Full Length Research Paper

Income upgrading model of cattlemen in the utilization of artificial insemination: A case study in village of Kanonang III regency of Minahasa – Indonesia

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Cattlemen allocate labor on their cattle business. These activities have contributed further to the family income used to meet household needs. Besides the beef business, they seek food crops such as rice, corn, peanuts and so forth to obtain additional income. The breeders utilized the technology of artificial insemination and natural mating in the beef cattle production. The usage of insemination technology was expected to increase the income derived from the beef cattle that will result in increasing the investments and the income of farming food crops. The objectives of this study were to analyze the correlating factors that affect the farmers' income from the cattle business and farming crops under condition of the usage of artificial insemination technology and to analyze the effects of the external factor changing toward the profits of beef cattle business, the costs of cattle production , the cost of crop production, food crops farm income, animal health costs and the cost of the barn with the condition of the artificial technology usage. The measurement technology of the artificial insemination used the cost inseminator approach. This research was a case study of 70 cattlemen in the village of Kanonang III Minahasa District selected by random sampling. Model of simultaneous equations with the method of 2 SLS were used to estimate all the parameters of the study. The result of these research showed that the economic model of cattlemen can be explain in relation to the use of artificial insemination with income and costs of production in cattle and farm crops as well. The effect of external factor on cattlemen household's economy was that 10% increasing of inseminator cost was the best alternative scenario that can increase the income of cattle business with 7.48%, beef production cost 0.17%, food plant production cost 5.32%, income of food plant business 4.56%, cattle medication cost 4.52% and cage cost 2.27%. These results indicated that the artificial insemination technology could improve economics performance of cattlemen.

Key words: Technology of artificial insemination, inseminator fees, revenues of beef breeders, economy model of the beef breeders.

INTRODUCTION

Minahasa is one of the districts that is potentially for cattle business. This business is a source of income for farmers in a rural area such as cutting jobless, cultivating the land and a means for transportation. The number of cattle population in Sulawesi Utara in 2009 were 108.335 and the most population was in the district of Minahasa as many as 27.938 (Sulawesi Utara, counted in number, 2010). The process of production, income and labor allocation in households are as an interrelated unit so that any change of policy in managing the activities of beef cattle will affect the production, income and employment (Rochaeni and Lokollo, 2005; Hartono 2006). Besides perform cattle business farmers in Kanonang III village seek food crops such as rice, corn, peanuts, red beans, tomatoes and red onion to meet household needs. The cattles are used to cultivate the field and to transport the farm crops. Meanwhile the cows' dung is then used as a source of manure to fertilize the fields (Hoddi, 2010).
Beef breeding business in Kawangkoan regency of

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Minahasa is mostly traditional breeders managed in small-scale by using simple technology. The main characteristic of the cattlemen family shows that the business is managed by household and their family members in hereditary. Commonly, they do the business to cultivate their fields and to transport the farm crops. This phenomenon is as a household behavior as producer in economic activity. A household has a role as not only both producer and labor supplier but also consumer. The labor of family members is allocated for the business of breeding and the other agricultural activities like food crops to generate income.

Diwyanto (2008) claims that artificial insemination program has to improve the quality of beef cattle through artificial injection, further, to increase the production and the breeders' income. But there are still many obstacles for breeders in relation to insemination technology such as the available beef of mixed blood 'Ongole' (PO) by artificial insemination and the discontinuity of inseminators' member. They cause the breeders back to the natural mating even though the breeders have difficulties in supplying cow stud. This condition is similar to Hadi and Ilham (2002) statements that the efforts of insemination still have some obstacles as follows, the limited inseminator member, the qualified cow stud and the facilities of insemination. The artificial insemination technology has been applied extensively in Indonesia since 1972 in dairy cows and beef cattle but only applied in Minahasa District since 1992. Various activities of artificial insemination carried out in Indonesia have often not been successful due to various factors such as farmer's ability to detect lust, inseminator availability and so on. Implication of crosses in beef cattle in Indonesia was very diverse so it is necessary to evaluate the strategy in order to obtain better benefits at the farm level.

