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RESEARCH ARTICLE

OPTIMIZING THE INTEGRATION OF COFFEE PLANTING AND LAMB BREEDING CASE STUDY OF THE FOREST RURAL COMMUNITY ORGANIZATION (LMDH) OF TAMAN PUTRI IN KEMIRI VILLAGE, PANTI DISTRICT, JEMBER REGENCY EAST JAVA – INDONESIA.

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Abstract

The objective of this research was to optimize the integration of crop farming and lamb breeding in Kemiri Village, Panti District, Jember Regency. It was done from July to September 2016. The approach for this optimization was Goal Programming. Method of research was survey subjected to 119 people-coffee farmer-households. This population consisted of 29 farmer-households with crop farming on the farmland (Model 1) and 90 farmer-households without crop farming (Model 2). Respondents were selected based on cluster method under criterion that respondents were members of the Forest Community Organization (LMDH) of Taman Putri and had several housed lambs managed under collective ranch. Result of research indicated that both Model 1 and Model 2 were not yet optimum. In Model 1, LMDH farmers had an integrative work of coffee and crop farming. The mean score of lamb breeding in this model was 1.62 ST with contribution rate of 35.57% to annual net contribution. In Model 2, farmers only planted coffee and the mean score of lamb breeding was 1.43 ST with contribution rate of 8.32% to annual net contribution.

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Introduction:-

The integrated people-coffee plantation model was developed by integrating farming commodities such as cassava, land coverage plants, and woof plants (Nitis, 1999). Integration model involving these plants in reality have given additional value to the living of farmers by increasing fertility of plantation soil (Ugmumba, et al, 2010).

Integration system was an integrated farming applied through low external input between crop and livestock. It may increase efficiency of input usage and production, and also minimize failure risk (Thornton, et al., 2001). Some benefits are obtained from applying this planting-breeding integration system: (1) it helps diversifying the use of productive resource; (2) it suppresses hostile risk of mono-commodity planting; (3) it increases laborer efficiency; (4) it improves effiency of the use of productive components; (5) it reduces the dependence on chemical and biological substances; (6) it helps conserving ecology without causing environmental pollution; (7) it increases the yield; and (8) it gives more stable development of household economic (Devandra, 1999).

The integrated farming of crop planting and lamb breeding in Kemiri Village, Panti District, Jember Regency, was very promising recalling a fact that this region has a greatest potentiality of goat and lamb in East Java Province.

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The population of this animal has increased since 2010 from 2,822,912 heads to 2,830,915 heads in 2011, and still rised about 2,879,369 heads in 2012 and grown bigger in 2013 into 2,937,980 heads. Jember Region has Technical Managing Unit for Livestok Nursing and Feed Greening (UPT PT & HMT). This unit is the important instrument for Animal Husbandry Service for East Java Province. UPT PT & HMT for Jember Region works based on the Decree of East Java Governor No.130/2008.

Coffee planting on forestland cannot escape from the role of National Forestry Enterprise (Perhutani) and Forest Rural Community Organization (LMDH). Perhutani is required to conserve the forest, and therefore, it is then given a right to manage forestland with forest rural community. The relevant case in this research is that Perhutani builds a cooperation with forest rural community to cultivate coffee. LMDH Taman Putri, in Kemiri Village, Panti District, is the organization containing with robusta farmers who plant coffee on forestland. It is also a forum of communication across the members to understand about know-how of coffee cultivation on forestland, about their right and obligation related to this cultivation, and also about other information related with robusta coffee planting on forestland.

The integration of crop planting-lamb breeding is widely done in research location. The question is “Can the integration system be done in the people-coffee plantation with resources available at farmer level? The analysis on economical aspect of integrated farming between crop planting and lamb breeding, therefore, is required.

The objective of research is to determine the optimum integration between coffee planting and lamb breeding which is done by people-coffee farmers who join with LMDH Taman Putri in Kemiri Village, PantiDisttrict, Jember Regency, by considering some environmental and economical aspects. Economical goals of this integration are (a) to maximize income from plantation land; (b) to maximize income from lamb breeding; (c) to maximize income from lamb population growth; (d) to maximize the number of lamb on breeding; and (e) to maximize income from crop. Enviromental goals of this integration are: (a) to optimize planting interval of coffee or protector plant; (b) to optimize farmland for field rice; (c) to optimize the balance between protector plant and coffee; (d) to optimize livestock woof production from protector plant; (e) to maximize the production of lamb dung for fertilizer; and (f) to optimize plantation to be planted with coffee and protector plant. It is expected that result of research will provide guidance needed for integrating the work of coffee planting and lamb breeding on Perhutani land, because this integration at least may increase farmer welfare on specific environment of location.

