GLOBAL JOURNAL OF COMMERCE & MANAGEMENT PERSPECTIVE
(Published By: Global Institute for Research & Education)
www.gifre.org

INPUT DEMAND AND CATTLE PRODUCTION IN EAST NUSA TENGGARA PROVINCE, INDONESIA

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Abstract

The farm household's behavior in deciding to purchase production input, conduct production activities, and offer output represents the household's economic activities. This study about input demand and cattle production by farm households aims to discover the cattle business production value structure, the farm household's behavior in production, and cattle business labor demand. The study was conducted in 8 villages throughout Kupang District and South Timor Tengah District, East Nusa Tenggara Province. These two districts are cattle production center districts. Data were collected between April and June 2013 by interviewing 178 respondents which were divided into two groups, households on dryland ecosystems (128 households) and households on wetland ecosystems (50 households). The study results showed that the cattle fattening business gave a relatively low profit compared to the labor share during the fattening period. Farm household persist in conducting this aspect of the business because of the limited job opportunities and social prestige. Household behavior in cattle production and production input demand are influenced by input price, especially yearling price and cattle price, labor, and the availability of credit and capital support which is differentiated based on agroecosystem zones. Increasing the income of farm households which are involved in the cattle business can be done by a) implementing yearling price and cattle determination regulations according to the standard and weight of the cattle, b) applying technological innovations in cattle fattening, especially technology to provide feed in the dry season (e.g. silage), c) the presence of other economic activities to keep the farmers busy during the cattle fattening period.

Keywords: production input, cattle production, farm household, welfare.

Introduction

Farm households in East Nusa Tenggara Province run agribusinesses which involve a variety of commodities including food crops, plantation crops, horticultural crops, and livestock. The cattle commodity, specifically, is run by the households for commercial purposes and, occasionally, social needs. Cattle are considered to be a form of savings that can be utilized by the household if the need arises (Soedjana, 2012).

Farm households which raise cattle conduct the cattle business as with any other agribusiness, by making production and selling decisions. Production decision begins from the decision to buy production input such as yearlings, feed, medicines, vitamins, and other production input, and selling the output, the cattle. Cattle are fattened for a few months and the decision to sell is made with consideration to the current selling price and household needs.

One of the obstacles faced in the cattle input and output market is the fact that sometimes the price of yearlings is obscure to the farmers. The determination of the price is done single-handedly by the sellers by assessing the yearling's condition. Similarly, the price of cattle is determined by estimating the weight and determining the price. Estimating the prices puts the farmers in loss. Regulations about weighing and setting a standard price according to the regional regulations are ignored. The study by Talib *et al.* (2007) discovered inefficiency in the cattle market and price.

Even during unprofitable market conditions, a household still makes production decisions alongside consumption decisions (Nakajima, 1986; Ellis, 1998; Bryant, 1990). The production behavior and cattle agribusiness production value and the behavior in making decisions in using input and selling the production results describes the cattle farmer's household conditions.

Based on the description above, it is deemed important to conduct a study about the economic value of the cattle business run by the farm household, the behavior in production, the demand of cash input, and the demand for labor in the cattle-raising business. The benefits of this study include supplying empirical information about the production and input demand conditions of the cattle agribusiness run by farm households in order to help increase farm households' production and welfare.

Methodology

Location, Time, and Method

East Nusa Tenggara Province was selected as the study location because it is one of the national cattle production centers. The study was conducted in eight villages throughout Kupang District and South Timor Tengah (TTS) District which consist of five villages in the dryland agroecosystem zone and three villages in the wetland agroecosystem zone. Kupang and TTS Districts were chosen as the study location because these districts are the cattle production centers in

East Nusa Tenggara, have the highest number of farm households which raise cattle and are also yearling breeding centers and cattle roughage development centers. The villages in Kupang District were Teunbaun, Buraen, Sillu, Oesao, and Naibonat and the villages in TTS District were Boentuka, Benlutu, and Oebelo.

Data collection was done between April and June 2013. The collection was done using the survey method by interviewing respondents. The observation units were cattle farmer households. The number of samples was 178 households consisting of 128 households in the dryland zone and 50 households in the wetland zone.