Winarso et al. (2005) points out that the income, at small-scale farmer business, is net return and this is the subtraction of overall revenue with the cost expensed by the farmer. The farmer's income, thereby, comprises of the result of production selling, wage of family labor and interest rate itself (tools, land, etc). Thus, the income is divided into (1) Gross income, an income of farmer business that has not been subtracted with the cost. Gross income consists of cash and non cash. The form of cash is the real result received, while non-cash is the unsold product but to consume or stock, (2) Net income, a gross income is subtracted with the cost or revenue after subtracted with the cost, (3) Manager income is the subtraction result of total output with total input, either input actually paid or merely measured. If applied to small farmer, it is generally negative. Income value or production cost of beef production, based on economic theory, is overall liabilities that are bear by producer (farmer) to provide goods in terms of ready-used by consumer and in the income measurement, it can be classified into two, fixed and unfixed cost (Sudarsono, 1995). In the short term, there is fixed and variable cost yet in the long term all costs are variable cost. Moreover, fixed cost is cost unrelated with production volume meaning that in certain period the amount is constant, such as cage depreciation, construction tools, interest over capital and so on. Meanwhile, the unfixed cost is cost related directly with production volume meaning that the changing of variable cost will cause the changing of production volume resulted, for example feed cost, medicines and vaccine, cage cost and inseminator cost.

To boost income of beef cattle business, the breeder has to utilize artificial insemination technology or natural breeding system that the implementation requires several costs, inseminator cost for artificial insemination process and natural breeding system by renting male cow. In term of cattle growth optimally, thus, the breeder has also expensed on feed cost, cattle medication cost, cage cost as well as labor cost. Therefore, the income of beef breeder also derives from food plant business such as rice, corn, peanut, red peal, tomato and shallot. The production process to obtain income from food plant business also requires production cost like fertilizer cost, drugs and labor cost. According to that issue, the beef breeder will allocate their income in beef breeder and food plant business.

Unfortunately, the research dealing with technology utilization in beef cattle business is limited on integrated technology of cattle and plant, thus, the effect on the production and farmer's income (Elly et al., 2009; Priyanti, 2009), the effect of cattle fattening and feed technology toward the income of beef cattle business (Karyasa, 2007). The research concerning on the utilization of artificial insemination is still limited on the effect of the income of beef cattle business (Sulin et al., 2006; Eniza et al., 2006), while the information relating the correlation of the utilization of insemination technology, income of beef cattle business, production cost of beef cattle business as well as income of food plant is inadequate indeed. The developing of cattle population from insemination technology in study area was faced constraint such as the inseminator's number. There were two insemination officers which had to serve all cattle in this area, so farmers used to pay them in every insemination activity. The inseminator will be more enthusiastic to do their job if the farmers pay them. This phenomenon then create question; what are the impact of inseminator cost to the income and production cost of cattle business and how income of cattle influence cattle's production cost and income from food plant business.

According to above consideration, thus, the main objectives of the research was to
(1) Analyze the relevance of factors affecting cattlemen's income of beef cattle business and food plant business in the condition of utilizing artificial insemination technology,

(2) To analyze the effect of external factor changing on the income of beef cattle business, production cost of food plant, income of food plant, cattle medication cost and cage cost in the condition of utilizing artificial insemination technology.

RESEARCH METHODS

Population and research sample

This research was a case study conducted in the village of Kanonang III, District of Kawangkoan, Regency of Minahasa, North Sulawesi Province, Indonesia on June 2011 – August 2011. The reason why village of Kanonang III was chosen as the research location was that the village has the largest population of beef cattle in Regency of Minahasa, 765 beefs in 2010 (North Sulawesi in Grade, 2010). Total of sample in this research was 100 farmers selected by random sampling of 230 breeders by considering that farmers at least has one cattle and ever sold it out, they have utilized artificial insemination technology on their cattle and own land for cultivating. The research data was a primary data which was an inseminator cost, natural breeding cost, income of beef cattle business, cattle medication cost, income of food plant business and production cost of beef cattle as well as food plant collected through interview by using question list. Data collecting technique was employed with survey technical 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 was conducted with head of village, chief of hamlet and head of animal health post to ensure the trustworthiness of information from respondents.