Theoretical Review:-

The approach to optimization is Goal Programming (GP). Main idea of GP is to involve all managerial goals (objectives) into GP formulation. In this formulation, the statement of expectancy or desire from the decision-maker at certain specification in certain aspiration level would be expressed into more certain numeric forms. However, aspiration level cannot be achieved satisfyingly, but at least, deviation against the goals can be minimized.

Mathematically, the formula can be written as following (Ijiri, 2005):

$X1, X2, \ldots, Xn$ = decision variable;

k = number of goals considered;

cjk = coefficient Xj ($j = 1, 2, \ldots, n$) in the objective function of each goal-k ($k = 1, 2, \ldots, k$),

gk = target for goal-k. . . . . . (2.1)

Solution for GP is by setting the proximity to targets or goals as close as possible, and if any deviations, these must be minimum.

$$\sum_{j=1}^{n} c_{j1}X_j = g_1$$

. . .

$$\sum_{j=1}^{n} c_{jk}X_j = g_k \qquad \ldots\ldots (2.2)$$

Therefore, achieving all targets are impossible. What can we do is only to define objective function that must be sufficiently comprehensive or compromistic to GP. It is useful to achieve many various targets although still assuming that deviation value is positive or negative. Objective function of GP is expressed as preference function or achievement function depending on its deviation from target. Comprehensive objective function for GP is written as follows:

$$Z_{min} = \left| \sum_{k=1}^{K} \left(\sum_{j=1}^{n} c_{jk} X_j - g_k \right) \right| \quad \ldots\ldots (2.3)$$

Nixon, et. al., (2014) wrote that Goal Programming was better than conventional method used in the literature on the planning of bioenergy project at Punjab District, India.

The breeding of small ruminants (goat/lamb) must attend three main components, that is related to each other, such as the availability of land, livestock, and food (Soedarjat, 2000). Integrated farming concept, which involves plants and livestocks, had been applied by Indonesian farmers for long ago, and so did farmers in Southeast Asia (Diwyanto et al, 2004). However, as other smallholders in other place, their farming system was traditional but it remained possible for optimization into better condition in the future (Dent, et al., 1971).

Sudaryanti (2004) had examined factors affecting people-coffee production in Temanggung Regency. These factors influence robusta coffee, and they include: land width, plant quantity, and fertilization. Laborer sector is not significantly influential, and the use of laborer in people-coffee plantation is too excessive compared to production yield. The efficiency of people plantation is not maximum. Inefficiency was estimated to 26.73%. Technical efficiency reaches 73.27% but both price efficiency and economic efficiency rates only attain 2.70% and 1.98%. If reviewed from return to scale, coffee production in research area has a decreasing trend. Reason behind this trend is that production input is not yet optimum which leads to contra-productive condition.

As reported by Sudiana (2010), since 1999, BPTP Bali had pioneered the review of agro-ecosystem applied by a farmer group. This review attempts to investigate the optimum use of farmer resources by examining the integration of coffee planting and lamb breeding in Bongancina Village, Busungbiu District, Buleleng Regency.

Soemarno (2007) said that people plantation development is a regional development model with its main activity focused on plantation commodities, either those cultivated in genuine, mix or versatile plantation. Diwyanto, et al., (2004) also asserted that regional development model is directed toward the integrated farming system between plantation and animal husbandry or fishery. Other name for this system is Crop-Livestock System (CLS).

The benefits of CLS are explained by Devendra (1999). These include: (1) diversifying the use of productive resource; (2) reducing risk of failure; (3) increasing laborer efficiency; (4) improving effiency of the use of productive components; (5) reducing the dependence on chemical and biological energies, and the dependence on external inputs; (6) conserving ecology without causing environmental pollution, which thus protecting life environment; (7) increasing the output; and (8) stabilizing the economic of farmer household (Devandra, 1999).

