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Household Economic Behavior of Traditional Cattle Farmers in Utilizing Artificial Insemination Technology: A Case Study in Village of Kanonang III, Minahasa Regency of Indonesa

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ABSTRACT

The aim of this research was to analyze interrelation between factors affecting the economic behavior of cattle farmers in the utilizing of artificial insemination technology as well as natural mating and the impact of changes in external factors on household economic. The measurement of artificial insemination technology used the cost of inseminator approach. This research used survey method in order to gain and collect any information of 100 households randomly chosen. Simultaneous equation model and 2SLS method were employed in estimating all research parameters. The results, eventually, showed that economic model of household established can well describe the interrelation between the utilization of artificial insemination technology and natural mating with the economic trait of household. Moreover, the artificial insemination technology and natural mating actually showed an impact on value added of cattle business and subsequently significantly affect the usage of family labor, the cost of forage crops, cattle health cost, cost of stable, cattle selling value, production value of manure, rent out value of stud and value of unsold cattle. Farmer's income significantly influence on food consumption, non-food consumption and family saving. Then, the simulation of increasing utilization of artificial insemination technology of 25% combined with the increasing of natural mating as well as cultivated land area of 25% was the best impact toward the household economic of traditional cattle farmers.

Keywords: technology, inseminator cost, cost of natural mating, economic behavior of household

INTRODUCTION

In the last few years, the economic issue of household has been the concern of experts [1-3]. One of the most important commodities to improve breeder's income is cattle. Cattle business which is well managed provide benefits on household of farmers [4,5]. The increasing of farmer's income as a result in the improvement of cattle production will improve the welfare of farmers. Consequently, farmers initiates to consume much more food, especially having high nutrients in the form of high-quality grains, eggs, milk, fruits and other.. Process of Production, income, labor allocation and consumption of cattle farmer are an integrated unit related one another, subsequently, any changing occurred in policy managing cattle activity will impact on economic trait of household [6,7].

Efforts to improve cattle productivity conducted through the use of artificial insemination or natural mating because these two techniques have their own benefits [8,9]. Artificial insemination technology is an alternative that can be developed since the aim of this program targeting on cattle is to improve genetic quality and by the end improving production of cattle and the breeder income as well [10,11]. The use of insemination gives two possible impacts on the economic behavior of households that is increasing the use of family labor or even reduces family labor. If cattle was sideline business that productivity improvements will reduce the use of family labor and the opposite effect will occur if the cattle business was the main business.. Accordingly, insemination technology is very important in Indonesia nowadays related to Government program to succeed meat self-sufficient in 2014 and to increase farmer's income. Many information concerning the positive impact of utilizing artificial insemination technology in cattle either in beef-typed breeder, dual-purposes or in dairy which neglect its effect on labor allocation and household consumption [12-16].

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Households in village of Kanonang III, Minahasa Regency are traditionally managing cattle in small scale business, and, the cattle remains utilized as a source of farm labor processing and transportation of agricultural products. They have implemented artificial insemination combined with natural mating system to increase production and income from cattle business. Income from cattle is used to meet households' needs such as food, clothing, educational and healthcare. In fact the production, household income, labor allocation and consumption are an integrated unit that is mutually affected and can not be separated in household activity, thus, the given budget in household will result on the rivalry between production and consumption decision. By that, it is necessary to analyze simultaneously the relationship among household economic behavior of cattle farmer such as production, income, employment and consumption in terms of the utilizing of artificial insemination (AI).

Thus, the study was aimed to investigate the interrelation of factors influencing economic behavior of traditional cattle farmers in utilizing artificial insemination technology and to analyze the impact of technological change in the use of insemination toward the households' economic behavior.

MATERIALS AND METHODS

Location and Time of Research

The collecting of research primary data was conducted since June 1st to 30th August, 2011.This research was a case study employed in Village of Kanonang III, sub district of Kawangkoan, Minahasa district, North Sulawesi, Indonesia. Village of Kanonang III, was set out as purposively research area for the largest cattle population in sub district of Kawangkoan, Minahasa district of 765 heads in 2010. The beef breeder of Village of Kanonang III had implemented artificial insemination technology despite of natural mating system and managing manure as compost.

Sampling Methods and Data Collection

The formative of total sample was conducted by taking into account that sample representatively can represent population. Therefore, the formulation of formative sample size by accuracy (error rate) of 10% is [17]

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

Where, *n* is total minimum of sample, *N* is population, and d is accuracy stated 10% that is deviation rate of sample characteristic on population. Total of sample in the research is 100 farmers selected by *purposive random sampling* of 230 beef breeders by considering that breeder, at least, has one cattle and ever sold it out.

