Analysis of Beef Cattle Production and Population at Manokwari West Papua, Indonesia

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ABSTRACT

One important factor in determining beef cattle development policies is knowing the trend model for beef cattle production and population based on a large of data. This research aims to analyze the trend model of beef cattle production and population and predict them. The data collected from 2011 to 2020 consists of the production and population of beef cattle. Data was taken from the West Papua Province Livestock and Animal Health Service. The trend models and prediction data were analyzed using Minitab version 17. The research showed that the contribution of beef cattle production and population in Manokwari to West Papua is 0.251 and 0.354, respectively. The results of the trend model for the production and population of beef cattle are $Yt = 1475291 - 440243t + 47760t^2$ and $Yt = 21626 - 3t - 14t^2$, respectively. It can be concluded that the growth rate of the beef cattle population and production in Manokwari is -0.364% and 13%, respectively. Based on the model, in 2026 the number of beef cattle in Manokwari started to decline, and vice versa, production increased in 2025.

Keywords: beef cattle, model, population, production

INTRODUCTION

Beef cattle are the main livestock commodity that provides meat and the main source of animal protein, besides poultry. After successfully launching the Special Efforts program for the Acceleration of Increasing the Population of Pregnant Cows and Buffaloes, the Ministry of Agriculture through the Directorate General of Animal Husbandry and Animal Health is accelerating the fulfillment of people's needs for animal protein, namely meat and milk with the National Mainstay Commodity Cattle and Buffalo program. To increase the cattle population, through the program, it is hoped that the beef cattle population will grow more quickly and ultimately reduce dependence on feeder cattle and imported beef. Beef cattle are the second commodity after broiler chickens in consuming meat. In 2021 beef production will be 487.80 thousand tons, out of total meat production of 4,546.96 thousand tons or contributing up to 10.73% of national meat production (Directorate General of Animal Husbandry and Animal Health, 2022). Generally, around 30% - 40% of the beef is still supplied by imported feeders to meet beef needs.

More than 90% of local beef supplies come from small-scale livestock farms, resulting in low production efficiency or high production costs per unit. If the amount of imports remains uncontrolled, low import prices will depress the price of local beef in the market, resulting in losses for farmers. If this happens in long-term and with limited capital, it will make farmers less enthusiastic about running a beef cattle business. According to Maart-Noelck and Musshoff (2013), a farmer's decision to invest in their business is to learn from previous investments and consider the value obtained through observation over time. To increase production, farmers choose to reinvest when they are valuable or profitable, and vice versa. Likewise for smallholder beef cattle breeders in Indonesia, if farmers suffer losses and there is limited capital, the increase in local cattle production becomes slow, causing the average beef import per year to remain above 30%. Year over year, Indonesian people's beef consumption continues to increase by an average of 5.54% per year. Even though local beef

production continues to increase, it is not yet able to meet national consumption needs. Estimates suggest that as population and income levels rise, the demand for beef will persist. If smallholder livestock production patterns remain unchanged, the local beef deficit will persist.

West Papua Province is one of Indonesia's eastern regions with the potential for beef cattle development due to favorable environmental conditions for beef cattle development, the potential for adequate land and feed availability. According to Supriadi (2008), West Papua Province has prepared 75,000 ha of grazing land in the districts of Bomberay (Fakfak), Kebar (Tambrauw), and Salawati (Sorong) for the raising of beef cattle using a ranch system. Apart from that, it also has available agricultural land covering an area of 11,263 ha, oil palm plantation land covering an area of 38.98 thousand ha, and other Bali cattle enclaves such as ex-transmigration areas and other expansion areas.

Manokwari is one of the centers for beef cattle development in West Papua, which has promising prospects for developing the beef cattle business. Bali cattle are the most commonly kept breed of beef cattle. According to Bandini (2003), Bali cattle exhibit high adaptability, good feed conversion, disease resistance, and good fertilization, making them suitable for use as working livestock. Farmers keep Bali cattle in small numbers (2–3 heads), or the equivalent of 1-3 animal units (AU) per farmer, with the nature of the business being less efficient. Widiati (2006) reported that people's beef cattle farming that is integrated with crops on dry land on the slopes of Mount Merapi, Yogyakarta, with land ownership of around 0.5 ha, supported by limited family labor resources, capital, and capabilities, will only obtain a positive net farm income, with a maximum maintenance of around 2 AU per breeder.

One important factor in determining beef cattle development policies, especially in planning programs, is knowing the trend model for beef cattle production and population based on a large series of data, for example, the last 10 years. There are some trend models, namely: linear, quadratic, exponential, and logistic (Thomsett, 2019). In the livestock sector, trend analysis has been carried out by Mastuti et al. (2020) in broiler chickens and Hidayat et al. (2021) in buffalo. Analysis of production and population trends in beef cattle in Manokwari Regency from 2011 to 2020 has never been carried out. Therefore, this research aims to analyze the production and population trend model of beef cattle and predict the production and population of beef cattle in Manokwari Regency, West Papua Province.

