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Constraints, Opportunities and Determinants of Livestock Production in Assosa District, Benishangul-Gumuz Regional State, Western Ethiopia

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Abstract
The study was carried out in three selected PA's of Assosa district, western Ethiopia with the objectives of identifying the major constraints and opportunities of livestock production and analyzing the determinants of livestock production of sampled households. Both primary and secondary data were used. The collected data was analyzed through descriptive and cobb-douglas econometric model by using both SPSS and STATA software. For this purpose, a multi stage purposive and simple random sampling technique was used and a total of 99 sampled household heads were selected and interviewed using a structured questionnaire. The study result showed that the average age of sampled farmers was 47.34%. 7.1% and 92.9% of selected farmers were female and male headed households, respectively with mean educational schooling of 4.25 years. The study revealed that the average grazing land size was 1.62 hectares with mean 1.64 km and 2.44 km of distance traveled by livestock to water source and sampled household head to the livestock market, respectively. The major livestock constraints identified in the study area were disease, shortage of grazing land, lack of capital and improved breed, water scarcity during the dry season and lack of artificial insemination, respectively with the livestock production opportunities of availability of veterinary supply, input access, mixed crop production system, access to credit service and feed availability. The econometric result showed that from the hypothesized 14 explanatory variables, only six variables (labor, Extension contact service, capital, grazing land, veterinary service, breeding type) were found to be statistically significant at 1 and 5% significance level in determining household livestock production. The study recommends that provision of extension service, supply of improved breed and capital along with upgrading marketing infrastructure (health and sanitary conditions) will increase the livestock production and welfare of smallholder farmers.
Keywords: Assosa district, Challenges, Opportunities, Cobb-Douglass

Introduction

Agricultural sector in Ethiopia is the mainstay of the country's economy with raising crop is the main activity experienced by farmers [1]. As livestock sub sector is one element of agriculture, livestock product also plays a crucial role in the Ethiopian economy scoring the second largest earner of foreign exchange after coffee contributing about 20% to the GDP and 40% to the gross value of annual agricultural output [2] and [3]. In addition, as [4] revealed, livestock plays a vibrant role in income generation, job creation, ensuring food security, service provision and sustaining the livelihood of farmers. In terms of potential, Ethiopia ranked tenth world and first in Africa with respect to livestock population with an estimated 41 million cattle, 26 million sheep, 23 million goats, 41 million chicken, 5.7 million equines and 2.3 million camels [5].

As [6] and [7] showed, even though the nation is endowed with huge potential, number and diversity of livestock production, the sector was facing chronic challenges such as prevalence of major endemic diseases, poor feeding and high stocking rate on grazing lands, lack of support services (extension services, veterinary services), inadequate information on how to improve animal breeding, marketing and processing, livestock management problems and lack of human capital. In addition, the use of poor technological skills resulting in low production with poor quality, which finally resulted in being neglected both domestically and internationally. In addition to the above, shortage of adequately trained animal health service providers, fragmented coordination between private and public animal health delivery system, uncoordinated development of the few existing staff and the need to access remote and often large areas characterized by poor infrastructure and communication networks was major constraints in the country facing livestock sector [4].

The Benishangul-Gumuz region has a remarkable number of livestock population with the current estimate of 659,587 cattle, 104,547 sheep, 440,719 goats, 1.3 million poultry and 67,702 donkey [5]. According to [8] trends in cattle population, sheep and goats were slightly increasing and livestock production is considered as an important economic activity to the livelihood for the growing population and for smallholder farmers. Despite there are efforts done by the local government (supplied different improved breeds, provided extension services up to community levels and helped in reducing the spread of animal disease), the livestock production has registered low to the extent of trailing in the study area. In addition, limited number of veterinary service, absence of government subsidy and shortage of forage and lack of research and development on livestock

production by the concerned bodies were some hindering factors that limited livestock production in the study area [8]. As indicated by the above source, livestock production have a potential to contribute to the national economy in general and improving the livelihood of the farmers, the study tried to assess the challenges and opportunities of livestock production and identify major factors that determines livestock production in the selected study area and suggest possible events for its improvement.