The data collecting technique was employed with survey technical (direct observation) in field by obtaining a clear and detailed explanation from the sample of breeder concerning on particular issue with the questionnaire manual in depth. Informal discussion, thus, is conducted with head of village, chief of hamlet and head of animal health post to ensure the trustworthiness of information obtained from respondent sample

Data Analysis

To meet the research objective, it was used econometric model. The economic household model established employs simultaneous equation thus, it can clearly explain the interrelation of factors influencing economic behavior of traditional cattle farmers in utilizing artificial insemination technology. In assuming parameter estimation is utilized 2 SLS method initially after the model is known as '*over identified*' by using *order condition* technique. Moreover, the aspect of artificial insemination technology (AI) usage conducted by cattle breeder is measured using the approach of *inseminator cost.* The aspect of cattle production, then, is calculated using the approach of added value of cattle by counting the disparity of cattle value in the end and initial of year. In order to recognize the impact of technological change in the use of insemination, the simulation assimilation is done regarding to (1) inseminator cost increases 25%, (2) natural mating cost raises 25%, (3) combination of 1st and 2nd simulation, (4) combination of natural mating cost and cultivated land area augments as 25%, (5) combination between inseminator and natural mating cost increases 25%, and cultivated land area declines of 25%, (6) combination of inseminator cost, natural mating cost and cattle labor wage raises as 25%, (7) combination of inseminator cost, natural mating cost and cultivated land area augments of 25 (8) combination of inseminator cost, cultivated land area, cattle – labor wage, cost of education and health , income from *off farm* activity increases of 25%, initially after the model is validated by using *Theil's Inequality Coefficient* and *decomposition criteria* . Decomposition of U- Theil comprises of U^M (average bias), U^S (regression slope bias) and U^C (covariance bias). A model has well prediction ability if U^M and U^S value close to zero and U^C closes to one. The data processing is conducted with program of Statistical Analysis System (SAS) version 9.1.3. Therefore, simultaneous equation model established is:

1. Added Value of Cattle

$$PROS = a0 + a1TKDS + a2BIN + a3\ BKA + ei \quad (1)$$
$$a1, a2, a3, a4 > 0$$

2 Labor Usage

$$TKDS = b0 + b1\ PROS + b2\ JARP + ei \quad (2)$$
$$TKTS = c0 + c1TKNS + c2\ LHN + ei \quad (3)$$
$$TKNS = d0 + d1\ LHN + d2\ JARP + ei \quad (4)$$
$$b1, b2, c1, c2, d1, d2 > 0$$

3. Cost of Cattle Business

$$BPTS = BKD + BPH + BIN + BKA + BOB + BTK \quad (5)$$
$$BKD = e0 + e1\ PROS + ei \quad (6)$$
$$BPH = f0 + f1\ BPKS + f2\ PROS + ei \quad (7)$$
$$BOB = g0 + g1\ BPKS + g2\ PROS + ei \quad (8)$$
$$BTK = h0 + h1\ TKDS + h2\ BPH + ei \quad (9)$$
$$e1 > 0, f1 < 0, f2 > 0, \quad g1 < 0, \quad g2 > 0$$
$$h1 > 0, \quad h2 < 0$$

4. Income and Revenue

$$PDRT = PDS + PDNS + PDOF + PDLP \quad (10)$$
$$PDS = PNS + PSTS + NPKS + NMJ + NTD - BPTS \quad (11)$$
$$PNS = i0 + i1PROS + ei \quad (12)$$
$$PSTS = TKTS * UPHS \quad (13)$$
$$NPKS = j0 + j1PROS + e1 \quad (14)$$
$$NMJ = k0 + k1\ PROS + ei \quad (15)$$
$$NTD = l0 + l1\ PROS + ei \quad (16)$$
$$PDNS = m0 + m1TKNS + m2\ LHN + ei \quad (17)$$
$$PDLP = n0 + n1\ JARP + n2\ PDOF + ei \quad (18)$$
$$i1 > 0, \quad j1 > 0, \quad k1 > 0, \quad l1 > 0, \quad m1,$$
$$m2 > 0, \quad n1 > 0, n2 < 0$$

5. Consumption

$$KP = o0 + o1PDRT + o2PDFO + o3JART + ei \quad (19)$$
$$KNP = p0 + p1\ PDRT + p2\ KP + ei \quad (20)$$
$$TKRT = KP + KNP \quad (21)$$
$$o1, o2, o3, > 0, \quad p1 > 0, p2 < 0$$