Data analysis method

In answering the research aim, approach of econometrics model was used (Greene, 2003). Thus, the measurement of artificial insemination technology utilizes inseminator cost. Economic model of cattlemen established the uses of simultaneous equation, so that, it could explain the relevance factors affecting income of beef cattle business and food plant as well in the condition of insemination technology. This model has 6 equations consisting of 5 structural equations and one identity equation. The number of endogenous variable was 6, while exogenous were 4. Moreover, the model identification was done to determine assumption method parameter. Based on Koutsoiyannis (1977), the identified equation could be recognized by comparing exclude variable (K-M), the number of equation is subtracted one (G-1). Since the simultaneous equation model consists of 6 equations (G)

and 10 variables (K) as well as the amount of predetermined variable in each maximal equation was 3 (M), the established equation includes over-identified (K-M > G-1). Therefore, in order to assume this, estimation parameter is used,   2 SLS (Two Stage Least Square) method and to acknowledge the effect of external factor changing on income and production cost of beef and food plant is conducted with simulation analysis toward (1) 10% rising of inseminator cost, (2) 10% rising of natural breeding, (3) 10% rising of feed cost, (4) 10% decreasing of family labor wage in beef business, (5) 10% decreasing of inseminator and natural breeding cost, (6) 2 and 4 of simulation combination as well as (7) 3 and 4 of simulation combination. Simulation is conducted after the model was validated prior by using Theil's Inequality Coefficient and decomposition criteria (Greene, 2003) in order to compare actual value and assumed value of endogen variable. Thus, decomposition of U- Theil comprises of U^M (average bias) measuring how far the average simulation and actual value deviate from each other, U^S (regression slope bias) quantifying the deviation of regression slope and U^C (covariance bias) is component indicator of residual bias. A model has well prediction ability if U^M and U^S value close to zero and U^C closes to one. Data tabulation utilizes statistical analysis system (SAS) program version 9.1.3. Following is the simultaneous equation model established:

Income of Beef Cattle Business
$$PDS = a_0 + a_1 BIN + a_2 BKA + a_3 BPH + e_i \quad (1)$$
Hypotesis $a_0 < 0$, $a_1, a_2, a_3 > 0$

Beef Production Cost
$$BPTS = BKD + BPH + BIN + BKA + BOB + BTK \quad (2)$$
$$BOB = b_0 + b_1 PDS + e_i \quad (3)$$
Assumed parameter mark expected c_0, $c_1 > 0$
$$BKD = c_0 + c_1 PDS + c_2 BIN + e_i \quad (4)$$
Hypotesis d_0, $d_1 > 0$, $d_2 < 0$

Food Plant Production Cost
$$BTP = d_o + d_1 BPTS + d_2 PTP + e_i \quad (5)$$
Hypotesis $b_0, b_1 < 0$, $b_1 > 0$

Income of Food Plant Business
$$PTP = e_0 + e_1 BTP + e_2 BTK + e_3 PDS + e_i \quad (6)$$
Hypotesis $b_0, b_1, b_3 > 0$, $b_2 < 0$

Where, PDS was income of beef cattle business (IDR/year/breeder), BIN was inseminator cost (IDR/year/breeder), BKA was natural breeding cost (Rp/year/breeder),   BPH   was   feed   cost (IDR/year/breeder), BTP was food plant production cost (IDR/year/breeder), BPTS was beef cattle production cost (IDR/year/breeder),   BKD   was   cage   cost (Rp/year/breeder),   BOB   was   beef medication cost (IDR/year/breeder), BTK was labor cost of beef business

Table 1. Income structure and farm business cost.

Description	Value
(A) Revenue of Cattle Business (IDR/year)	48,478,206 (100%)
Cattle selling (IDRp/year)	9,356,250 (19.30%)
Compost value (IDR/year)	184,255 (0.30%)
Cattle labor (IDR/year)	6,257,701 (12.91)
Renting male cow (IDR/year)	1,440,000 (2.97%)
Value cattle has not been sold (IDR/year)	31,240,000 (64.44%)
(B) Cattle Production Cost (IDR/year)	8,913,733 (100%)
Feed (IDR/year)	7,636,406 (85.67%)
Labor (IDR/year)	813,904 (9.13%)
Drugs (IDR/year)	81,750 (0.92%)
IB Inseminator (IDR/year)	54,650 (0.62%)
Natural breeding (IDR/year)	173,250 (1.94%)
Cage and tools (IDR/year)	115,330 (1.29%)
Cage depreciation (Rp/year)	38,443 (0.43%)
R/C Ratio	5.43
(C) Income of Cattle Business (A – B) (IDR/year)	39,564,473 (69.84%)
(D) Revenue of Food Plant Business (IDR/year)	33,676,561 (100%)
Result selling (IDR/year)	31,884,968 (94.68%)
Household consumption (IDRp/year)	1,791,593 (5.32%)
(E) Food Plant Production Cost (IDR/year)	1,6595,013 (100%)
Seed (IDR/year)	201,000 (1.21%)
Fertilizer (IDR/year)	2,530,739 (15.25%)
Insecticide (IDR/year)	870,000 (5.24%)
Human and cattle labor (IDR/year)	1,299,3274(78.30%)
R/C Ratio	2.02
(F) Income of Food Plant Business (D-E) (IDR/year)	17,081,548 (30.16%)
(G) Income of Cattlemen (C+F) (IDR/year)	56,646,021 (100%)

Source: Tabulation Result of Primary Data (2012)

(IDR/year/breeder) and PTP was income of food plant business (IDR/year/breeder), a0, b0,c0.d0.e0 are intercept, ei was factor disturbance.

