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Economic Assessment of Dual Purpose Type of Cattle Farming in Minahasa Regency – Indonesia

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ABSTRACT

The aim of this study was to analyze dual purpose type of cattle farm households' economy in Langowan District Minahasa Regency, Indonesia. Data relies on sample survey of 100 farm households in Tumarats Village during 2017. Descriptive and quantitative analysis using a probit model was employed. Result of this study showed that Family labor absorbed by cattle farms on the first, second and third scales were 44.34, 27.46 and 16.82 man days/AU/year respectively. The contribution of cattle income on the first, second and third scales were 52.84%, 66.31% and 70.19% respectively. Value added of cattle, selling price, family labor, cattle labor and cultivated land area had significantly positive effect on households' decision to increase cattle scale of business.

1. INTRODUCTION

Three elements that always interact in household activity are production, income and consumption. Process of production, consumption, income and labor utilization on beef cattle farmers is influenced by government regulation. Cattle farmers have to work hard in order to increase their income and production.

Input price and labor wage will affect household's income and then influence household's consumption (Udoet al, 2011:25; Hartono, 2006:226; Wantasen et al. 2012:142; Dalie et al, 2015:93) Hence, process of production will affect households decision in consumption through household's income and expenditures. The increasing of farmers income will improve farmers welfare in the villages area. Farmers begin consume much more food especially high quality food such as grain, eggs, milk, fruits. Surplus of beef cattle production will increase farmer's standard of living (Anis et al, 2015:39)

Households food consumption pattern is determined by their income. If cattle farm household get more income they will change their consume pattern. Angel's low stated that the contribution of income in food consumption by households will decrease along with the income increase while non food consumption tend to be more than before. Increasing the share of non food consumption indicated that household economic condition are getting better. There are two types of non food consumption such as consumption by needs and consumption by wants. The consumption by wants will affect household saving, investment and production (Obayelu et al, 2009:21-23).

Households in village of Tumaratas Minahasa Regency are traditionally managing strain of ongole crossbreed cattle in small scale business and the cattle remains utilized as a source of farm labor processing and transportation of agricultural product. Therefore it was clear that cattle on this area is known as dual purpose type. Its provide meat, draught power for tillage, hauling carts, handling, dragging and stacking timber logs in forests and produce manure as input for crops production. Households income is obtained from on farm activities, off farm and non farm activities. The study of cattle households economy heve been conducted including In Indonesia (Umar et al, 2008:5; Bart et al, 2013: 155-156; Sikhweni and Hassan, 2013: 40; Kalangi et al, 2014:34). The studies showed the positive effect of input factor on beef cattle production, production cost, revenue and income as well as in dairy farm. Unfortunately detailed economic assessments of dual purpose type of cattle that covered cost production, revenue, households income, households consumption and factors affected households' decision to expand dual purpose cattle business scale in smallholder level are still rare. Therefore the present study was undertaken with the objectives to analyze cattle households economy, family labor utilization, cost of cattle production as well as its revenue, households income, expenditures and factors affect households' decision to increase cattle business scale.

2. MATERIALS and METHODS

This research was a case study employed in Tumaratas village, District of West Langowan, Minahasa Regency North Sulawesi Province. Tumaratas village was purposively chosen based on largest cattle population in District of West Langowan of 3,764 heads in 2016 (Center of Statistics Bureau, 2016:384) and farmers had implemented relatively good management on cattle compare to farmers in other villages (Wantasen and Paputungan, 2017: 298)