6. Saving

$$TAB = q0 + q1\ PDRT + q2\ KNP + ei \quad (22)$$
$$q1 > 0 \quad q2 < 0$$

where, PROS was Value added of cattle (IDR/year/household), TKDS was family labor on cattle business (man days/year/household), TKTS was cattle – labor (man days/year/household), TKNS was labor on food crops business (man days/year/household), LHN was cultivated land area (hectare/household) , BPTS was production cost of cattle business (IDR/year/household), BKD is Cost of stable (IDR/year/household), BPH is cost of forage crops (IDR/year/household), BOB was cattle health cost (IDR/year/household), BTK was labor cost of cattle business (IDR/year/household), PDRT was Household income (IDR/year/household), PDS was income from cattle business (IDR/year/household), PNS was revenue of sales cattle (IDR/year/household), PSTS was revenue from renting out cattle (IDR/year/household), NPKS was Production value of manure (IDR/year/household), NMJ was rent out value of stud cattle (IDR/year/household), NTD was value of unsold cattle (IDR/year/household), PDNS was food crops income (IDR/year/household), PDLP was non farm income (IDR/year/household), KP was food consumption (IDR/year/household) , KNP was non food consumption (IDR/year/household), TKRT was total of family consumption (IDR/year/household), TAB was family saving (IDR/year/household), BIN was inseminator cost (IDR/year/household), BKA was natural mating cost (IDR/year/household), BPKS was cost of education and health (IDR/year/household), PDOF was income from *off farm* activity (IDR/year/household), JARP was number of productive age of household members (person/household), JART was family size (person/household), PDFO was education of head (year), UPHS was cattle labor wage (IDR/mandays), *a0, b0…..q0 was* intercept coefficient and *ai, bi…qi* was estimation parameter and *ei* is disturbance factor.

RESULTS AND DISCUSSION

Household's Characteristics

The research finding in Table 1 portrays that the average land size possessed by beef breeder's household, in research area, is 0.92 hectare, the cultivated land, however, is 0.74 hectare. The possessing farm land, that is relatively small, is obtained hereditarily from parents' inheritance descending to their children, in short, the more children owned, the smaller field inherited to each child. The uncultivated land was used to graze the cattle, then, so that the breeder allows their field as the breeding ground of forage crops for livestock feed. The cattle, thus, can feed the grass as well as agriculture waste in the field. The cultivated field was used by the breeder to plant corn, rice, peanuts, red beans, tomato and red onion. The breeder, in general, cultivates two and three plant varieties in a year. Most farmers in Village of Kanonang III have obtained formal education, though there are some household head not graduated from elementary school. Furthermore, most of household head pass their formal education in high school of 38%, elementary of 18%, 35% of junior high school and 9% of university graduate. It meant that 91% of farmers had low – middle education. Despite the formal education, the beef breeder, in research area, also obtained informal education, such as counseling of agriculture and husbandry officer from District of Kawangkoan, Minahasa Regency, thus, supported by their experience in cattle long enough, their knowledge in cattle business was sufficient indeed, In far, it is simply the breeder in receiving new technology and the application as well. The research finding described that total average of cattle owned by the breeder was 3.43 animal unit (AU) This phenomenon was caused by the breeder in research area, had no farm land area as feed source to raise their cattle in big amount since the average of farm land area possessed is only 0.90 ha per breeder.. The average family size of each breeder was 3.86 persons consist of of father, mother, and children. The reason was that breeder was more preferred to separate from their parents after marriage, whereas non – productive age of breeder usually stays with their children including son in law and grandchildren. Further, most of total of family members includes in productive age, which is 2.63 persons (71.47%) and 1.23 persons (33.43%) embraces in non-productive one. In short, the breeder's family has more potentially of family labor.

Table 1 Characteristics of Respondent

Variables	Categories	Frequency	Percentage	Average
Land Size (hectare)	0.18-0.78	56	56.00	0.92
	0.79-1.38	24	24.00	
	>1.38	20	20.00	
Cultivated Land area (hectare)	0.12-0.75	72	72.00	0.74
	0.76-1.38	17	17.00	
	>1.38	11	11.00	
Number of cattle (AU)	≤5	93	93.00	3.43
	5 - 10	5	5.00	
	>10	2	2.00	
Family size (persons)	2-4	79	79.00	3.86
	5-7	19	19.00	
	>7	2	2.00	
Household members (persons)	Productive age		71.47	2.63
	Unproductive age		33.43	1.23
Educational level	Elementary	18	18.00	
	Secondary	35	35.00	
	High school	38	38.00	
	University	9	9.00	

Interrelation of Factors Influencing Household Economic Behavior of Cattle farmers in utilizing artificial insemination technology

Results were presented in Table 2. Value added of cattle in Kanonang III was measured at the difference of current cattle value with the value of previous year. The utilization of insemination results the additional calf each year for the breeder, draught power, beef and dung so it will improve value added to the breeder. Breeders used to raise *ongole- cross breed cattle* as a source of labor on farm activity. In research area, average value of a calf resulted from *ongole-cross breed cattle*; whose age is less than 6 months was IDR. 3,500,000; equally relative with US$ 400 In addition, the value will increasingly turn to IDR.8 million – IDR 12 million per cattle, at 1 until 2 years old of age and IDR 15 million – IDR 17 million per cattle, at 2 until 4 years old, because it was more productive used as managed labor of agriculture field and transporting

the harvest as well. The usage of tractor had not been applied by most farmers for the expensive price and its inappropriate usage in the hillside region ranging from most agriculture areas in Village of Kanonang III. The result showed that inseminator cost had significantly effect on value added of cattle. Since it will be encourage inseminator the officer more actively in conduct the insemination task. The average of inseminator cost at each time process in study area was IDR 54, 650 (US$ 6, 07), since there is a subsidy by Indonesian government.

