of Optimal Conditions on Farmers' Households in the Research Area

Types of Simulation	Scenario	Expected Results
Changes in farming land resources	- The greatest increase in the paddy farming scale managed by farmers from 0.45 ha to 0.6 ha - Other resource constraints are considered unchanged / fixed - Inputs and output prices are considered unchanged / fixed	- Farm scale increases due to land expansion - Increase in farmers' income - Changes in optimal farm patterns
Increases in Input prices	- Increase in input prices based on the highest price change, which is around 10% - Other resource constraints are considered unchanged / fixed - Output prices are unchanged / fixed	- Changes of income in farmers - breeders household - Changes in optimal conditions

Table 6. Simulation Results Regarding Changes in Animal Resource Constraints on Farmers' Households in the Research Area

Resources	Optimal Condition	Simulation Results	Percentage of Change (%)
Land	0.48	0.6	0.25
Local cattle	2.75	2.80	0.018
Labor	80.415	80.415	No change
Income	52,112,440.00	61,152,910.00	14.78

optimal solution is possible because an increase in input prices of 10% can still be counter balanced by the results of farming sales; given the addition of farm scale will result in production as the source of revenue. It can be noted from the simulation results that the optimal solution showed the ability of the farmers in managing their farming and cow-calf beef cattle. The simulation showed the farmers ability to manage their farm if there is an increase in the land area scale, but input and output prices are fixed. This is consistent with Karmini and Syarifah (2008) and Howara (2011) that land area will affect farming production and profits. Determining the right amount of optimal land is one way to increase production with the aim of achieving maximum profits. An increase in the amount of farmers' income is also still possible by making changes to the use of land inputs, so that productivity increases and ultimately increases the income. In addition, the ability to manage land for farming is generally also influenced by the availability of labor and capital, as stated by Khalik *et al*. (2013). As in optimal conditions, labor in the farmer's household is used up to manage his farm.

CONCLUSION

Based on the study results, it can be concluded that the optimal condition is obtained on cow-calf beef cattle of 2.75 AU and a land area of 0.45 ha. The maximum income of farmer households was IDR. 52,112,440/year. The simulation results of changes in input use indicated that the addition of land area of 0.25%, from 0.45 ha to 0.6ha results in a change of 0.018% in the scale of cow-calf farm and increasing income of 14.78%, from IDR. 52,112,440,- to IDR. 61,152,910,-. Changes in the results of the optimal solution in the simulation indicated that farmers have the ability to develop their farm.

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