The study used 100 sample of respondents selected by stratified purposive random sampling considering that farmers at least had one ongole crossbreed cattle and ever sold it. There were 135 farm households of cattle on this study site fulfilled this criterion. Number of samples calculated by applying formula of Knottnerus (2003:153-154):

$$n = \frac{N}{N\,(d)^2 + 1}$$

Where :

n = Number of sample

N = Number of population = 135

d = Sample error (critical value 5% = 0.05)

where: N (d)2 + 1 = 135(0.05)2 + 1 = 1.34

n = 135/1.34 = 100.74

Data were analyzed by using descriptive and quantitative methods. Descriptive analysis described the source of households income, income from cattle business, number of cattle ownership, households expenditure or households consumption. In order to fit with the real condition in study site, selected sample are grouped into three scales of cattle ownership consist of ≤ 5 Animal Unit (AU) , 50 respondents, 5-10 AU, 30 respondents and >10 AU, 20 respondents. Survey method is used for data collection through interviews to farmers using questionnaires in 2017. Data collection consisted of cattle size, cultivated land area, family labor, farmers' education, age, value added of cattle, cattle price, cost of forage, production cost, households income and households expenditure. Quantitative analysis was used to determine the economic incentive or income and to determine factors influencing farmers' decision to improve cattle business scale. Income was computed by subtracting revenue obtained to cost of production spent by farmers. The formula is given as follow (Amir and Natnipscheer, 1989: 79) :

$\Pi = TR - TC$

Where:

Π = Income/ economic incentive (IDR/year/farmer)

TR = Total revenue (IDR/year/farmer)

TC = Total Cost (IDR/year/farmer)

Pyndick and Rubenfeld (1991: 229) stated, probit model is a type of regression where the dependent variable can take only two values. The purpose of the model is to estimate the probability that an observation with particular characteristics will fall into a specific one of the categories; moreover, classifying observations based on their predicted probabilities is a type of binary classification model. Suppose a response variable Y is binary, that is it can have only two possible outcomes which we will denote as 1 and 0. For example, Y may represent presence/absence of a certain condition, success/failure of some device, answer yes/no on a survey, etc. We also have a vector of regressors X, which are assumed to influence the outcome Y, and ϵi is random variables that assumes is normal. Specifically, we assume that the model takes the form

$$Pr(Yi=1) = Pr(\epsilon i \geq - \beta Xi) = 1 - \Phi(-\beta Xi) = \Phi(\beta Xi) \quad \ldots\ldots(1)$$

Since $Pr(Yi = 0) = 1 - Pr(Yi = 1)$ ..... (2)
can also say

$$Pr(Yi = 0) = \Phi(-\beta Xi) \quad \ldots\ldots (3)$$

where Pr denotes probability, and Φ is the Cumulative Distribution Function (CDF) of the standard normal distribution. The parameters β are typically estimated by maximum likelihood.

A probit model was used to determine factor affecting the farmers' decision to increase cattle scale of business. A procedure to measure breeders' decision was to apply both binary and non binary variables for quantify factors mostly affecting positive or negative of farmers' decision to rise cattle production. A probit procedure that specifies the binary dependent as a function of the number of quantitative explanatory variables was used for the ability of generating bounded probability estimates. For individual farmer (Borooah, 2002: 57). The formula used to estimate factors influencing farmers' decision to increase cattle business scale in the model of Gujarati (2001:387) showed as follows:

$Yi = \alpha + \beta Xi + ei$ …….(4)

Where X i represent vectors of explanatory variables of the ith farmer, Yi is a binary variables such as Yi =1 if the i th farmer wants to increase production of cattle and Yi = 0 if otherwise. Xi is assumed to be stochastic and independent of the zero mean random variable ei. Yi can be assumed to two different values, i 0 and 1. So the expected probability could be obtained:

E (Yi) = 1 X f i (1) + 0 X fi (0) = fi (1)……. (5)

Where, f i (1) is probability of expanding operation for a farmer with a set of resources and economic characteristic (Xi). From (4) and (5)

$E (Yi) = \alpha + \beta X i$ ……...(6)

meaning that the probability of f i (1) would be different for farmers with different levels of resources and economic characteristics. Hence, the expected probability E (Yi) which could be interpreted as the proportion of all farmers with resources and economic characteristics (Xi) mostly increasing production scale would be:

$0 \leq \alpha + \beta Xi \leq 1$ …….(7)