Table 2 Interrelation of factors influencing the household economic of ongole-crossbred cattle farmers (Ongole-crossbred cattle) in utilizing artificial insemination technology

Explanatory Variable	Code	Coefficient	Probability		R^2
			F-test	t-test	
Value added of cattle	PROS				
Intercept		-1.51E7***	<.0001	0.0002	0.7743
Family Labor on Cattle business	TKDS	159553.4 ***		<.0001	
Cost of inseminator	BIN	57.65**		0.0025	
Cost of natural Mating	BKA	26.60 ***		<.0001	
Family Labor on Cattle Business	TKDS				
Intercept					
Value added of cattle	PROS	97.74***	<.0001	<.0001	0.6021
Number of productive age of	JARP	0.000002628***		<.0001	
household members		1.38		0.6347	
Cattle Labor	TKTS				
Intercept		33.40***	<.0001	<.0001	0.7141
Labor of food crops business	TKNS	0.12**		0.0402	
Cultivated land area	LHN	13.58***		0.0006	
Labor on food crops business	TKNS				
Intercept		72.41***	<.0001	0.0011	0.6165
Cultivated land area	LHN	53.24***		<.0001	
Number of productive age of	JARP	8.44**		0.0416	
household members					
Cost of stable	BKD				
Intercept		-96087.4**	<.0001	0.0301	0.5225
Value added of cattle	PROS	0.01***		<.0001	
Cost of forage crops	BPH				
Intercept		5824112***	<.0001	<.0001	0.6025
Value added of cattle	PROS	0.12***		<.0001	
Cost of Education and Health	BPKS	-0.01		0.1838	
Cattle Health Cost	BOB				
Intercept		23749.12***	<.0001	0.0030	0.5752
Value added of cattle	PROS	0.0384***		<.0001	
Cost of Education and Health	BPKS	-0.0021		0.1272	
Labor Cost of Cattle Business	BTK				
Intercept		559617.7**	0.0001	0.0379	0.6882
Family Labor on Cattle business	TKDS	30078.45***		<.0001	
Cost of forage crops	BPH	-0.52***			
				0.0007	
Revenue of selling cattle	PNS				
Intercept		7208853***	0.001	<.0001	0.5533
Value added of cattle	PROS	0.14***		0.0002	
Production value of manure	NPKS				
Intercept		-156970***	<.0001	0.0017	0.6175
Value added of cattle	PROS	0.02***		<.0001	
Rent out value of stud cattle	NMJ				
Intercept		-4349179***	<.0001	<.0001	0.7072
Value added of cattle	PROS	0.38***		<.0001	
Value of unsold cattle	NTD				
Intercept		-9108377***	<.0001	0.0004	0.7596
Value added of cattle	PROS	1.21 ***		<.0001	

Food crops income	PDNS				
Intercept		2138526	<.0001	0.4449	0.6048
Labor on food crops business	TKNS	94725.37***		0.0007	
Cultivated land area	LHN	1524769		0.4046	
Non farm Income	PDLP				
Intercept		7545173*		0.0888	
Off farm Income	PDOF	-0.46**	0.0406	0.0462	0.5662
Number of productive age of household members	JARP	1826450		0.2466	
Food Consumption	KP				
Intercept		4885729***		<.0001	0.7011
Household Income	PDRT	0.43**	<.0001	0,0170	
Education of head	PDFO	172132.0*		0.0870	
family size	JART	1350623 ***		<.0001	
Non food consumption	KNP				
Intercept		7743148***		0.0079	0.6035
Household Income	PDRT	0.12***	0.0050	0.0084	
Food Consumption	KP	-0.04		0.1531	
Family Saving	TAB				
Intercept		-1.129E7 ***	<.0001	0.0004	0.9715
Household Income	PDRT	0.38***		<.0001	
Non food consumption	KNP	-0.67***		<.0001	

Source: Primary data managed using SAS 9.1 program (2012)
***, **, * Significant rate of 1% , 5% and 10%

Moreover, natural mating cost had significant effect on value added of cattle for natural mating is an alternative option for the breeder if the prospectus PO cattle by artificial insemination is not available at the time their cattle is ready to mate, thus, the farmer will seek the stud that will be mated with their female cattle. However, if viewed from analysis parameter value, it portrays that cattle added – value achieved from artificial insemination is higher than cattle added – value of natural mating. It is caused that the quality of male ongole-crossbreed cattle with AI technical is better than male prospectus of natural mating technical. Natural mating process, the stud usually serves five female a day, so that the cattle is often tiresome as consequence the natural mating is delayed sometimes.

The usage of family labor significantly provides consequence on Value added of cattle for the breeder takes care their cattle daily in better way as the result the cattle has well physical appearance as labor and their value will be higher as well. The family labor in cattle business comprises giving water and feed, bathing, mating, selling and managing the manure as compost.

Value added of cattle gave significant influence on the use of family labor in cattle business because the larger value added resulting from insemination and natural mating makes family allocate much time to take care their cattle, particularly giving forages and drink or taking care the pregnant cattle as well as looking after the calf. It shows that the potency of family labor has been used in cattle business since the family does not substitute their power with hired labor.