Materials and Methods

The Study Area: The study was conducted in Assosa district of Benishangul Gumuz Regional State, western Ethiopia, located at 663 km away from Addis Ababa lies between $10^0 20'$ latitude in the North and $34^0 58'$ longitudes in the East. The district is composed of 74 rural and 4 urban PA's bordered with Bambasi and Menge districts in the East, Sudan and Kurmuk in the West, Homosha and Menge districts in the North and Tongo and Bambasi districts in the South with the estimated land area of 2,330 square kilometers and is home to 92,687 (49.43% Female), of the listed, about 73.9% lives in rural areas [9]. The pattern of rainfall is uni-modal type being distributed from end of April to end September ranging from 219.7 to 1,858.3 mm of rainfall/year. The mean minimum and maximum annual temperature ranges from 26.5^0C to 30.1^0C, respectively [10]. Agro-ecologically, the district is mostly classified as lowland with an average rainfall of 1,275 mm/year with altitude range of 1300-1570 m.a.s.l [9]. Mixed farming is the predominant sources of livelihood for the majority of the population. Major crops grown in the area includes sorghum, maize, haricot bean, niger seed, soya bean, sesame, tomato, onion, pepper, head cabbage, carrot, potatoes, sweet potato, mango, banana, papaya, avocado and cazamiro. Additionally, the major livestock reared in the district are cattle, goats, sheep and poultry [9]. The three largest ethnic groups in Assosa were the Amhara (53%), the Berta (34%) and the Oromo (9.4%) and all other ethnic groups made up 3.6% of the population [11].