Shamimet. al,. (2011) admitted that Bangladesh farmers had professed integrated farming system (IFS) at least to alleviate their income uncertainty. IFS system provides Bangladesh people with benefits. It is succesfully resolving their economical and ecological problems, providing household needs such as fuel, fertilizer, and food, and also improving food productivity.

Ezeakuet, al., (2015) had reported that integrated crop-livestock system was often suggested as a very promising solution to deal with the problems of reduced soil fertility and productivity loss in Nigeria. The increase of livestock productivity, in terms of body weight and milk production, will not only benefiting but also supplying protein needs for urban community.

As shown by Krisnan, et al., (2013), the development of goat breeding in Simalungun Regency, North Sumatera, was quite promising because it is functional to meet the needs for available food source. It is consistent with some facts that: (1) there is a local development policy that has set a priority on farming/breeding sector, including goat; (2) goat density was relatively low; (3) farmland cultivated by farmers is widely extensive with great potential to be the supplier of animal feed from the remnants of farming, or to be the place for herding the goats; and (4) there are reliable human resources or enthusiastic breeders who will accept pleasantly feed processing technology. Therefore, in Krisnan study, development strategy must settle on some priorities such as: developing integration between crop planting and goat breeding, optimizing feed processing technology, increasing a synergy in government policies, and providing reliable capital support.

Method of Research:-

Design of Research:-

Research location is Kemiri Village, Panti District, Jember Regency. In this village, there is a people-coffee farmer group called as the Forest Rural Community Organization (LMDH). This group has applied integrated farming between crop planting and lamb breeding with Collective Ranch System. Respondent population is 119 people-coffee farmer-households, consisting of 29 LMDH farmers in Model 1 with lamb breeding (at real condition, the quantity of lamb on breeding in this model is 419 heads) and 90 LMDH farmers in Model 2 with coffee planting only (in this model, the lamb on breeding is 1,602 heads). The farmers in both model are stratified. In Model 1, Strata 1 farmers have land width < 0.22 Ha, while those in Strata 2 and Strata 3 have land width > 0.22 – 0.53 Ha, and > 0.53 Ha. In Model 2, farmers in Strata 1, 2 and 3 are those with land width < 0.20 Ha, > 0.20 – 0.50 Ha, and >0.50 Ha.

Method of Data Analysis:-

Goal Programming:-

Data analysis technique in this research uses Multiple Goal Program, or popularly known as Goal Programming (GP) (Lee, 2002), and farming analysis. GP involves two models (Ijiri, 2005). In this case, LMDH farmers in integration of crop planting and lamb breeding will be assigned into two models. Model 1 represents LMDH farmers who cultivate coffee and crop on their own farmland beyond plantation, whereas Model 2 stands for LMDH farmers who only do coffee planting.

Model 1:-

Mathematic model equation is then used to describe the function of GP Model in explaining integration farming between crop planting and lamb breeding. The priority order is set as follows:

$Z_{min} = P1\ d1^- + P2\ d2^- + P3\ d3^- + P4\ d4^- + P5\ d5^- + P6\ d6^- + P7\ d7^-$ . . . . (3.1)

Where:

P1 : maximizing income from plantation land, Goal 1.
P2 : maximizing income from lamb breeding, Goal 2.
P3 : maximizing lamb population growth, Goal 3.
P4 : maximizing number of lamb on breeding, Goal 4.
P5 : maximizing quantity of livestock feed obtained from protector plants, Goal 5.
P6 : maximizing income from crop, Goal 6.
P7 : maximizing lamb dung for fertilizer, Goal 7.

Decision Variable and measurement unit:-

X1 = land width for coffee (ha/year); X2 = land width for protector plants (ha/year); X3 = lamb (livestock unit, ST); X4 = land with for field-rice (ha/year).
Bi = target of ith resource capacity.

Goal Problems:-

Goal of maximizing income from plantation land:-

$c1.1\ X1 + c1.2\ X2 + d1^- - d1^+ = B1$ . . . . . (3.2)

c1.j is a technical coefficient for each decision variable Xj.
B1 is a target of income/year. It measures Proper Living Standard (IDR/year) which stands for IDR 1,400,000.00 per month or IDR 16,800,000.00 per year.