Total of productive age of family members are less affecting the use of family labor in cattle business since the use of family labor is measured by the overall family condition. Thus, the total of productive age of family members are also allocated to food crops activity or working outside of agriculture field to gain additional income

Labor of food crops business sector had significant influence on the cattle labor since the breeder requires their cattle to do certain works, such as plowing and transporting the harvest. By that, the cattle and human labor will be inter-completing mutually one with another. The usage of cattle labor, further, by breeder's family was not only used in farmer's own farm, but also as the labor in others' field to make money. As the substitute of family labor, the cattle were consequently used as labor.

Similarly, the cultivated land area had significantly effect on cattle labor. It means that the cattle labor was potentially utilized by breeder in food crops management. The family, then, employees the cattle labor to cultivate their food plant field, for example, corn, rice, red bean, and so on. The land extensification has greater influence in the utilization of cattle – labor. Moreover, the extensification of cultivated area is responded directly by the family through increasing the work hour of cattle – labor. As a reason, that is, the cattle also are rented by others family, either cultivating the field or transporting their harvest as well as other material.

The cultivated land area had major influence on human labor in food crops activity for the vast of cultivated area so the family cannot fulfill the necessity of labor, therefore, they has to hire the labor outside their family. Despite those things, some farmers had family member that was being at school, so that, they cannot wish to assist all agriculture tasks. The larger vast area results on the large amount of plant seed, as consequence it required the management in long period, starting from land management, weeding, planting, fertilizing as well as eradicating disease and pest, maintaining plant before harvest time and harvesting. The other reason was that the breeder usually plants corn to feed the cattle as well as family income source. In this stance, family tries to adding working hour, even they spent some funds for hireling. This phenomenon, hence, enhances family to apply the expansion of corn – field. As the result, the increase of corn – field was followed with the demand of hired labor. The fact showed that farmers utilizing of mix-farming system on their agriculture field; aside planting corn, they also plant other plant, such as bean, red bean, red onion and other.

Number of productive age of household members had sizeable effect on labor on food crops activity since the factor influencing the family labor was highly defined by overall family's background and condition. Further, total of family members and its composition influence the utilize of family labor. In addition, the composition and total of family member that comprises greatly in productive age directly have higher potency to have an extra total of labor

The value added of cattle significantly had important effect on the cost of stable because the increasing of cattle added value reflects on the improvement number of cattle ownership, consequently, the breeder had to extent their cage. The cage was required to keep the existing cattle, especially at night in order to avoid thievery, while, at noon, the cattle is released nearby common land.

Likewise, the value added of cattle had major role in the cost of forage crops for this cost depends on total of herd size resulting from insemination technology and natural mating. The larger total of cattle, the greater the cost is. If, otherwise, the green – feed was less, thus, the growth of cattle will be bothered and in far it will reduce value added in livestock. Nonetheless, the forage allocated in the research is free of charge, yet the cost of forages was measured from the wage expensed by breeder in seeking out the grass The family will face barrier to find grassing area for the cattle at dry season, as result, the breeder will seek out location further for grassing area. It means that the cost of forage is larger. Since the feed not only from grass, but also from corn's leaf and young corn as well shows the farmer in research area not only considers the feed quantity, but also its quality. The reason is that, though, the cattle genetic potency is higher, if the feed giving is inappropriate with its quality and quantity standard, then, the high production and cattle added – value will not be reached out. The result was similar with Mapiye *et al* [18]

In contrast, the education and health cost negatively less affects on the cost of forage. The reason was that if family requires education tuition for their children, thus, the breeder will sell their cattle and it tends to reduce feed cost. The increasing of education and health cost is indirectly responded by breeder by selling their cattle since they still have harvest of food crops to fulfill the education and health cost. The other is that the improvement of education and health cost was not also retorted by reducing feed cost for it assumes highly important for the growth and developing of cattle

The Value added of cattle had significant influence on cattle health cost, depicts that the cattle health is essential and establish the value added of cattle. If the cattle are sick and died, so it will reduce value added in turn the breeder will protect their cattle's health condition, though they need to spend much money on that. Therefore the most prominent constraint to livestock production is prevailing infections and parasitic disease

While, the education and health cost negatively less influenced on cattle health cost since the family had budget limitation, thus, the increasing of education and health cost tends to influence on cattle health cost. However, the increasing of education and health cost is indirectly answered by reducing cattle health cost for the breeder considers that the health is crucial to improve the value added. In one side, education and health are two necessary things to increase quality and productivity of family resource because various family economic policies are highly influenced by education investment, working hour allocation and consumption extent *Labor*

The family labor in cattle business gave significant effect on family labor cost in cattle business. The reason was that each cattle activity requires several costs including labor cost. Even, family not spends labor cost to take care the cattle, yet family labor cost on cattle took care was measured with the approach of wage spent by breeder on various activities in managing the cattle. In research area, the work activity on

cattle business comprises of mating the ready – mated cattle by insemination or natural mating, dragging into stable, bathing, manure processing as compost and selling the cattle as well, while feeding and giving drink of cattle was measured as cost of forage crops.