RESULT AND DISCUSSION

Income structure and farm business cost

Table 1 shows the calculation result of cattlemen's income on beef and food plant business in a year. The result explains that 69.84% of breeder income comes from beef business and 30.16% is from food plant activity. The type of plant cultivated comprises of rice, corn, peanut, red peal, tomato and shallot. In addition, the revenue from beef business is 64.44% derived from the cattle value that has not been sold, while 19.30% is the revenue from the cattle selling. The revenue gained breeder from renting the beef labor was 12.91%.

Table 2. Estimation result of economic model of cattle farmer.

Variable	Code	Estimation Parameter	Probability		R^2
			F-test	t-test	
Income of beef cattle business	PDS				
Intercept		-1.861E7***	<.0001	0.0019	0.7224
Inseminator cost	BIN	542.35***		<.0001	
Natural breeding Cost	BKA	94.15***		<.0001	
Feed cost	BMT	1.62**		0.0395	
Food plant production cost	BTP				
Intercept		-9856.9	0.0005	0.3825	0.5867
Cattle production cost	BPTS	-0.32		0.1344	
Income of food plant business	PTP	1.14***		0.0003	
Cattle medication cost	BOB				
Intercept		32336.39***	<.0001	<.0001	0.7298
Income of cattle business	PDS	0.0012***		<.0001	
Cage cost	BKD				
Intercept		28635.28	<.0001	0.3472	0.6267
Income of cattle business	PDS	0.0060***		0.0001	
Inseminator cost	BIN	-2.81**		0.0414	
Income of food plant business	PTP				
Intercept		3934082	<.0001	0.3742	0.5877
Food plant production cost	BTP	0.59		0.2340	
Family labor cost on cattle business	BTK	-0.09		0.3526	
Income of cattle Business	PDS	0.08***		0.0090	

Source: Tabulation result of primary data of SAS 9.1 for Windows (2012)
***, **, significant in 1 and 5%.

The biggest cattle production cost was feed cost of 85.67%, while other cost component was below 10%. The calculation of revenue ratio on cattle business cost (R/C ratio) shows 5.43 meaning that the farmer obtained IDR 5,430 of revenue for IDR.1,000 each of cost expensed. Further, the revenue of cattlemen of food plant business was 94.68% of the result of food plant selling and 5.32% was the result for family consumption. The research result illustrates that the component of biggest food plant production cost was labor cost of 78.30% and the other production cost was smaller than 20%. The R/C ratio measuring for food plant business was as 2.02 meaning that food plant business was already efficient since IDR.1,000 each of cost expensed the breeder receives IDR. 2,020 of revenue.

Estimation of economic model of cattlemen in utilization of artificial insemination technology (IB)

The estimation result of economic model of cattlemen can be seen in Table 2. All estimation signs for variable affecting endogen variable have adjusted with economic criteria. Meanwhile, most exogenous variable had actual effect on endogen variable at the level of 5%.

The analysis result demonstrated that the income of cattle business was affected by inseminator cost, natural breeding cost and feed cost with <0.0001 of probability.

Determination coefficient value (R^2) is 0.7224, which means that inseminator cost, natural breeding and feed cost affected income of beef cattle business as 72.24% and 27.76% was the rest of other factors not available in the model. In addition, inseminator cost has positive influence toward the income of beef cattle business by its parameter as 542.35 and it is statistically significant in interval test <0.0001. Thus, natural breeding also had positive influence on beef cattle business by its parameter as 94.15 and it is statistically significant in interval test < 0.0001. Feed cost had positive influence as well on revenue of beef business by the parameter 1.62 and it is statistically significant in the interval test 0.0395.

The increase of inseminator cost could motivate the insemination officers to do their tasks therefore the cattle can produce offspring from artificial insemination technique. The result showed that if inseminator cost rise IDR. 10.000, the farmer's income from cattle will increase IDR 5.423.500. Farmers in the study area used to benefited cattle as draught cattle therefore its price was more expensive than beef cattle.