Goal of maximizing income from lamb Breeding:-

$c2.1\ X3 + d2^- - d2^+ = B2$ . . . . . (3.3)

c2.1 is technical coefficient (net income/ST) for lamb breeding.
B2 is a target of profit from selling lamb/year (IDR/year).

Goal of maximizing lamb population growth:-

$c3.1\ X3 + d3^- - d3^+ = B3$ . . . . . (3.4) c3.1 is technical coefficient (population growth) for lamb breeding.B3 is target of lamb populatin growth/tahun (ST/year).

Goal of maximizing number of lamb on Breeding:-

4.1X3 + d4- - d4+ = B4 . . . . . (3.5)

c4.1 is technical coefficient (the number on breeding) for lamb breeding.

B4 is a target of number of lamb on breeding (ST/year).

Goal of maximizing quantity of livestock feed obtained from protector plants:-

c5.1 X2 + d5- - d5+ = B5 . . . . . (3.6)

c5.1 is technical coefficient (feed output/Ha protector plant/year).

B5 is a target of feed output total obtained from protector plant/year (IDR/year).

Goal of maximizing income from Crop:-

c6.1 X4 + d6- - d6+ = B6 . . . . . (3.7)

c6.1 is technical coefficient (net income) for field-rice/ha/year.

B6 is a target of net income from field-rice/year (IDR/year).

Goal of maximizing lamb dung for fertilizer:-

c7.1 X3 + d7- - d7+ = B7 . . . . . (3.8)

c7.1 is technical coefficient (the monetary value of lamb dung/ST/year).

B7 is a target of income from lamb dung /year (IDR/year).

Resource Problems:-

Meeting the suggested planting interval between coffee and protector plant:-

c8.1 X1 + c8.2 X2 < B8 . . . . . (3.9)

c8.1 is technical coefficient (space width/coffee dan protector plant).

B8 is plantation width for coffee and protector plant (ha/year).

Limited plantation width for coffee/ protector plant:-

c9.1X1 + c9.2 X2 < B9 . . . . . (3.10)

c9.1 is technical coefficient (space width/coffee).

c9.2 is technical coefficient (space width/protector plant).

B9 is plantation width for coffee and protector plant (ha/year).

Limited plantation width for field-Rice:-

c10.1 X4 < B10 . . . . . (3.11)

c10.1 is technical coefficient (space width/field-rice).

B10 is farmland width for field-rice (ha/year).

Balance between coffee and protector plant:-

c11.1X1 – c11.2X2 > B11 . . . . . (3.12)

c11.1 is technical coefficient (space width/coffee).

c11.2 is technical coefficient (space width/protector plant).

B11 = 0, the balance between land width for coffee and protector plant (ha/year)

$\forall$Xi > 0. All decision variables are non-negative.

Model 2:-

The formulation for Model 2 farmers who do coffee farming only is similar to that of Model 1 farmers. In relation with Goal 6, Equation (3.7) and (3.11) are rejected. GP Model Formulation is explicitly made by involving technical coefficient values derived from input given by experts during Focus GrupDisscusion (FGD). To obtain optimum solution for GP, then an application in Add-in Excel Program, named Solver, is used. The problems in Model 2 include goal constraint and resource constraint. People-coffee planting and lamb breeding are the work managed by farmers/breeders to facilitate the issuance of capital from government-based micro financial agencies (owned by BRI, Bank Mandiri, and BNI 1946) and also from those owned by private (Bukopin, Danamon, BCA, Sinar Mas). Recently, these banks only provide a loan for financing the investment and also for capitalizing the work until 1 billion bail-out coverage. Moreover, capital is not problem anymore. Laborer for coffee plantation, livestock caring, and field-rice cultivation, is not constraining factor anymore because the laborer is mostly family member and neighbor, and the number is quite plenty.

Farming:-

Production cost total is the sum of fixed cost and variable cost. The equation is written as follows:

$$TCi = FCi + VCi \qquad \text{. . . . . (3.13)}$$

Where: TCi = Cost Total of ith Commodity (IDR/year); FCi = Fixed Cost of ith Commodity (IDR/year); VCi = Variable Cost of ith Commodity (IDR/year). Farming revenue is a multiplication between production and sale price.