Data Analysis

The cattle business in this study is the cattle-fattening business. The observation period was one year; therefore, the cattle assets in that period were divided into the sold cattle and the cattle still in being raised. The cost of the cattle business calculated was the cash spent on purchasing input aside from the yearlings. The income of the cattle business was the difference between the revenue and the cash expenditure. The income was calculated as the profit from the cattle business after being substracted with the yearling value without counting the household labor as labor cost. The real income was the income from the cattle business after calculating the household labor as labor cost. These values were measured in single cattle units.

The model developed was an econometric model in the form of a simultanenous equation system having 43 equations which consisted of 26 behavioral equations and 17 indentity equations. The model was divided into three blocks i.e. the cattle production block, the cash input demand block, and the labor demand block. The production block was defined by the cattle-bodyweight-estimate equation, the number-of-cattle-raised equation, and the number-of-cattle-sold equation. The input demand block was defined by the feed-demand equation, the yearling-demand equation, and the medicine-and-vitamin-demand equation. The labor demand block was defined by the female-and-male-labor-demand-for-the-cattle-business-in-the-household equation and the external-male-labor-demand equation. The model had gone through re-specification and re-estimation phases with consideration of the economic, statistical, and econometric conditions (Koutsoyiannis 1977).

Results and Discussion

The Production Value Structure

The cattle business production structure was explained by the calculation of the cattle production value calculation (Table 1). The value of the cattle sold and the cattle raised depicts the cattle assets owned by the farm household and livestock raising activities conducted by the farm household. Within the one-year observation period, the average number of cattle sold was one and the number still raised was between two and three cattle. The cattle-raising business in these farm households are relatively small scale (Kustiarti *et al* 2010), so the compared to the potential land and labor availability is low (Lole, *et al* 2013). This phenomenon shows that farm households would decide to sell cattle when in need of relatively large quantities of cash but still safeguarding the assets they have control over.

Table 1. The Business Production Value Structure in Farm Households in East Nusa Tenggara

(IDR)

Value Stucture	Agroecosystem		East Nusa Tenggara
	Wetland	Dryland	
Value of the cattle sold	3,202,800	3,633,881	3,573,073
Value of the cattle still raised	7,473,000	8,129,099	8,143,899
Cattle business income	3,092,200	3,133,213	3,173,264
Cattle business cost	501,574	524,375	526,380
Cattle business income	2,590,626	2,608,839	2,646,884
Calculated income	1,277,950	1,506,076	1,474,101
Real income	534,436	594,737	583,690

Source: Primary Data, 2013.

The length of the fattening period by the households was between nine months to one year, or even longer. In this period, the process of buying yearlings, raising, and selling was done continuously and the decision to buy yearlings or sell cattle was adjusted to the household financial needs and the price of cattle in the market.

The cost of the cattle business presented in Table 1 is the input cost aside from the value of the yearlings. The cost was cash expenditures for the purchase of feed, external labor, vaccinations, and vitamins. The calculation was done because some households raise yearlings birthed by the cows owned by the households themselves.

The income from the cattle business which was categorized as low indicated that economically, the added value of the cattle-fattening business was relatively small compared to the amount of labor during the fattening period. However, this business was still conducted by the households. This demonstrates two facts, one, cattle-raising was a job opportunity for the households to channel labor and that there wer no other jobs available aside from agribusinesses, and two, the business was done to increase social prestige.

The low added value was because of the limited job opportunities outside from agribusiness and it also explains the relatively unfair treatment of cattle business actors by the cattle market mechanism. The farmers had a weak bargaining position in the input market where the price of the yearlings were determined by the sellers by estimating the weight and setting the price, and also in the cattle market where the weight and price of the fattened cattle were also estimated mainly by the cattle merchants. Other costs that could decrease the cattle farmers' income were the transactional costs from the purchase of yearlings to the marketing of the cattle. Transactional costs can severely reduce cattle business income (Elly, 2009).

Cattle Business Production Block

The estimation of cattle production was developed from three equations, i.e. the change-in-body-weight equation, the number-of-cattle-raised equation, and the –number-of- cattle-sold equation. The change in body weight was calculated from the additional weight gained by the cattle during the observation period. The number of cattle sold was the number of cattle sold during the observation period. The number of cattle raised was the number of cattle still kept when the end of the observation period.