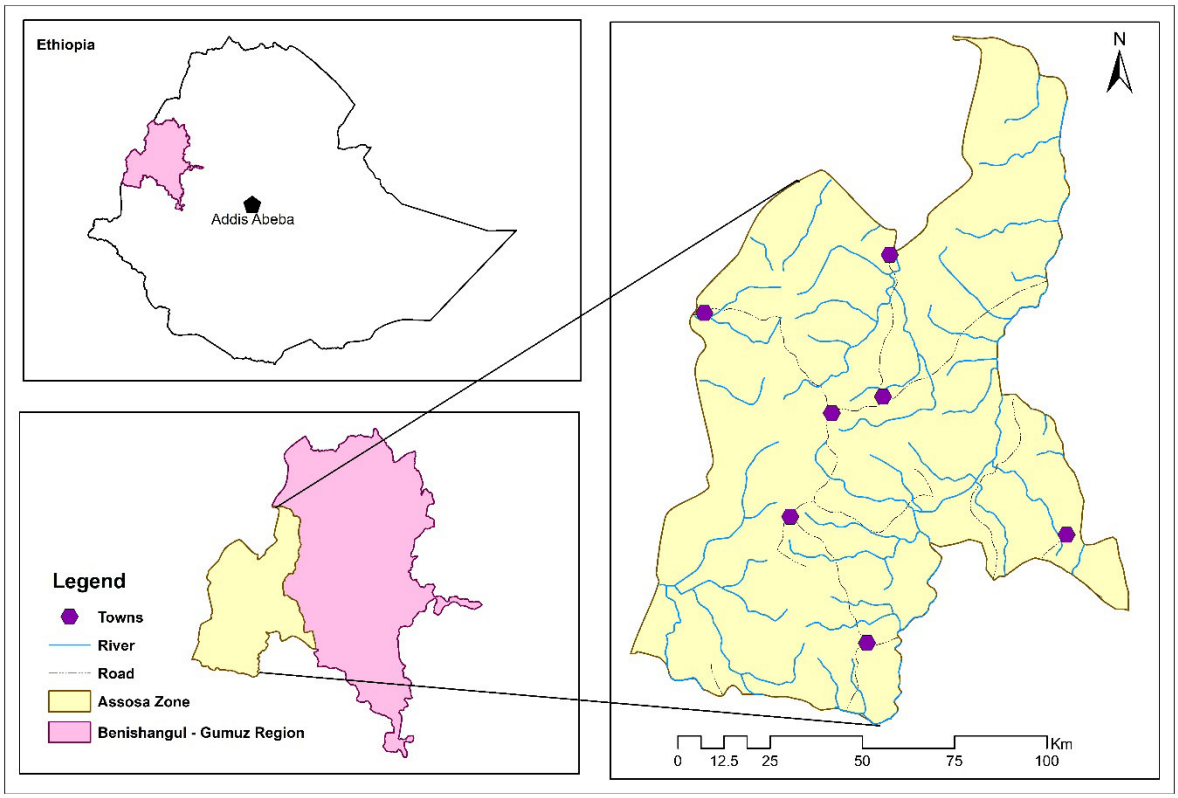

Figure 1: Map of the study area

Data Source and Method of Data collection

The study used primary and secondary data types. The primary data was collected from sampled smallholder farmers through well-trained enumerators using a structured questionnaire under the supervision of researcher. Pre-test was implemented for both open and close-ended questions in order to ensure the validity and reliability. Secondary data was collected from Assosa district office of agriculture, journals, books CSA, published and unpublished material (report).

Sampling Techniques and Sample Size Determination

Multi-stage purposive and simple random sampling procedure was implemented at three stages. In the first stages, out of 74 PA's found in Assosa district, 10 PA's were selected purposively based on the level of production and access to infrastructure (road). In the second stage, from 10 livestock producer rural PA's, 3 PA's namely: Amba 3, Amba 5 and Amba 6 were selected randomly. In the third stage, a total of 99 sampled household heads were selected randomly using probability proportional to population size-sampling technique. Accordingly, the study applied a simplified formula provided by [12] to determine the required sample size at (95%) confidence level, degree of variability (0.5) and level of precision (10%) in order to get a sample size.

$$n = \frac{N}{1+N(e)^2} = \frac{18{,}811}{1+18{,}811(0.1)^2} = 99$$

Where: n = is the sample size of livestock producer households, N = is the total households in the district (N = 18,811) and e = 0.1 is the level of precision defined to determine the required sample size at 95% confidence level.

Table1 Distribution of sampled household head by their location and size sample area

	Total number of HH			Sampled HH			
PA's	Female	Male	Total	Female	Male	Total	%
Amba-3	12	335	347	2	27	29	29.3
Amba-5	17	503	520	3	41	44	44.4
Amba-6	11	303	314	2	24	26	26.3
Total	40	1141	1181	7	92	99	100

Method of Data Analysis

The study employed both descriptive statistics and econometric methods to analyze the data. Descriptive statistics such as mean, percentage and standard deviation were used and tabulated. To run statistical analysis, data were coded and entered in to a computer program with SPSS version 16 and STATA 13 software packages.

Econometric model

Cobb-Douglas production function was used to analyze the determinants of livestock production of smallholder farmers in the selected study area. Most of the studies using the Cobb Douglas production function approach stated that the functional form of the Cobb-Douglas production model assume homogeneity, unitary elasticity of substitution between input and output and also it is among the best well known production function utilized in applied production and productivity analysis [13]. According to [14], the generalized form of the CD production function can be specified as:

$$Y = \beta o X_1^{\beta 1} X_2^{\beta 2} X_3^{\beta 3} - - - X_n^{\beta n} e^{ui} \quad \text{(1)}$$

Where, Y- is number of livestock household have in TLU, βo - constant factor, X_i'-s are explanatory variables. Since the CD production function is a power function, it is impossible to directly use the ordinary least square (OLS) Method; therefore, logarithmic transformation was made to obtain its linear form and to estimate the parameters. In this case, the dependent variable, logarithmic number of livestock HHH, which is a continuous variable expressed in terms of TLU. The nature of explanatory variables were composed of both dummy as well as continuous.

$$\ln Y = \beta 0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 X_3 - - - - - - - - \beta_n \ln X_n + ui \quad \text{---------- (2)}$$

Where:

LnY = Logarithm of number of livestock HHH have (TLU)

$lnX_1, lnX_2, \ldots, lnX_n$: are explanatory variables

$\beta 0$ *and* βi (I = 1, 2, 3…, 13) are parameters to be estimated.