This statement is written as Follows:-

$$TRi = Yi.\ PYi \qquad \text{. . . . . (3.14)}$$

Where: TRi = Revenue Total of ith Commodity (IDR); Yi = Production Output of ith Commodity (IDR); PYi = Price of Yi (IDR).

Farming income is the differential between income and cost. It can be written in the equation as following (Soekartawi, 2002) :

$$NIi = TRi - TCi \qquad \text{. . . . . (3.15)}$$

Where: NIi = Net Income Total of ith Commodity (IDR/year).

Result of Research and Discussion:-

Profile of Lamb Breeding Farming:-

Breeding system has an experience of transition from individual ranch system into Collective Ranch System. The goals of collective ranch are: (1) to facilitate livestock management (nearby the source of feed) and (2) to improve the concern in security.

Figure 1:- Lamb and the Location of Collective Ranch System Nearby the Location of People-Coffee Plantation of LMDH Taman Putri.

Integrated Farming of Crop and Lamb in Reality:-

Net income and the contribution of each component in the real integrated farming conducted in recent one year by Model 1 LMDH farmers are explained as follows:

Table 1:-Real Net Income/Year and Components of Integration in Model 2

Type	Components of Integration			Volume	Mean Score (IDR 000)	Net Income Mean (IDR 000)	Contri-bution(%)
A. Strata 1	X1	a	Coffee Plant	0.20 ha	1,927.33	2,316.67	8.50
		b	Coffee Peel	268.34 kg		536.67	1.97
	X2		Protector Plant	0.20 ha		12,768.00	46.82
	X3	a	UTD	1.02 ST	6,656.67	8,115.38	29.76
		b	Lamb dung	6,065 kg		1.213.00	4.45
	X4		Field-Rice	0.02 ha	1,448.33	2,317.67	8.50
Total						27,267.72	100.00
Continued							
Continued							
B. Strata 2	X1	a	Coffee Plant	0.50 ha	4,321.00	7,158.33	19.04
		b	Coffee Peel	440 kg		880.0	2.34
	X2		Protector Plant	0.50 ha		11,664.00	31.03
	X3	a	UTD	1.24 ST	6,000.00	9,866.67	26.25
		b	Lamb dung	4,200 kg		840.00	2.23
	X4		Field-Rice	0.03 ha	4,708.00	7,182.00	19.11
Total						37,591.00	100.00
C. Strata 3	X1	a	Coffee Plant	1.0 ha	8,428.89	18,230.00	34.60
		b	Coffee Peel	838.89 kg		1,677.78	3.18
	X2		Protector Plant	1.0 ha		11,840.00	22.47
	X3	a	UTD	1.21 ST	7,075.56	9,672.00	18.35
		b	Lamb dung	5,111.1 kg		1,022.22	1.94
	X4		Field-Rice	0.05 ha	8,692.78	10,253.00	19.46
Total						52,695.00	100.00

UTD = usahataniternakdomba (lamb breeding farming)

More extensive is the owned land or farmland for coffee planting, more possible is for farmers to set priority on cultivating coffee and crop. The consequence is that time spent into livestock breeding becomes smaller.

Net income and contribution of each component of real integrated farming conducted in recent one year by Model 2 LMDH farmers are described as follows:

Table 2:-Real Net Income/Year and Components of Integration in Model 2

Type	Components of Integration			Volume	Mean Score (IDR 000)	Net Income Mean (IDR 000)	Contri-bution (%)
A. Strata 1	X1	a	Coffee Plant	0.20 ha	2,073.33	2,177.47	7.78
		b	Coffee Peel	277.79 kg		555.88	1.99
	X2		Protector Plant	0.20 ha		12,769.41	45.64
	X3	a	Lamb on Breeding	1.41 ST	5,644.19	11,255.34	40.23
		b	Lamb dung	6,112.9 kg		1,222.58	4.37
Total						27,980.69	100.00
B.Strata 2	X1	a	Coffee Plant	0.50 ha	5,155.35	5,494.65	18,93
		b	Coffee Peel	479.41 kg		958.82	3.30
	X2		Protector Plant	0.50 ha		11,371.76	39.18
	X3	a	Lamb on Breeding	1.25 ST	6,985.29	9,965.38	34.34
		b	Lamb dung	6,153.9 kg		1,230.77	4.24
Total						29,021.39	100.00
Continued							