Table 2. The Estimation Results of The Change-in-Cattle-Bodyweight Parameter

Variable	Estimation Parameter	t- value	Elasticity
Intersep	-42.0007	-0.97	-
PKNS	0.311197	1.21*	0.43124599
NOBT	0.000041	1.93***	0.16691911
PKUS	0.210437	0.63	0.503053045
WKUS	0.478799	1.06*	0.210583743
PLUS	0.328169	0.28	0.043927338
BBAS	0.26465	2.65***	0.725185639
JPRS	-1.41879	-0.30	-0.103489371

Notes: *= sign 15% **= sign 10% ***= 5%

PKNS : amount of feed (kg)
NOBT : value of medicine (IDR)
PKUS : amount of work by male household labor for the cattle business (man days)
WKUS : amount of work by female household labor for the cattle business (man days)
PLUS : amount of work by male extra-household labor for the cattle business (man days)
BBAS : initial weight of yearlings (kg)
JPRS : number of cattle produced in a year (individuals)

The change in the cattle's body weight was simultaneously affected by the amount of feed consumed, the value of the medicine used, the amount of male and female household labor used, the amount of male external labor used, the initial yearlings' weight, and the number of cattle produced annually. Partially, the change in the cattle's body weight was affected by the amount of feed consumed, the value of medicine used, the amount of female household labor used, and the initial yearlings' weight (Table 2).

The amount and quality of the feed and the condition of the yearlings used in the fattening period significantly affected the cattle's weight gain. The availability of feed in adequate quantities and quality determined the weight gain. A problem that often arised was feed during the dry season was available in limited amounts only and had poor quality. This of course affects the cattle's body weight (Baba, *et al* 2011). An interesting finding from the estimation value was that the amount of female household labor had a significant effect on the cattle's body weight gain. This indicates that the women were more diligent in feeding the cattle. Several studies about the involvement of women in household economic activities showed similar indications (Gomez *et al* 2007; Mastuti and Hidayat, 2009; Magali and Joel K.L., 2014).

The number of cattle raised was simultaneously affected by the cattle selling price, the amount of household labor (both male and female) involved in the cattle-raising business, the amount of external male labor, the amount of credit and capital assistance received which were differentiated between dryland and wetland agroecosystem zones dryland and wetland and between the group of households receiving credit and capital support and the group of households only receiving capital support.

Partially, the number of cattle raised was affected by the cattle selling price, the amount of household labor (male and female), the amount of male external labor, and the amount of credit received (Table 3). Farm households would decide to sell or keep the cattle depending on the cattle selling price. Higher cattle prices would encourage households to sell cattle, decreasing the number of cattle kept. The tendency to sell cattle due to rising prices decreased the cattle assets owned by the farmers.

Table 3. The Number-of-Cattle-Raised Parameter Estimation Results

Variable	Estimation Parameter	t- value	Elasticity
Intersep	0.75701	2.18***	-
HJUA	-0.000000161	-2.94***	-0.247480463
TKKS	0.007186	3.67***	0.380003841
PLUS	0.096693	4.70***	0.254496293
CRBM	5.794E-08	1.20*	0.112881862
DUMZ	0.195657	0.94	-
DUMC	-0.24828	-0.89	-

Notes: *= sign 15% **= sign 10% ***= 5%

HJUA : mature cattle selling price (IDR/individual)
TKKS : amount of household labor dedicated to the cattle business (man days)
CRBM : amount of credit and capital support received by the household (IDR)
DUMZ : dummy for the agroecosystem zones (1=dryland 0=others)
DUMC : dummy for households receiving credit and capital support (1=credit+ capital support 0= others)

This phenomenon would make households do two things, a) sell cattle because of the price rise and buy yearlings so that the number of cattle kept is the same as before or higher than before, and b) due to economic needs or the increased yearling price, not purchase yearlings and therefore reducing the number of cattle kept. These two things described the farm households' behavior according to the economic condition.

The number of cattle sold was simultaneously affected by the cattle selling price, the total household expenditure, the cattle-raising labor cost which was differentiated based on the agroecosystem zones, and household groups based on the credit and capital support received (Table 4).