Equally, feed cost negatively effects on family labor cost in cattle business since the calculation of feed cost and family labor cost was based on family labor wage in feeding the cattle and other activity such as bathing, mating, dragging into stable and else. It means that the higher the cost of forage, the lower labor cost. This condition was in line with economic theory that the bid of family labor in certain agriculture sector was changed over with family labor for other activity.

The value added of cattle had considerable effect on revenue of selling cattle since the farmer raises ongole – crossbreed type that are appropriate with the condition and necessity of society in research area. Value added of cattle in Village of Kanonang III relies on cattle variety, total of cattle ownership and cattle condition as well. In general, the increasing of value added attributable to the use of artificial insemination technology was followed by the improvement of cattle selling price, as the upshot, the breeder's incomes is bigger . In research area, the cattle selling price is dependable on the physical appearance of cattle since the cattle was used as labor assisting farmer's task, thus, if the breeder sells their cattle as beef then the price will be lower. The increasing of value added of cattle is indirectly responded by the farmer to sell their livestock because they will sell cattle in certain condition, like paying their children's education fee, health cost, food, funerals, clothing etc.]

The reason why value added of cattle had major influence on production value of manure was that increasing of cattle will improve manure production so it is required by family labor to manage it as compost. In research area, the compost was not sale for pubic consumption, but it was only used by breeder family for food crops field and grass production. The measurement on value of animal manure was done by comparing the prize of urea fertilizer. Based on farmers experienced those are 50 kilograms of urea equivalent to 200 kilograms of dung to fertilize soil.

The value added of cattle had significantly effect of rent out value of stud cattle. The reason was the stud the farmer possessed was *ongole crossbreed* selected and well – known in society for its ability in producing qualified calf as the farmer's hope, so that it influences in its renting out value. Moreover, the value of stud is ranging from Rp. 150.000 - Rp 300.000 depending on the cattle's physical appearance such as white colour, healthy, strong and sturdy. In addition, the breeder desires calf that has similar characteristic with the stud as well as the parental.

The cattle's value added also had significant effect on value of unsold cattle because the breeder raises productive crossbred-ongole cattle for working and producing descendent, it was less than 6 years old included of pregnant cattle and stud. In a year, the farmer averagely achieves extra calf from artificial insemination and natural mating program, so the value of cattle possessed is larger. At 18 months up to 28 months, the female starts being mated and the stud begins as prospectus source. As result, if the age of female and stud is more than 7 years old, meaning that they will be sold by breeder considering their unproductiveness.

Labor on food crops activity had major role in food crops income since food crops activity requiring many labors in order to gain the result as hoped starting from preparing area, planting, fertilizing, preventing of pest and disease, irrigating, plant management before harvest time and harvesting. In conducting this kind activity, beef breeder often has to rent additional labor outside of their family.

The cultivated land area that had fewer effects on the income of food crops business reflects that the income received was not used to extend their cultivated field, but used as other agriculture capital such as fertilizer, drugs and labor. This phenomenon shows that the farmer starts to employee intensively agriculture effort because of the limited ownership of farm land.

The family income from *off farm* activity negatively impact on non farm income. The motive was that the breeder employees their ability in *off farm* activity to sustain family income, such as hired worker, trading the harvest and cattle as well in order to meet the demand for food and non food. This condition will affect on family activity in non agriculture sector, therefore it will reduce income from that sector.

The total of productive age in family member had less influence on farmer's income outside of agriculture sector. It causes that not all family members conduct external activity of agriculture. Then, the family member results their extra income from civil servant, private employee, expertise or kiosk, usually done by husband or wife since their children are at school, either elementary or university. The other motive was the family still requires their family member to take care the cattle and their farm land.

The family's income results major influence on family's food consumption. The reason was that the additional family's income in particular edge makes family will use it to add food consumption type and volume.. Family allocates some of their income to fulfill other necessity. Not all of the additional income was used by household to meet food consumption. To particular edge, extra incomes will utilized by family in fulfilling their secondary need.

Further, the formal education of head had not significant effects on food consumption because the family was rationally in allocating their income for food consumption. Family in Village of Kanonang III begins to apply health and simple way of life by consuming food based on its quantity, but prefers on its quality. It was indicated that well – educated person tends to prioritize food quality rather than the quantity.

Finally, the family size results major affects food consumption since the higher the family member, the bigger the need of rice and meat requires. The family, moreover, highly considers family's food necessity for daily activity in cultivating the field and outside of it.

Significantly, the family's income results sizeable effect on non food consumption. The reason was that the income achieved by family was allocated to various daily needs including non food such as the need of agriculture production process, education and health, clothes, social – religion matter, transportation and else. The breeder's family, however, considers the priority scale of expenditure for non food consumption as well the food consumption having less influenced on non food consumption reflects that the family distributes their income on both expenditure types. Yet, the family responds the increasing of expenditure on food consumption ultimately by reducing non food consumption since the family in Village of Kanonang III also considers education and health cost, social religious spending as well as agriculture expenditure.