Continued

C. Strata 3	X1	a	Coffee Plant	1.0 hal.	9,664.14	10,871.57	29.16
		b	Coffee Peel	814.29 kg		1,628.57	4.37
	X2		Protector Plant	1.0 hal.		11,571.43	31.03
	X3	a	Lamb on Breeding	1.50 ST	6,387.14	11,990.00	32.15
		b	Lamb dung	6,386.4 kg		1,227.27	3.29
Total						37,288.84	100.00

More extensive is coffee plantation, more possible are for farmers to concentrate on coffee cultivation, and therefore, time spent to livestock breeding becomes smaller.

Optimum Integrated Farming of Crop–Lamb with GP Approach:-

Net income and contribution of each component of optimum integrated farming conducted in recent one year by Model 1 LMDH farmers will be elaborated as follows:

Table 3:-Optimum Net Income/Year and Components of Integration in Model 1

Commodity	Opti-mum Rate	NIi (IDR 000)	Contribution (%)	Opti-mum Rate	NIi (IDR 000)	Contribution (%)	Opti-mum Rate	NIi (IDR 000)	Contribution (%)
	Strata 1			Strata 2			Strata 3		
X1 (ha/year)	0.15	13,260	28.98	0.40	33,160	40.00	0.74	60,290	55.51
X2 (ha/year)	0.15	21,600	47.19	0.40	36,000	43.42	0.74	33,300	30.66
X3 (ST/year)	1.29	5,880	12.86	1.71	7,060	8.52	1.86	7,060	6.50
X4 (ha/year)	0.024	5,020	5.98	0.067	6,680	8.06	0.081	7,970	7.34
TI/Year		45,780	100		82,910	100		108,620	100

NI = net income = net income/year.

ST = satuanternak (livestock unit) = 7 heads/unit (Ensminger, M. E.,1991).

Strata-1. The contribution of coffee (X1) is 28.98%. Of this percentage, there is a contribution of coffee peel for 2.10% or IDR 960,000.00 in its monetary value. This pecuniary value remains as opportunity cost that can reduce the cost of mixture in preparing organic fertilizer. The contribution of protector plant (X2) is 21.60% and it becomes opportunity cost with monetary value of IDR 21,600,000.00 that can reduce the cost of lamb feed. The contribution of lamb on breeding (X3) is 12.86%, and included within this percentage, there is lamb dung contributing for 0.39% with monetary value of IDR 180,000.00. This dung is also opportunity cost that may reduce the cost of mixture in preparing organic fertilizer.

Strata-2. The contribution of coffee (X1) reaches 40.00%. Within this percentage, there is also contribution of coffee peel for 2.89% with monetary value of IDR 2,400,000.00. Coffee peel contribution is opportunity cost that can save the cost of mixture in preparing organic fertilizer. The contribution of protector plant (X2) is 43.42% and it also represents opportunity cost with monetary value of IDR 36,000,000.00 that can reduce the cost of lamb feed. The contribution of lamb on breeding (X3) is 8.52%, and including within it, there is lamb dung that contributes for 0.26% with monetary value of IDR 220,000.00. It would be opportunity cost that can reduce the cost of mixture in preparing organic fertilizer.

Strata-3. The contribution of coffee (X1) counts for 55.51%, and including within it, coffee peel contributes for 4.09% with monetary value of IDR 4,440,000.00. It becomes opportunity cost that can spare the cost of mixture in preparing organic fertilizer. The contribution of protector plant (X2) is 30.66%, and representing opportunity cost with monetary value of IDR 33,300,000.00, that can save the cost of lamb feed. Lamb on breeding (X3) contributes for 7.34%, and including within it, there is lamb dung contributing 0.20% in monetary value of IDR 220,000.00, and it represents opportunity cost that can reduce the cost of mixture in preparing organic fertilizer.

Model 1. Percentage mean of contribution from real breeding work (24.79%) is smaller than optimum one (35.57%). This remains apparent because the mean of lamb ownership in real breeding work (1.15 ST) is smaller if compared to the optimum work (1.62 ST).