Table 4. Estimation Results of The Number-of-Sold-Cattle Parameter

Variable	Estimation Parameter	t- value	Elasticity
Intersep	-1.09051	-2.41***	-
HJUA	3.529E-07	8.14***	0.832252112
TPRT	4.715E-08	2.56***	0.608723695
BTKS	2.441E-07	0.73	0.04104735
DUMZ	0.07535	0.48	-
DUMC	0.176332	0.90	-

Notes: *= sign 15% **= sign 10% ***= 5%

TPRT : total annual household income setahun (IDR)

BTKS : cost of external labor for cattle business (IDR)

Partially, the farm household's decision to sell cattle was affected by the cattle selling price and the amount of household expenditure. The household's decision to sell cattle was strongly influenced by the cattle selling price; this means that households had already had economic motives in raising cattle and determining the right time to sell the cattle based on the cattle selling price in the market. It was also influenced by household expenditure. This indicates that if the household had major expenses, especially those for investment (household, social, educational, and health investments), the household would make a decision to sell the cattle owned (Table 4).

Input Demand Block

The input demand for the cattle business was developed using the feed-demand, the yearling-demand, and the medicine-demand equations. Feed demand was the demand for various kinds of feed purchased for the cattle. The kinds of feed purchased were grasses, gebang palm stalks, bran, hay (rice and corn stalks), and concentrate feed. Yearlings were the cattle to be raised using the fattening method, aged 12-23 months. There are various kinds of vaccines and vitamins administered with different dosages and frequencies; therefore, the analysis used the kinds of vaccines and vitamins which are constantly administered.

The estimation results for feed demand were simultaneously influenced by the feed price, the cattle selling price, the cattle-raising labor cost, the amount of labor (both male and female) dedicated to the cattle business, the value of the feed which were based on the agroecosystem zone and the household groups based on the credit and capital support received.

Partially, the feed demand was influenced by the feed price, the labor cost for the cattle business, the amount of household labor (both male and female), and the difference between zones. Similar to the demand theory which states that the demand for goods will be affected by the price of the goods itself, the demand for feed was influenced by the price of the feed itself (Table 5). The feed was more available in the wetland agroecosystem zone compared to that in the dryland zone. The availability of water makes the farmlands (the ricefields) able to produce feed, especially greens, relatively all year round. There is always some form of feed that can be collected from the ricefields in addition to the feed collected from other fields and the forest.

Table 5. The Estimation Results of The Feed-Demand Equation

Variable	Estimation Parameter	t-value	Elasticity
Intersep	67.9604	10.19***	-
HPKN	-0.04296	-11.58***	-1.058866777
HJUA	7.019E-07	0.96	0.039596019
BTKS	-0.00001	-2.66***	-0.040224474
TKKS	0.04176	1.62**	0.081044305
NPKN	0.000603	52.54***	0.891995907
DUMZ	-1.29381	-0.46	-
DUMC	0.559251	0.18	-

Notes: *= sign 15% **= sign 10% ***= 5%

HPKN : feed price (IDR/kg)

NPKN : feed value (IDR)

The problem of providing feed in the dry season is quite distressing. The cattle lose quite a lot of weight during the dry season, especially because the availability of good-quality pastures have declined (Ilham, 2007; Baba *et al* 2011). Therefore, the various sources of feed would be utilized, from leftover grass, legumes and trees, to other naturally-occurring sources of feed (Sutaryono 2008; Lole, *et al* 2013). To prevent the amount and quality of feed from declining during the dry season, feed-preservation technology needs to be applied; even transgenic feed technology needs to be carefully introduced (Prawiradiputra and Muharsini, 2013).

The demand for yearlings was simultaneously influenced by the price of yearlings, the price of cattle, the amount of labor dedicated to the cattle-raising business, credit and capital support allocation which is differentiated between agroecosystem zones and household groups based on the credit and capital support received.

Partially, the demand for yearlings was influenced by the price of the yearlings itself, the price of cattle, the amount of household labor (both male and female) dedicated to the cattle business, and the agroecosystem zone. An increased price of yearlings would decrease the demand for yearlings and vice versa, an increased selling price would increase the farmers' interest in conducting the cattle business. The availability of household labor was also a consideration for farm households in increasing the number of yearlings or not.