The result showed that the analysis result explains food plant production cost was affected by beef cattle production cost and income of food plant business by 0.0005 of probability. Determination coefficient value (R^2) is 0.5867 meaning that beef cattle production cost and income of food plant business affected on food plant production cost as 58.67%, while 41.33% was the rest for

Table 3. Indicator of validation model.

Endogen Variable	U^M	U^S	U^C
Income of Beef Business (PDS)	0.00	0.08	0.92
Beef Production Cost (BPTS)	0.00	0.07	0.93
Food Plant Production Cost (BTP)	0.00	0.11	0.89
Income of Food Plant Business (PTP)	0.00	0.22	0.78
Cattle Medication Cost (BOB)	0.00	0.20	0.80
Cage Cost (BKD)	0.00	0.16	0.84

Source: Tabulation Result of Primary Data of SAS 9.1 for Windows (2012)
Note: U^M = average bias, U^S = regression slope bias, U^C = covariance bias.

other factor not available in the model. Moreover, beef cattle production cost had negative influence toward food plant production cost by its parameter of -0.32 and it was statistically not significant in interval test 0.1344. Income of food plant business had positive influence on food plant production cost with 1.14 parameter and statistically it was significant in the interval test 0.0003.

Analysis result demonstrated cattle medication cost was affected by income of beef cattle business by <0.0001 probability. Determination coefficient value was 0.7298 meaning that income of beef business affects medication cost as 72.98%, and the rest of 27.02% was for other factor not available in the model. Thus, income of beef cattle business had positive control on cattle medication cost by 0.0012 parameter and it was statistically significant in the interval test <0.0001

Analysis result explains that cage cost was influenced by income of beef cattle business and inseminator cost by <.0001 of probability. Determination coefficient value (R^2) is 0.6267 which means that income of beef cattle business and inseminator cost effect on cage cost as 62.67%, while the rest of 37.33% was for other factor not available in the model. In addition, revenue of beef cattle business has positive influence on cage cost by its parameter is 0.0060 and statistically it was real in the interval test 0.0001. Inseminator cost has negative influence on cage cost with -2.81 parameter and it was statistically real in the interval test 0.0414.

Furthermore, analysis result points up that income of food plant cattle business was influenced by food plant production cost, family labor cost on beef cattle business and income of beef cattle business by < 0.0001 probability. Determination coefficient value (R^2) was 0.5877 which means that food plant production cost, family labor cost on beef cattle business affect income of food plant business of 58.77%, and the rest of 41.23% was for other factor not available in the model. Thus, food plant production cost had positive influence on income of food plant business by its parameter is 0.59 and it was statistically not significant in the interval test 0.2340. Later on, family labor cost on beef cattle business has negative impact on income of food plant business by the parameter is -0.09 and statistically, it was

not significant in the interval test 0.3526. Income of beef business has positive impact on revenue of food plant business by the parameter is 0.08 and it was statistically significant in the interval test 0.0090.

Validation model

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

Effect of external factor changing

The effect of external factor changing scenario would be viewed on the endogen variable of Income of beef cattle business, beef production cost, food plant production cost, income of food plant business, cattle medication cost and cage cost in the condition of utilizing artificial insemination technology (Table 4).

The analysis resulted of cost and revenue of cattlemen illustrated that most their income came from cattle business meaning that cattle business has become family main business. Moreover, cattle has greater contribution toward farmer's income rather than other incomes such as horticultural and plantation (Syafril and Ibrahim, 2006; Dewa et al., 2008). Most of breeder's income on cattle business was value of cattle that was still being cared. The reason that cattle was the main commodity for farmer that they can sell their cattle any time as they wished for instance for education tuition and medical cost or family gathering event (Winarso et al., 2010). The biggest beef cattle production cost was for feed cost comprising of grass, concentrate and agriculture residue. Indeed, it was suitable with Hoddi et al. (2011) research

Table 4. Simulation of external factor changing effect.