General probit model for ith farmer is shown as follows (Borooah, 2002:254)

FD = F (VAC, PRICE, HS, FLAB, CLAB, EDU, LAND, AGE, CFOR)

The dependent variable was hypothetical index of farmers' decision to increase cattle production. The maximum likelihood technique was used to estimate the coefficient of cattle business scale (Gujarati, 2001:177)

The independent variables in the model with expected signs are presented in Table 1:

Table 1. Explanatory Variables

Explanatory Variables	Explanation	Expected Sign
VAC	Value added of cattle	+
PRICE	Selling Price of cattle	+
HERD SIZE	Actual number of cattle	-
FLAB	Family Labors working on cattle business	+
CLAB	Cattle labor	+
EDU	Dummy variable whether or not farmers has a high school education or above (1= yes, 0= otherwise)	-
LAND	Cultivated land area	+
AGE	Actual age of farmer	-
CFOR	Cost of forage is measured by money value of time that spent by household to fed cattle	-

Stastitical likelihood ratio (LR) was used as F test on the OLS method to test null hypothesis that all the explanatory variables simultaneously affect the dependent variable. In order to know the goodness of regression line we use coefficient of determination developed by McFadden (R2McF) where the value is ranging 0 and 1. Completion analysis was conducted by using computer with Eviews software version 8.

3. RESULTS and DISCUSSIONS

3.1. Cattles Ownership

Most of people in Tumaratas Village worked in agricultural sector include of rearing cattle. This site is known as center of cattles' production and development in Minahasa Regency. Average rain fall is 2,500-3,000 mm per year, temperature ranging is 24oC – 28oC while moisture is 91%. Such climatic condition makes West Langowan district potensial for crops and livestock development. Farmers cultivated their land with various crops such as cabbage, tomato, chili, onion, carrot, maize, ground nut, red bean and patato. Farmers raised ongole breed of cattle since this type of cattle was very useful particularly to provide meat and cultivate their land. The average of herd size per household was 3.47 heads. Based on the result of this study that is presented in Figure 1 showed that number of cattle owned by households on the first, second and third scales were 3.90, 6.25 and 11.00 Animal unit (AU) respectively. The result was different with Jaleta and Gebremedhin (2012:204) stated that in Ethiopian highland on average households own about 6.5 AU but in parallel with Umar et al., (2008:7) that inform average household owned around 2 to 4 heads of cattles.

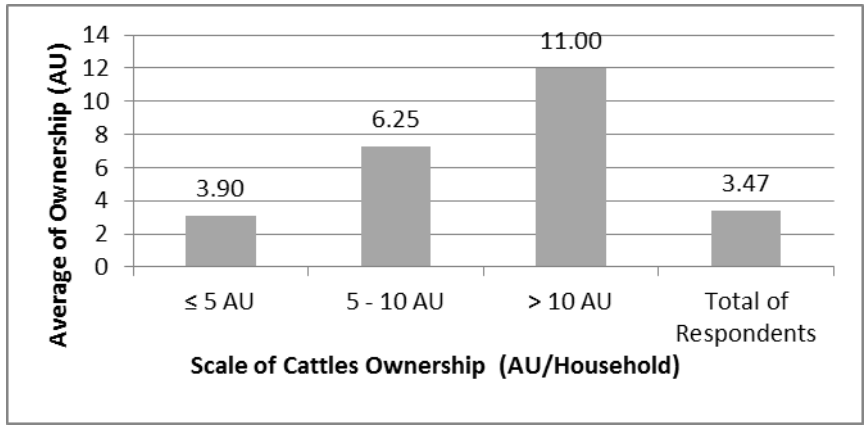

Figure 1. Average Of Cattle ownership

The result indicated that households had already taken advantage of all resources available in Village of Tumaratas and enhance their farming system due to cattle can produce meat, organic fertilizer, provide draught power and absorb family labor (Asmah, 2011:330; Franzluebbers, 2007:365-366)

3.2. Family Labor

Households still use family labor to manage the cattle business. As shown in figure 2 the study revealed that family labor absorbed in cattle farming on the first, second and third scales were 44.34, 27.46 and 16.82 man days/AU/year respectively. On the average the use of family labor is 41.22 men days/year. The study was in line with Dalie et al. (2011:30-31) revealed that the greater of herd size, the more efficient the use of family labor. Activities conducted by breeders in relation with rise cattle including feeding, matting, bathing, impounding, selling and manure processing, The study showed that cattle business was able to overcome the problem of labor in rural area especially in Minahasa Regency.