The family's income giving considerable effect on family saving depicts that not all of family's income spent for consumption, but also for saving partly. The family saves their money in several forms, like cattle, regular social gathering, saving and lending cooperation as well as bank account that can be used any time to fulfill daily need such as Christmas and New Year Eve celebration, Annual thanksgiving celebration , children's education, wedding festivity, and other necessity.

Moreover, the non food consumption negatively affects family saving as if the breeder requires additional cost for their children's education tuition and health cost, or one of family member gets sick so the breeder will sell the cattle or draws their saving from cooperation or bank, as consequence their saving decreases.

Validation Model

The result of validation model (Table 3) demonstrates U^M value closes to zero meaning that the model established is not experienced systematic bias. Then, U^S closes to zero meaning that analysis result of simulation can well follow the fluctuation of actual data. Thus, U^C closes to one meaning that it is meaningless error and does not follow certain pattern but it spreads in overall observation data. Analysis result of validation indicates that economic model of cattlemen is valid enough used as simulation instrument.

Table 3 Indicator of Validation Model

Variables	Average of Actual Value	Average of Prediction Value	U^M	U^S	U^C
PROS	15,225,000	15,216,478	0.00	0.06	0,94
TKDS	141,4	141.4	0.00	0.04	0,96
TKTS	62,578	62,578	0.00	0.08	0,92
TKNS	143,1	143.1	0.00	0.26	0,74
BPTS	8,875,290	8,873,924	0.00	0.23	0,77
BKD	115,330	115,209	0.00	0.16	0,84
BPH	7,636,406	7,635,360	0.00	0.27	0.73
BOB	81,750	81,714.6	0.00	0.22	0.78
BTK	813,904	813,741	0.00	0.20	0.80
PDRT	71,770,044	71,743,817	0.00	0.13	0.87
PDS	39,602,916	39,577,168	0.00	0.09	0.91
PNS	9,356,250	9,355,046	0.00	0.24	0.76
PSTS	6,257,800	6,257,799	0.00	0.13	0.87
NPKS	184,255	184,062	0.00	0.21	0.79
NMJ	1,440,000	1,436,765	0.00	0.14	0.86
NTD	31,240,000	31,217,420	0.00	0.09	0.91
PDNS	17,081,548	17,081,547	0.00	0.17	0.83
PDLP	9,966,840	9,966,861	0.00	0.25	0.75
KP	13,409,672	13,409,072	0.00	0.21	0.79
KNP	10,633,475	10,632,153	0.00	0.13	0.87
TKRT	24,043,147	24,041,226	0.00	0.12	0.88
TAB	41,964,805	43,812,615	0.00	0.11	0.89

Primary data calculated by using SAS 9.1 Program (2012)
U^M is average bias, U^S is regression slope bias, U^C is covariance bias

The Simulation of Technological Change in the Use of Insemination on Household Economic Behavior

The simulation result can be viewed in Table 4. In the implementation of artificial insemination technology (AI) by increasing of inseminator cost of 25% (1st simulation) results on positive effect, that is,

there is an improvement of all variables in household economic of breeder such as value added of cattle, family employment, income of cattle business, total of family income, consumption and family saving as well. Therefore, similarly, the improvement of inseminator cost combined with natural mating cost (3rd simulation) has same effect with the combination of the increasing of inseminator cost, natural mating cost and the decline of cultivated land area (5th simulation) as well as combination simulation of increasing inseminator cost, natural mating cost and area of cultivated field (7th simulation), regarding on the improvement of value added of cattle. Yet, it, relatively, presents lower effect toward family's income rather than 7th simulation. Apparently, the combination simulation of improvement of inseminator cost, natural mating cost as well as cultivated land area (7th simulation) provides the best effect concerning on the welfare of household cattle farmers, if it is seen from the increasing of family income, absorbing of family labor and expenditure for consumption than other simulation. Simulation results indicate that the consumption of non food rose 1.86% to 5.46% while food consumption rose 0.67% to 1.97% which means income farmers better allocated to non food consumption . This condition means that the use of insemination technology provides improved quality of life for family farmers.