Table 6. Estimation results of the yearling-demand equation

Variable	Estimation Parameter	t-value	Elasticity
Intersep	0.384587	1.97***	-
HBKL	-0.000000193	-2.46***	-0.255184325
HJUA	4.791E-07	21.40***	0.903611006
TKKS	0.001616	2.27***	0.104853379
AUTS	1.104E-08	0.35	0.022519767
DUMZ	0.108562	1.40**	-
DUMC	0.002786	0.03	-

Notes: *= sign 15% **= sign 10% ***= 5%

HBKL : yearling price (IDR/individual)

AUTS : credit and capital support allocation for cattle agribusiness (IDR)

Seen from the agroecosystem zone point of view, it is apparent that households in the dryland zone purchased more yearlings than those in wetland zone. This could have happened because households in the dryland zone received more credit and capital support used to purchase the yearlings compared to households in the wetland zone (Table 6).

Medicine demand was simultaneously influenced by the cattle price, the amount of male external labor dedicated to the cattle business, and the amount of female household labor dedicated to the cattle business which were differentiated based on the agroecosystem zone and household groups based the credit and capital support received.

Table 7. Estimation Results of The Medicine-Demand Equation

Variable	Estimation Parameter	t-value	Elasticity
Intersep	1.127995	1.16*	-
HJUA	3.163E-07	2.19***	0.241007929
PLUS	0.352086	6.61***	0.459359052
WKUS	0.00046	0.01	0.001971949
DUMZ	0.963662	1.76***	-
DUMC	-0.09453	-0.15	-

Notes: *= sign 15% **= sign 10% ***= 5%

Partially, the demand for medicine was influenced by the cattle price, the amount of male household labor dedicated to the cattle business, and the agroecosystem zone. Vaccines and vitamins used in order to improve the cattle's health would influence the cattle's body weight and would in turn influence the cattle selling price (Table 7). The effect of the selling price on the decision to purchase medicine and vitamins was similar to its effect on the decision to purchase yearlings; it affected it in a positive way. This explains why the farm household's decision to raise cattle depended on the cattle selling price. It means that the price of the output significantly influenced the farmers' decision in conducting the agribusiness.

Vaccination is usually done by agricultural and veterinary paramedics. There are two types of service, either the farmer own the vaccine and pays the paramedics for their services alone, or the farmer pays the paramedics for both the service and the vaccine. Regular visits by the paramedics would have a positive impact on the cattle's health and would also increase the demand for medicine and vitamins.

Labor Demand Block

The demand for household labor and external labor is the amount of labor demanded by the cattle business. The amount of labor depicts the amount of labor needed in the agribusiness to produce one production unit. Priyanti *et al* (2009) stated that in addition to production input, the production of cattle is also influenced by the use of household labor.

In this study, the demand for household labor was identified through the demand for male household labor for the cattle agribusiness, the demand for female household labor for the cattle agribusiness, and the demand for male external labor for the cattle agribusiness equations.

The demand for male household labor for the cattle agribusiness was simultaneously influenced by the number of cattle produced annually, the cost for labor for the cattle business, the amount of capital support, the amount of females household labor dedicated to the cattle business, and the number of yearlings which were differentiated based on the agroecosystem zone and household groups based on the credit and capital support received.

Partially, the demand for male household labor for the cattle business was assumed to be influenced by the number of cattle produced annually, the amount of capital support received, the amount of credit and capital support received, and the household's location, in the dryland zone or in the wetland zone (Table 8).

Table 8. Estimation Results of The Male-Household-Labor-for-The-Cattle-Business-Demand Equation

Variable	Estimation Parameter	t-value	Elasticity
Intersep	69.87598	3.31***	-
JPRS	3.931788	0.64***	0.119970934
BTKS	0.000011	0.47	0.025649627
BMDL	0.000003504	2.21***	0.123194973
BMKR	0.000002685	1.93***	0.156503985
WKUS	0.288194	0.49	0.053023069
BKLS	5.005195	0.51	0.086784053
DUMZ	-8.70377	-1.28**	-
DUMC	-10.3442	-0.72	-

Notes: *= sign 15% **= sign 10% ***= 5%

BMDL : the amount of capital support received by the household (IDR)

BMKR : the amount of credit and capital support received by the household (IDR)
BKLS : the number of yearlings (individuals)

The availability of additional agricultural capital both from credit and capital support programs would increase the amount of male household labor. The responsibility to repay or transfer the credit and capital support to other farmers required extra labor dedicated to the cattle business. Households which received capital support and credit would dedicate more of its labor to the cattle business. Seen from the land zone point of view, the amount of male household labor dedicated to the cattle agribusiness was larger in the wetland zone. This was because there were agricultural activities all year round and there was feed (grass) available causing the males in the household dedicate more of their time and energy to the cattle business.