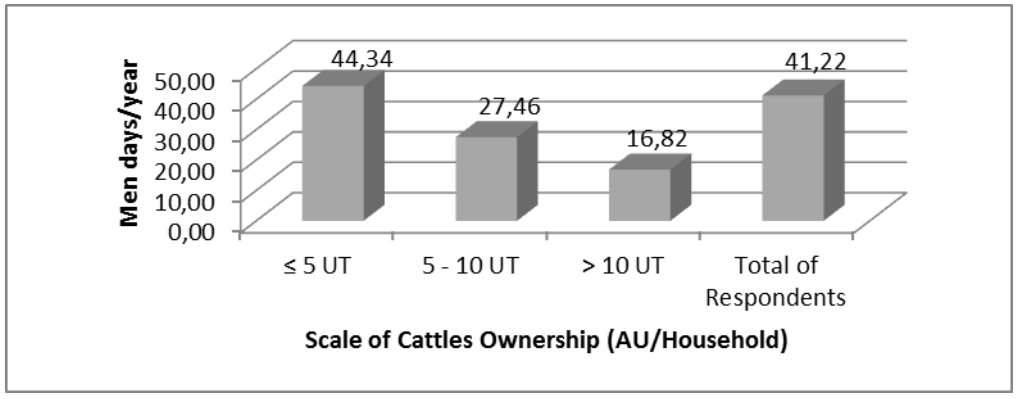

Figure 2. Family labor on cattle business

3.3. Households' Income

Household's income was obtained from on farm activities including raise cattle, plant cabbage, tomato, chili, onion, carrot, maize, ground nut, red bean and patato, off farm activies such as sell processed of agricultural products, and non farm activities such as non agriculture worker, remitant and national civil servant. Income share for on farm, off farm and non farm activities are presented in Table 2.

Table 2. Income Share for Each Activity of Household (IDR/Year/Household)

Income sources	≤ 5 AU	5-10AU	>10 AU	Total Samples
Rearing cattles	34,053,721 (52.84%)	102,745,856 (66.31%)	180,151,400 (70.19%)	39,636,226 (50.17%)
Crops	16,358,645 (25.38%)	24,628,681 (15.89%)	39,028,650 (15.21%)	17,081,548 (28.80%)
Off Farm	4,978,753 (7.72%)	3,883,333 (2.51%)	25,500,000 (9.93%)	5,118,240 (6.07%)
Non Farm	9,059,505 (14.06%)	23,691,667 (15.29%)	12,000.000 (4.68%)	9,966,840 (14.96%)

The contribution of income from cattle business was the largest one compared with other sources of income in the household. It was indicated that catlle was still the main bisiness of household especially on scale 2 (5-10 AU) and scale 3 (>10AU) for its contribution had exceed 60%. The studi was consistent with Pohler et al (2011:383) who stated that cows are viewed as primary income source of households' farmers in USA. The share of income from crops was relatively less for 15.21% to 25.38% . It can be seen in Table 2 that the increase of herd size, the income share of crops tend to decrease because households give more attention on their cattle business. Income from non farm activity seem to be lower by increasing of herd size. It considered make sense since household look for other income sources to meet their needs particularly when income from cattle business tend to decrease. Breeders earn income from cattle farming through selling cattles, organic fertilizer, value added of cattles, cattle labor, rent out of stud cattle. Cost of production included of cost of forage, cost of health, cost of labor and cost of stable. Households' income from cattle business is presented in Table 3.