Table 4 Simulation of Technological Change In The Use Of Insemination

Endogen Variable	Basic Value	SIM 1 (%)	SIM 2 (%)	SIM 3 (%)	SIM 4 (%)	SIM 5 (%)	SIM 6 (%)	SIM 7 (%)	SIM 8 (%)
PROS	15,216,478	8.91	13.04	21.95	13.64	21.95	8.91	21.95	8.91
TKDS	141.4	2.48	3.68	6.22	3.68	6.22	2.48	6.22	2.48
TKTS	62,578	0.00	0.00	0.00	7.22	-7.22	7.22	7.22	7.22
TKNS	143.1	0.00	0.00	0.00	8.46	-8.46	8,46	8.46	8.46
BPTS	8,873,924	2.52	3.95	6.48	3.95	6.48	2.52	6.48	2.46
BKD	115,209	16.35	23.92	40.27	23.92	40.27	16.35	40.27	16.35
BPH	7,635,360	2.17	3.17	5.34	3.17	5.34	2,17	5.34	2.02
BOB	817.146	6.38	9.33	15.71	9.33	15.71	6,38	15.71	6.23
BTK	813,741	2.52	3.68	6.20	3.68	6.20	2,52	6.20	3.27
PDRT	71,743,817	5.73	8.34	14.07	11.06	11,36	10,78	16.79	11.74
PDS	39,577,168	10.38	15.13	25.51	16.27	24.37	15.76	26.65	15.77
PNS	9,355,046	2.05	2.99	5.04	2.99	5.04	2,05	5.04	2.05
PSTS	6,257,799	0.00	0.00	0.00	7.22	-7.22	34.02	7.22	34.02
NPKS	184,062	16.52	24.16	40.68	24.16	40.68	16.52	40.68	16.52
NMJ	1,436,765	35.90	52.52	38.41	52.52	38.41	35.90	38.41	35.90
NTD	31,217,420	11.51	16.85	28.36	16.85	28.36	11.51	28.36	11.51
PDNS	17,081,547	0.00	0.00	0.00	8.75	-8.75	8.75	8.75	8.75
PDLP	9,966,861	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-5.97
KP	13,409,072	0.67	0.98	1.65	1.30	1.33	1.26	1.97	1.38
KNP	10,632,153	1.86	2.71	4.58	3.60	3.69	3.51	5.46	3.82
TKRT	24,041,226	1.20	1.75	2.94	2.31	2.38	2.26	3.51	2.46
TAB	43,812,615	8.11	11.81	19.92	15.65	16.08	15.26	23.76	16.62

Source: Primary data managed using SAS 9.1 program (2012)

Remark:

SIM 1 (1st Simulation) : Inseminator cost increases of 25%.
SIM 2 (2nd Simulation) : Cost of natural mating increases of 25%.
SIM 3 (3rd Simulation) : Combination of 1st and 2nd simulation.
SIM 4 (4th Simulation) : Cost of natural mating and area of cultivated land increase of 25%.
SIM 5(5th Simulation) : Cost of inseminator and natural mating increase 25%, and area of cultivated land area decreases of 25%.
SIM 6(6th Simulation) : Inseminator cost, cost of natural mating and cattle-labor wage increase of 25%.
SIM 7(7th Simulation) : Inseminator cost, cost of natural mating and cultivated land increase of 25%.
SIM 8(8th Simulation) : Inseminator cost, cultivated land area, beef-labor wage, cost of education and health as well as off farm activity income increase of 25%.

In terms of combination of the increasing of inseminator cost, cultivated land area, cattle labor wage, subsidize of education and health cost as well as income of *off farm* activity (8th simulation) shows the increasing effect on income of cattle business and food crops business, despite a negative impact on household income outside of agriculture sector. The biggest increasing effect of 8th simulation is revenue from renting out cattle that is, relatively similar increasing with the result gained from the combination of improvement of inseminator cost, natural mating cost and cattle labor wage (6th simulation), consequently, it provides likely similar effect on breeder income of cattle and family's income as well.

The utilization of insemination technology, in fact, has the capacity to improve the family labor on cattle business compared with the absence of the technology usage described in 1st to 8th simulation, where the family labor increases between 2.48% up to 6.22%. It means that this technology usage can improve income as well as family consumption. Moreover, it depicts that the family is reducing their leisure and

adding their working hour in cattle business indicating that cattle, in research area, is not only as side job, but it has also as family main business principle, eventually. The result is different with Ellis [19]

CONCLUSIONS

Interconnecting of factors influencing household economic of crossbred-ongole cattle farmer was, that, the artificial insemination technology affects on value added of cattle. Thus, the value added of cattle influences on the usage of family labor on cattle business, cost of stable, cost of forage crops, cattle health cost, revenue of cattle selling, production value of manure, renting out value of stud and value of unsold cattle. The increasing of value added of cattle, in turn, can increase family income, family labor, consumption and family saving. The combination of increasing inseminator cost, natural mating cost and land area cultivated by 25% provide the best impact on household economy of breeders, which is the improvement on value added of cattle, family labor, cattle income, food crops income, household income, consumption and family saving as well. Use of insemination technology can enhance the use of family labor 2.48% - 6.22% so that cattle not just a sideline but had become a major business families. Additional household income was relatively more allocated to non food consumption than for food consumption means insemination provides improved quality of life for cattle farming households. The alternative policy recommended was, *first*, that government should continuously introduce the seed or cement of ongole crossbreed cattle by artificial insemination technology in research area followed by the procurement of inseminator officer. *Secondly*, if in the implementation of artificial insemination faces barriers, therefore, government is necessary to intensify natural mating system by introducing prospective stud to the breeder since the limitation of stud cattle in research area.

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