Variable	Basic Simulation	Alternative Scenario (%)						
		SIM 1	SIM 2	SIM 3	SIM 4	SIM 5	SIM 6	SIM 7
PDS	39,601,901	7.48	4.12	3.10	0.00	-11.60	4.12	3.10
BPTS	8,825,293	0.17	0.33	8.64	-0.92	-0.50	-0.59	7.72
BTP	16,594,517	5.32	2.81	-2.18	0.63	-8.13	3.44	-1.55
PTP	5,684,048	4.56	2.44	-0.62	0.41	-6.99	2.85	-0.21
BOB	81,759.6	4.52	2.49	1.87	0.00	-7.01	4.49	1.87
BKD	115,323	2.27	8.39	2.25	0.00	-13.82	8.39	2.25

Source: Tabulation Result of Primary Data of SAS 9.1 for Windows (2012)
Note :   SIM   = Simulation,
            SIM 1 = 10% rising of inseminator cost
            SIM 2 = 10 % rising of natural breeding cost
            SIM 3 = 10% rising of feed cost
            SIM 4 = 10% decreasing of family labor on beef business
            SIM 5 = 10% decreasing of inseminator and natural breeding cost
            SIM 6 = SIM 2 and SIM 4 combination
            SIM 7 = SIM 3 and SIM 4 combination

that the biggest production cost on beef business in Regency of Barru of South Sulawesi was feed cost reaching out of 73.42%. Then, the value of R/C ratio of beef cattle business and food plant was 5.43 and 2.02 respectively showing that both businesses financially have provided advantage for cattlemen in the research area (Suastina and Kayana, 2008).

Moreover, analysis result of estimation model of cattlemen economy in utilizing artificial insemination technology demonstrates that inseminator cost effects on income of beef cattle business since the increasing of inseminator cost will motivate inseminator personnel to conduct insemination process right on the schedule, so that the farmer gains calf addition every year and their income increases as well. Later on, the natural breeding cost also affected on income of beef cattle business because the increasing cost will enhance the owner of bull to provide qualified bull in term of producing high value calf if mated with female cow of breeder. The feed cost also influenced on income of beef cattle business since the breeder provided qualified feed from their farm such as bulrush, young corn, straw added with concentrate so that it will improve cow's weight, body shape and its selling price. Therefore, this result was in line with Soedjana's research (2007) that corn business system with beef cattle gives largest advantage in certain area.

The income of food plant business affected on food plant production cost since additional income enhances the farmer to re-invest half of the result on their farm business and expanded the farming area, so it required larger amount of seed, fertilizer, labor and insecticide.

Income of beef cattle business influenced on cattle medication cost since beef cattle selling value in research area was highly determined by the health condition of cattle itself so that the cattlemen was willing to expense additional cost to prevent and cure the ill-cattle.

By contrast, inseminator cost had negative impact on cage cost because budget limitation possessed by breeder. Increasing inseminator cost causes the breeder reduces the budget to make a cage. It was in line with the research of Elly et al. (2009) that since the budget limitation so the increasing of input cost of urea fertilizer will reduce significantly the using of TSP fertilizer input in corn business. Meanwhile, revenue of beef business impacted on cage cost since increasing revenue showed the increasing number of beef ownership, thus, the breeder will expense additional cost to make cage protecting their cattle.

In addition, income of beef business influences on income of food plant business since the breeder invests half of income gained from beef business for expanding land management frequency and land expansion as well so that it improves the production and income of food plant business (corn, peanut, and so on).

Eventually, the analysis resulted of external factor changing effect views that the utilization of artificial insemination technology showed by the increasing of inseminator cost of 10% (SIM 1) provides well effect on all economic variables of beef breeder compared to other changing (SIM 2, SIM 3, SIM 4, SIM 5, SIM 6 and SIM 7). It can be viewed from the great changing of income on beef business, beef production cost, food plant business cost, income of food plant business, cattle

medication cost and cage cost that the increasing is relatively higher. The decreasing of inseminator cost and natural breeding cost that are 10% (SIM 5) respectively has decreased all economic variables of beef breeder. Thus, the feed cost increasing of 10% (SIM 3) had increased most economic variables of breeder, excluding on production cost and income of food plant business.

Conclusion

The relevance factors affecting cattlemen's economy were artificial insemination technology (inseminator cost), natural breeding cost and feed cost effects on income of beef business. Income of beef business and inseminator cost effect on cage cost. Moreover, income of beef business, food plant production cost and family labor cost on beef business effect on income of food plant business. Food plant business cost was affected by income of food plant business.

The effect of external factor on cattlemen household's economy was that 10% increasing of inseminator cost increases income of beef business, beef production cost, food plant production cost, income of food plant business, cattle medication cost and cage cost. Therefore, the utilization of artificial insemination technology increases all economic variables of cattlemen observed.

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