Table 3. Households' Income on Cattle Business

Herds Size (AU)	Average of cattle ownership (AU)	Annual Revenue (IDR/AU)	Annual cost of Production (IDR/AU)	Annual Income (IDR/AU)
<5 AU	3.90	12,804,300	2,413,646	10,390,654
5-10 AU	6.25	14,726,325	1,654,847	13,071,478
>10 AU	11.00	15,195,833	1,103,117	14,092,716
Total of Respondents	3,47	13.363.280	2.276.538	11.086.742

Table 3 explained that the more the cattle raised, the more the income obtained by household from cattle business due to the higher scale of bisiness, household can sell more cattle and manure as well as rent out of cattle labor to obtained more income. Some researcher showed

that extensive, semi intensive and intensive farming included livestock was one of the approach to increase the production, productivity and income of smallholder farming (Stainfield and Mack, 2001:20; McLeod et al, 2007:112-113; Anis et al, 2015:39)

3.4. Households' Expenditures

Households' expenditures is a total amount of money spent by households to meet their needs at the certain period of time. The greater the portion of income used on non food consumption indicated the increase of household welfare. The pattern of household consumption expenditures was devided into two parts namely expenditures on food consumption and expenditures on non food consumption. Expenditures on food consumption included rice, eggs, meat, fish, cooking oil etc. Non food consumption expenditures included education, health, clothing, electricity, housing, water, soap, fuel, social and spiritual, recreation, feast, savings etc.

The study indicated that in absolute terms the more animal are kept, the greater the expenditure consumption but the percentage was getting smaller. (Table 4). This indicated that the dual purpose type of cattle business had improved quality of life of household in Minahasa Regency.

Table 4. Households' Consumption Expenditures

Type of Consumption	Total Consumption			Total Of Respondent
	< 5 AU	5-10 AU	> 10 UT	
Food Consumption (IDR/Year)	13,121,314 (55.83%)	15,993,333 (54.26%)	19,068,000 (45.62%)	13,409,672 (55.77%)
Non Food Consumption (IDR/Year)	10,380,629 (44.17%)	13,480,167 (45.74%)	22,725,000 (54.37%)	10,633,475 (44.23%)

3.5. Factors Influencing Households' Decision to Increase Cattle Business

Probit Regression of Households' Decision to Increase Cattle Business Scale is shown in Table 5.

Table 5.Probit Regression of Households' Decision to Increase Cattle Business Scale

Independent variables	Coefficient	Standart error	Probability
Constant	-9.33658	1.14773	0.0000
VAC	1.22644***	0.27115	0.0043
PRICE	1.05437**	0.37446	0.0366
HERD SIZE	-0.03175*	0.00433	0.0685
FLAB	1.33674***	0.25771	0.0008
CLAB	1.25635***	0.54358	0.0076
EDU	-1,32364*	0.54421	0.0845
LAND	0.14283*	0.25533	0.0772
AGE	0.01665	0.03442	0.7758
CFOR	0.19664	0.16643	0.9547
Log Likelihood	-48,72157***		0.0039
Mc Fadden R^2	0.78574		