An extra term was added to represent the residual error but it was not included in the above equation assuming it is zero on average. The function was estimated using OLS method. The main interest of analysis in this part was to assess the determinants of livestock production and linear production function was selected and applied. To express quantitative relationships between variables, the production function must be expressed in functional form. The functional forms employed (Linear and Cobb Douglas) with definition of variables and hypothesis set are discussed for the above types of analyses in the following sections. Ordinary linear regression model is appropriate because of the non-interval or non-categorical nature of the dependent variable and the spacing of the outcome choice cannot be assumed uniform.

CD production function is one of the most widely used functions in the economic analysis of problems related to empirical productivity estimation in agriculture and industry. Many empirical studies including [13, 15]

have employed the CD form of production function to measure agricultural productivity. The sum of elasticities of output with respect to the relative inputs also provides the returns to scale of the parameters. Although this function has other advantages in that it shows diminishing marginal return, it involves some limitations. One of the limitations of the CD production function is that the elasticity of substitution between factor inputs is restricted to unity.

It is important to check the existence of multicollinearity problem before running the model both for continuous and dummy variables. Hence, Variance Inflation Factor (VIF) for continuous explanatory variables and Contingency coefficient (CC) for discrete or dummy explanatory variables were used in order to check the existence of multicollinearity problem through STATA 13. The VIF result revealed that there was no multicolinearity problem among the independent variables, which is less than 10 showing that there is no existence of a perfect or exact linear relationship among some or all explanatory variables of a Cobb- Douglas model and the CC value is less than 0.5 indicating that there is weak association between variables.

Results and Discussion

Household Characteristics: The survey result revealed that the average age of household head (HHH) was 47.34 years. The sampled HHH age was observed between 25 to 74 years (SD of 13.12). In relation to the gender of the HHH characteristics, from the total interviewed farmers, 7.1% of them were female headed and the remaining 92.9% were male headed households with the overall mean age around 40.3 years. The result of the study was in line with [16] who reported that 93% and 7% of livestock farmers were male and female-headed households, respectively. The probable reason for less number of female-headed households involved in the study area was due to cultural issues that forced females into early marriage due to economic reasons. Educational status of the HHH showed that the minimum and maximum years in education were 1 and 12 years with mean and standard deviation 4.25, 3.46 respectively. The higher rate of literacy in the study area has the benefit of accepting and adopting new technologies more rapidly than farmers with lower educational status. Willingness to accept and implement trainings offered from different concerned bodies were another major benefit of literacy among farm households in the study area which helps more production and productivity [16, 17and 18].

Number of livestock owned by the sampled households: Livestock is one of the major assets for smallholder farmers with the role of source of food, power for cultivation, threshing and transportation. In addition, as [19] indicated, livestock also reared for security purpose in time of crop failure since they are seen as "near cash" in the selected study area and providing manure for farm yard which helps improving soil fertility. The majority of survey respondents (90%) of them keep livestock and these include cattle, ruminants/shoats such as goats and sheep, and equines and donkeys. The survey result indicated that farmers in the study area have 211 TLU, 28.75 TLU, 78.75 TLU, 127 TLU, 4.03 TLU, 25.6 TLU, and 57.4 TLU of cow, calf, heifer, oxen, sheep, goat, and donkey, respectively. The most dominant species of livestock in the study area was cow followed by oxen; the cow might mainly be used as source of milking and greater number of oxen may be due to the need for draft power.