Table 4:-Optimum Net Income/Year and Components of Integration in Model 2

Commodity	Opti-mum Rate	NIi (IDR 000)	Contri-bution (%)	Opti-mum Rate	NIi (IDR 000)	Contribution (%)	Opti-mum Rate	NIi (IDR 000)	Contribution (%)
	Strata 1			Strata 2			Strata 3		
X1 (ha/year)	0.148	14,400	34.92	0.397	39,160	46.27	0.708	65,720	61.43
X2 (ha/year)	0.148	22,140	53.67	0.397	39,600	46.78	0.708	34,200	31.97
X3 (ST/year)	1.28	4,710	11.41	1.43	5,880	6.95	1.57	7,060	6.60
NI/Year		41,250	100		84,650	100		106,990	100

Strata-1. The contribution of coffee (X1) is 34.92%. Included within it, coffee peel has a contribution of 4.17% with monetary value of IDR 1,720,000.00. It stands as opportunity cost that can spare the cost of mixture in preparing organic fertilizer. The contribution of protector plant (X2) remains as 42.67% and it represents opportunity cost with monetary value of IDR 22,140,000.00 that may help saving the cost of lamb feed. The contribution of lamb on breeding (X3) is 11.41%, and included within it, lamb dung contributing for 0.35% with monetary value of IDR 140.000,00 which also representing opportunity cost that would reduce the cost of mixture in preparing organic fertilizer.

Strata-2. The contribution of coffee (X1) is 46.27%, and included within it, there is coffee peel that contributes for 5.46% with monetary value of IDR 4,620,000.00. It is an opportunity cost that can spare the cost of mixture in preparing organic fertilizer. The contribution of protector plant (X2) is 46.78%, and it may become opportunity cost with monetary value of IDR 39,600,000.00 which can save lamb feed cost. The contribution of lamb on breeding (X3) is 6.95%, and included within it, lamb dung with contribution of 0.21% or IDR 180,000.00 in its pecuniary term. It is opportunity cost that helps reducing the cost of mixture in preparing organic fertilizer.

Strata-3. The contribution of coffee (X1) is 61.43%. Included within this percentage, there is coffee peel contributing for 7.46% with monetary value of IDR 7,980,000.00. It is opportunity cost that helps saving the cost of mixture in preparing organic fertilizer. The contribution of protector plant (X2) is 31.97% and it represents opportunity cost with monetary value of IDR 34,200,000.00 that will help saving lamb dung cost. The contribution of lamb on breeding (X3) is 6.60%, and included within it, lamb dung with contribution of 0.20% or IDR 220,000.00 in its pecuniary term. It will be opportunity cost that can reduce the cost of mixture in preparing organic fertilizer.

Model 2. Percentage mean of contribution from real breeding work (9.57%) is smaller if compared to optimum breeding work (35.57%). It is evident although the mean of lamb ownership in real breeding work (1.39 ST) is smaller than that in optimum breeding work (1.43 ST).

The goal of maximizing income from plantation (Goal 1) has achieved 100%, which can be said that this goal gives the biggest contribution of income. Result from optimum integrated farming (with lamb breeding) has supported Sudaryanti (2004) and Devendra (1999) who state that workers are not considered as resource problem. The demand for finance for integrated farming in research area is also not perceived as resource problem, and it corresponds with a fact that when farmers lack of funding, they can afford financial support from KUT/KUR provided by public and private banks.

In average, the optimum number of lamb on breeding in all strata of Model 1 is 1.62 ST, while that in Model 2 is 1.36 ST. Farmers in Model 1 obtain additional net income from crop (with annual planting pattern of field-rice – field-rice – field-rice), and by this income excess, they can breed more lambs. Field-rice production is not for sale to others, but for family consumption. The demand for food consumption in Model 2 farmers can be met with certain proportions of the sale of coffee or lamb.

The Comparison Between Real and Optimum Incomes:-

Real and optimum incomes are compared as follows.