*** Significant rate at 0.01 ($p<0.01$)
** Significant rate at 0.05 ($p<0.05$)
* Significant rate at 0.10 ($p<0.10$)

Table 5 showed that Value added of cattle, selling price, family labor, cattle labor and cultivated land area had a significant and positive effect on households' decision to increase cattle business scale. Level of education and herd size had a significant and negative impact on breeders' decision to increase cattle business scale while age and cost of forage were not affect farmers' decision. It implies that the factors of family labor, cattle labor and value added of cattle were mostly improve possibility of increasing productivity and provide better opportunity for increase income in the future. Altogether the dependent variables have effect to households' decision as much as 78.57% (R2McF = 0.7857). The value of log likelihood was 48.72 ($p<0.01$) meaning that all independent variables in the model effected the dependent variables simultaneously. Value added of cattle was closely related to household decision to increase cattle production ($p< 0.01$) because cattle can produce feces that could be made as organic fertilizer. Farm households had been able to process cow dung into organic fertilizer. They had several times received guidance from agricultural extension at the study site. Organic fertilizer was used by farmers on their crops. Moreover farmers could rent out cattle labor as well as cattle as stud. The organic fertilizer was very useful for crops and forage planted by farmers besides minimizes the use of agrochemicals, reduces environmental impact, improve soil structure and fertility. If farmers have larger value added from cattle they will increase the number of cattle due to the income they will have. The result was different with previews study since they didn't measure value added of cattle impact on income and households' decision to increase cattle business scale (Raharjo and Suroyo, 2013:143 Wantasen et al, 2013: 152). Family labor had a significant influence ($p< 0.01$) on households' decision to increase cattle business scale. Variety of tasks in rearing cattle such as feeding cattle, looking for forage, bathing and breeding need family labor to perform it. Therefore family with large members was useful for rearing cattle particularly to looking for forage as the main input. Availability of family labor was very important to guarantee the sufficient number of forage. Hence, household could increase business scale if the forage available in large number.

Cattle labor had a significant effect on households' decision ($p<0.01$) because there were many of cultivated lands needed cattle labor. Cattle can serve both as a source of power for ploughing farm land and as a means of transportation. Tractor usage was still considered more expensive than labor of cattle. Many farmers in village of Tumaratas rent out their cattle to get money income. Therefore the more cattle they rent out, the more income they earned. The implication was that household would improve the cattle scale if they earned more money.

Price of cattle had a significant influence on households' decision ($p< 0.05$) to increase the scale of cattle business. The selling price of cattle in the study area depends on the physical condition of livestock, sex and age. Farmers prefered to maintain cattle from ongole crossbreed type and had good characteristics included productive working on farm land, has clean- white colour, healthy body, have a high hump. All characteristics mentioned was considered as factors that had contributed on economic incentive of cattle price. Therefore household was interested in increasing their scale of cattle business.

Herd size had negative response ($p<0.10$) on households' decision to increase cattle scale. Farmers with smaller herd size will tend to increase the scale of cattle business due to their capacity and feed availability. If farmers have larger business scale of cattle they were not

interested in improving the scale of business because they need more forages to meet livestocks requirement.

Education had negative influenced ($p<0.10$) on households' decision to increase scale of cattle business. It showed that farmers with higher level of education tend to work outside of agricultural sector with more income and relatively high of social status. The result was in line with Asmah (2011:332) claimed the lower level of educated farmers had use less technology innovation on their business of cattle.

Although effort to increase scale of cattle need substantially large of cash input to purchase more cattle, forage and adequate infrastructures however the annually income of farmers from cattle business was average IDR 11,086,742 whereas the annually cost production was average IDR 2,276,538 indicating that household had economic incentive to increase their cattle scale of business. The result was consistent with Kalangi et al. (2007:32) and Bart et al.(2013:159) who claimed that income had significant influence on farmers' decision to increase the cattle business scale.

4. CONCLUSION

The study indicated that the cattle business on Tumaratas Village, Minahasa Regency was the main business of household due to absorbed family labor, increase both family income and non food consumption. Value added of cattle, family labor, cattle labor, selling price of cattle had positive impact on farmers' decision to increase cattle business scale. In contrary, level of education and herd size had negative effect on households'decision, while age of farmer and cost of forage had not indicated significant effect.

The study showed that cattle farming could improve farmers' income in Minahasa Regency. Nevertheless farmers still face problems to develop herd size such as forages availability and technology of cattle reproduction. Therefore the local government District of Minahasa should introduce the kind of quality forages and intensify the implementation of insemination technology and natural mating system by using superior bull cattle. Local government need to train cattle farmers to inseminate and facilitate them with equipment due to limited number of inseminator in the region. So that farmers will not rely on the inseminator officer to increase their owned cattle number.

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