Major Constraints of Livestock Production in the Study Area: Major bottlenecks of livestock production in the study area were shortage of grazing land, lack of improved breed, scarcity of water during dry season, occurrence of diseases, lack of capital and artificial insemination (Table 2). According to the sampled respondents, occurrence of diseases is the primary hindering factor for livestock production followed by shortage of grazing land. Livestock diseases mainly caused by internal and external parasites and antrax was reported as the major diseases of livestock in the study area. Expansion of crop land due to increase in number of population number is a prime factor for shortage of grazing land, which is the second livestock constraint indicated during the study. Shortage of capital improved breed, scarcity of water and shortage of artificial insemination, were major livestock bottlenecks identified in the study area, respectively.

Table 2: Description of major constraint to livestock production in the study area

Constraints	Respondents		Rank
	Number	Percent	
Shortage of Grazing Land	21	21.21	2nd
Lack of improved breed	12	12.12	4th
Water scarcity during dry season	11	11.11	5th
Disease	31	31.31	1st
Lack of capital	17	17.17	3rd
Lack of artificial insemination	7	7.07	6th
Total	99	100	

Source, Owen Survey (2017)

Opportunities for Livestock Production in the Study Area: Even though livestock production have the importance of serving as intermediate food, draught power, wealth status and cash source, the production level is

not utilized as potential. As a major opportunities identified in livestock production in the study area, out of 99 respondents in the study area, 27%, 25%, 22%, 13% and 12% of the respondents reported that availability of veterinary supply, input access, mixed crop production system, access to credit service and feed availability were the major opportunities for livestock production in study area**.**

Table 3: Description of opportunities of livestock production of the sampled household

Opportunities for livestock production in the study area	**Respondents**		**Rank**
	Number	**Percent**	
Feed availability	12	12.12	5th
Credit service	13	13.13	4th
Veterinary supply	27	27.27	1st
Availability of input	25	25.25	2nd
Mixed crop-livestock system	22	22.22	3rd
Total	99	100	

Source Owen survey (2017)

Econometric Model Results (Determinants of Livestock Production)

Table 4: Econometric parameters estimation results of Cobb-Douglas production function

Variables	Coefficient	Standard Error	T- ratio
Constant	1.6595	0.457	3.63
SexHH	0.0399	0.153	0.26
LS-DIS	0.042	0.069	-0.62
lnEduHH	0.074	0.045	1.64
VETAC	0.255**	0.3	2.55
LS-BRT	-0.289**	0.2012	-2.07
IFR	0.079	0.085	0.94
AI	0.038	0.127	0.3
lnCP	0.669***	0.155	4.29
lnAgeHH	-0.032	0.124	-0.26
lnLB	0.260***	0.064	4.03
lnAGL	0.360***	0.111	3.23
LnAV-EXS	0.395***	0.107	3.69
lnDTWS	-0.048	0.075	-0.64
LnDST-LSM	0.034	0.066	0.51

Number observation= 99

R^2= 0.7297

Adjusted R^2= 0.688

***, ** and * are significant at 1%, 5% and 10% probability level respectively.

Source: Model Output, 2017

As indicated in Table 4, the coefficient of determination (R^2) and the adjusted R^2 values are 0.7297 and 0.688, respectively. It means that about 72.97% of the variation in the dependent variable is explained by the independent variables, indicating relatively high explanatory power (goodness of fit) of the model. The regression analysis result reveals that most of the coefficients of the explanatory variables included in the model have positive sign. The positive sign of the coefficients indicates that the explanatory variables influence the dependent variable positively. However, the level of significance varies from one independent variable to the other. The OLS method was applied to the log transformed values. Cobb-Douglass production analysis showed that Out of these 14 explanatory variables, only 6 variables (*labor, Extension contact service, capital, grazing land, veterinary service, breeding type*) were found to be significantly affecting' household livestock production at 1 and 5% significance level and are discussed below.