The demand for female household labor for the cattle business was assumed to be simultaneously influenced by the number of cattle sold, the amount of credit and capital support received, and the amount of household labor (both male and female) dedicated to the cattle business which were differentiated based on the agroecosystem zones and household groups based on the credit and capital support received.

Partially, the demand for female household labor for the cattle business was influenced by the amount of household labor (both male and female) dedicated to the cattle business, the amount of household income that can be readily spent, and the agroecosystem zone (Table 9).

Table 9. Estimation Results of The Female-Household-Labor-For-The-Cattle-Business-Demand Equation

Variable	Estimation Parameter	t- value	Elasticity
Intersep	0.021271	0.001	-
JSJU	1.44821	0.49	0.109149723
CRBM	2.712E-07	0.47	0.061096264
TKKS	0.176541	8.09***	1.079507478
PRTD	-0.000000433	-1.11*	-0.449213509
DUMZ	5.445879	2.35***	-
DUMC	-2.54537	-0.64	-

Notes: *= sign 15% **= sign 10% ***= 5%
JSJU: the number of cattle sold (individuals)
PRTD : the amount of household income that can be readily spent (IDR)

The women in the household were involved in the cattle-raising business especially in cleaning out the stalls, feeding and watering, and occasionally gathering feed relatively far from home. The involvement of the women in the cattle business was inseparable from the activities done by the men in the haousehold for the cattle business.

Based on the land zone, the women who live in the dryland zone were more active in the cattle business compared to the women living in the dryland zone. This was because feed was relatively gathered far from home, requiring the women to be more involved in activities both around the barn and away from home gathering feed.

The demand for external labor was limited to male labor. Female labor was not demanded by households. The demand for male external labor for the cattle business was assumed to be simultaneously influenced by the amount of credit and capital support received by the household, the number of cattle raised, and the cost of labor for the cattle business which were differentiated based on the agroecosystem zone and credit and capital support received by the household (Table 10).

Table 10. Estimation Results of The Male-External-Labor-For-The-Cattle-Business-Demand Equation

Variable	Estimation Parameter	t- value	Elasticity
Intersep	-0.55364	-0.53	-
CRBM	2.399E-08	0.17	0.017757814
JSPE	0.739902	1.07*	0.281117431
BTKS	-0.000018	-11.25***	-0.749575213
DUMZ	-0.07392	-0.15	-
DUMC	0.618862	0.83	-

Notes: *= sign 15% **= sign 10% ***= 5%
JSPE: the number of cattle raised (individuals)

Partially, the demand for male external labor was assumed to be influenced by the number of cattle raised and the labor cost for the cattle agribusiness. An increased number of cattle would persuade the farm household to add male labor aside from the household members to in the cattle business. The types of jobs done by the male external labor were gathering feed and vaccinating the cattle (done the veterinary paramedics). With limited capital for the cattle business, if the labor cost increased, the farm household would decrease the use of external labor and instead did everything by themselves. Especially for veterinary paramedics, the pay was sometimes not according to the standard. This was because there was a close relationship between the farmers and the veterinary paramedics.

Conclusion and Suggestions

Conclusion

1. The added value which is considered the household income from the cattle business is categorized as low. However, the households still conduct cattle-raising activities because job opportunities outside of agribusiness are scarce and because owning and raising cattle is prestigious.
2. Cattle production was influenced by the use of production input (feed, vitamins and medicine) and the initial condition of the yearlings used in the fattening.
3. Both male and female household labor and external labor influenced production decisions. The decision to use labor was influenced by the cattle business scale, additional capital from credit and capital support, and the cost for external labor.

Suggestions

The suggestions for increasing farm household production and income are: a) the determination of yearling price and cattle price should be done according to the standard and the animals must ne weighed in order to guarantee the price and body weight, b) job opportunities should be increased or more cattle should be raised by each through the assistance of credit and capital support programs.

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