Table 5:-The Comparison Between Net Income/Year in Real Farming and Optimum Net Income

Model 1 : Model 1 Farmers					
Strata	Real Net Income (IDR/Year)	Optimum Net Income (IDR/Year)	Differential (IDR/Year)	Percentage (%)	Real Farming Status
1	27,267,717.95	45,780,000.00	18,512,282.05	67.89	Not optimum
2	37,591,000.00	82,910,000.00	45,319,000.00	121.00	Not optimum
3	52,695,000.00	108,620,000.00	55,925,000.00	106.00	Not optimum
Mean	39,184,572.65	63,843,348.59	59,878,141.03	98.30	

Model 2 : Model 2 Farmers					
Strata	Real Net Income (IDR/Year)	Optimum Net Income (IDR/Year)	Differential (IDR/Year)	Percentage (%)	Real Farming Status
1	27,980,693.78	41,250,000.00	13,269,306.22	47.42	Not optimum
2	29,021,389.14	84,650,000.00	55,628,610.86	191.68	Not optimum
3	37,288,844.16	106,990,000.00	69,701,155.84	186.92	Not optimum
Rerata	31,430,309.03	77,630,000.00	46,199,690.97	142.01	

The positive impact of economic goals is various: (a) farmers' income is increasing which leads to the increase of welfare in people-coffee farmers; (b) integrated farming of crop-livestock system has contributed to the increase of farmers' income, especially related with additional income from plantation residues (for livestock feed) and livestock dung (for fertilizer). Environmental goals have some positive impacts: (a) there is a symbiotic mutualistim cycle in the ecosystem between livestock dung, feed for livestock, and coffee feel as fertilizer; and (b) farmers become more aware about the importance of environmental conservation at landslide-vulnerable area, that must also be protected, such as protected forest in the region of LMDH Taman Putri, in Kemiri Village, Panti District, Jember Regency. The mean for optimum net income in both Model 1 and Model 2 has exceeded KHL of Jember Regency which counts for IDR 16,800,000.00.

Table 6:-The Percentage of Increase in Optimum Goal against Real Condition

Goals	Optimum Model 1 against Real Condition (%)	Optimum Model 2 against Real Condition (%)
Economic :		
Increase in Income from Plantation Work (IDR/Year)	76.17	45.84
Increase in Livestock Population (ST/Year)	7.50	12.07
Livestock on Breeding (ST/Year)	7.50	12.07
Mean of Economic	30.38	23.33
Environment :		
Increase in Utilization of Lamb Dung for Fertilizer (Kg/Year)	7.50	12.07
Increase in Utilization of Crop (Kg/Year)		
Protector Plant for Livestock Feed (Kg/Year)	7.50	12.07
Mean of Environment	7.50	12.07

Table 6 shows that the goal of maximizing income is increasing relative to real condition. Farmers in Model 1 and Model 2 have their income increasing for 76.17% and 45.84%. The increase of lamb population in both models reaches for 7.50% and 12.07%. The increase of mean score in economic goals has shown as 30.38% in Model 1 and as 23.33% in Model 2.

Environmental aspect optimization is found in the form of increasing lamb dung utilization. Model 1 and Model 2 indicate the increase of 7.5% and 12.07% lamb dung utilization. Environmental aspect optimization is also evident in protector plant utilization which both models show the increase of 7.5% and 12.07%. The mean score is 7.5% for Model 1 and 12.07% for Model 2.

The optimization found in Model 1 and Model 2 for economical and environmental goals is similarly showing positive increase percentage. It can be said that farmers as the object of research have opportunity to increase income and to improve environmental quality.

Field observation has found that all land-width strata in Model 1 and Model 2 farmers have worked below optimum rate, and this is evident because: (a) farmers do farming without good planning; (b) they do farming without clear targets; (c) they do farming only with resources available; and (d) they do farming as they will.

Conclusion:-

Economical Goal:-

a. Model 1 LMDH Farmers are those who do planting coffee and crop. They have lamb breeding in mean score of 1.62 ST. The mean of contribution to net income per year is 35.57%.
b. Model 2 LMDH Farmers are those who only do planting coffee. Their lamb breeding is 1.43 ST in mean score. The mean of contribution to net income per year is merely 8.32%.

Environmental Goal:-

a. The utilization of remnants from coffee plantation for lamb feed is increasing.

Model 1 LMDH Farmers have contribution of IDR 30,300.000.00 per year to net income, while Model 2 LMDH Farmers have contribution of IDR 31,980,000.00.

b. The utilization of lamb dung is increasing.

LMDH Farmers with crop farming on their farmland have their income increasing to IDR 233,000.00 per year, while the income of farmers without crop farming increases to IDR 181,300.00 per year.

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