Extension contact: the estimated coefficient of this variable supports the proposed hypothesis and it is significance at 1% level of significance. Other being constant a one-unit increase in extension contact household livestock production increases by 0.395 units. This is true by expanding and encouraging the household participation rate for the use of extension program is still important for the livestock production enhancement since the extension user households are more productive than non-user.

Number of labor used in production: - the estimated coefficient of this variable supports the proposed hypothesis and it is significance at 1 per cent level of significance, other factors being constant. This implies that a 1% increase in family labor, smallholder livestock production increases by 0.260%. One known reason behind this is that, the rural household of Ethiopia uses more family labor than hired labor in their livestock production processes. As a result having more family labor with in a household would be able to a high possibility of livestock management work like timely keeping increasing livestock production.

Livestock Breed Type: Breed type here refers to adoption of improved livestock breed types by the households. It was assumed that improved breeds are more necessary for livestock production. The regression model analysis reveals that livestock breed type in the study area found to have a negative relationship with livestock production. The estimated coefficient of this variable contradicts the proposed hypothesis and was significant at 5% level. As supply of improved breed increases 1%, livestock production decreases by 0.289%. Therefore, the implication of the result of the analysis is that as the smallholder farmers adopt improved livestock breed types means that mainly depend on the improving the quality and performance of livestock rather than increasing number of livestock they have.

Availability of Grazing Land: Availability of grazing land is one of the most figurative constraints of smallholder farmers in the study area. The econometric model analysis result revealed that availability of grazing land as hypothesized has a positive relationship with the level of livestock production. The relationship between livestock production and availability of grazing land is significant at 1% level of significance. Other factors being constant as availability of grazing land increases by one unit of hectare, livestock production increases by 0.36 units. This is true as farmers have more grazing land and more likely to produce livestock. The implication of the analysis result is that grazing pasture is major inputs for livestock production in the study area. Sufficient grazing resources will be initiate farmers to have more number of livestock.

Veterinary service: The econometric model analysis result reveals that the estimated coefficient of this variable supports the proposed hypothesis and is significance at 5% level of significance. As availability of veterinary service increases by 1%, livestock production of smallholder farmer increase by 0.36%. The implication of the analysis result is that veterinary service is an input for the health of livestock production, hence increases number of livestock production.

Capital: -The econometric model analysis result reveals that the estimated coefficient of this variable supports the proposed hypothesis and it is significance at 1% level of significance. Coefficient estimated capital of household have is 0.669 with respect to livestock production, other factors being constant as capital of household head increase in one unit of birr, with estimated 0.669 unit increase in livestock production in the study area. This is true that capital is an important for enhancement of inputs like veterinary service, improved breed, and extension service that increases livestock production.

Conclusion and Recommendations

As the descriptive analysis result showed, the major constraints hindering the livestock production system in the study area were: livestock disease, lack of artificial insemination, lack of improved breed, shortage of grazing land and lack of infrastructure. Availability of veterinary supply, input access, mixed crop production system, access to credit service and feed availability were the major opportunities for livestock production in study area**.** Cobb-Douglas production function model analysis was carried out by using STATA 13 in order to analyze major factors affecting livestock production in the selected study area. The regression analysis result revealed that from the hypothesized 14 explanatory variables, only 6 variables (Labor, capital, availability of extension contact, and availability of grazing land) were found to be statistically significant at 1 and 5% level of significance in affecting farmer's livestock production. To this effect, the study suggested that future interventions should be taken in the following areas: improving the local animal breed potential through selection and crossbreeding, identifying and controlling animal diseases in order to avoid frequently bans and increasing supply through increasing the veterinary vaccination and providing veterinary medicines at reasonable prices, expanding infrastructural developments in order to raise flow of livestock, processing and marketing and due consideration should be given in training the farmers in haymaking and feed conservation practices.

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