MATERIALS AND METHODS

This research was carried out in Manokwari Regency, West Papua Province. Map of Manokwari is shown in Figure 1. Manokwari Regency administratively has an area of 3,168.28 km^2, and the population of Manokwari Regency in 2021 was about 192,633 people. Geographically, Manokwari Regency is located between the heads of the birds of Papua Island at a position below the equator between 132º35-134º45" E and 0.15-3º25" E. With regional boundaries as follows: North: Pacific Ocean East: South Manokwari Regency South: Teluk Bintuni Regency West: Tambrauw Regency

The method used in this research is a descriptive method with case study techniques. The data collected from 2012 to 2021 consists of the production and population of beef cattle in Manokwari. Data was taken from the West Papua Province Livestock and Animal Health Service. The collected data is then analyzed according to the research objectives.

Figure 1. Map of Manokwari District (Source: https://www.lamudi.co.id/journal/peta-manokwari/)

The variables measured include (1) the percentage of beef cattle production and beef cattle population in Manokwari Regency from production and population in West Papua; (2). Growth in beef cattle production and population in the Regency Manokwari; (3). Beef cattle production and population trend models in Manokwari Regency; (4). Prediction of beef cattle production and population in Manokwari Regency. The trend models and prediction data were analyzed using Minitab version 17.

RESULT AND DISCUSSION

The proportion of beef cattle production and population in Manokwari Regency to beef cattle production and population in West Papua Province from 2012 to 2021 is shown in Table 1.

Based on Table 1, the contribution of beef cattle production in Manokwari Regency to West Papua Province is 0.251. Likewise, the population of beef cattle in Manokwari Regency contributes 0.354 of the total population of beef cattle in West Papua Province. Historically, the development of both beef cattle production and population in the country has shown a significant increase over the last 3 decades. However, population growth, economic development, lifestyle changes, nutritional awareness, and improving education levels (Delgado et al., 1999) appear to experience a higher rate of demand than the increase in beef cattle production. In the future, it is predicted that there will continue to be an increase in demand for beef, which will open up huge domestic market opportunities.

Table 1. Proportion of beef cattle production and population

Year	Production (ton)		Proportion	Population (head)		Proportion
	Manokwari	West Papua		Manokwari	West Papua	
2012	899539	2657004	0.339	21003	52046	0.404
2013	0	4077000	0.000	20843	48159	0.433
2014	1114513	3658046	0.305	21287	61436	0.346
2015	0	3809200	0.000	21911	67287	0.326
2016	1163202	3957990	0.294	23598	68999	0.342
2017	631105	2700740	0.234	23856	67706	0.352
2018	584451	1914770	0.305	16857	50991	0.331
2019	602803	1914930	0.315	16987	51738	0.328
2020	436234	1650590	0.264	21212	61415	0.345
2021	534978	1832350	0.292	22272	66319	0.336
	Mean		0.251			0.354

Source: Data from the West Papua Province Livestock and Animal Health Service (2023)

The average annual growth in beef production is only 13%, while the average annual growth in the beef cattle population is -0.36%. The growth in beef production in several regions is not always in line with the growth of the livestock population. Regions as cattle population centers are not necessarily centers for beef production. Likewise, vice versa, areas that do not have cattle at all can turn into beef production centers (Lauirie, 1995; Soeparno, 1992). This is possible because livestock trade occurs between regions based on demand for meat.

Therefore, the development of beef production in a region more accurately describes the magnitude of the development of cattle slaughter in that region (Kariyasa, 2004). The results of testing the population and beef production trend model are presented in Table 2.

Table 2. Model of population and beef production trends

Trend Model	MAPE	MAD	MSD
1. Population			
Linear	9	1887	5157358
Quatratic	9	1871	5147353
Exponential	10	1917	5179519
2. Production			
Linear	1.88997E+01	1.26863E+0	2.20611E+10
Quatratic	10	68259	786803528
Exponential	1.63637E+01	1.14499E+05	1.93265E+10

Note: MAPE = Mean Absolute Percentage Error; MAD= Mean Absolute Deviation; MSD = Mean squared Deviation

The results of the trend model for the production and population of beef cattle in Manokwari Regency are the quadratic model. The quadratic model was chosen from three criteria (MAPE, MAD, and MSD), which had the smallest model value of those criteria. The quadratic regression equation model for the beef cattle population is $Yt = 21626-3t-14t^2$. The graph of the quadratic model is presented in Figure 2. The graph also presents population predictions from 2022–2031. In a forecasting system, the use of various forecasting models will provide different forecast values and degrees of forecast error. One way to do forecasting is to choose the best forecasting model that can identify responses to historical activity patterns from data. In general, forecasting models can be grouped into two main groups, namely qualitative methods and quantitative methods. Furthermore, quantitative methods are grouped into two main parts, called intrinsic and extrinsic (Gaspersz, 2004).
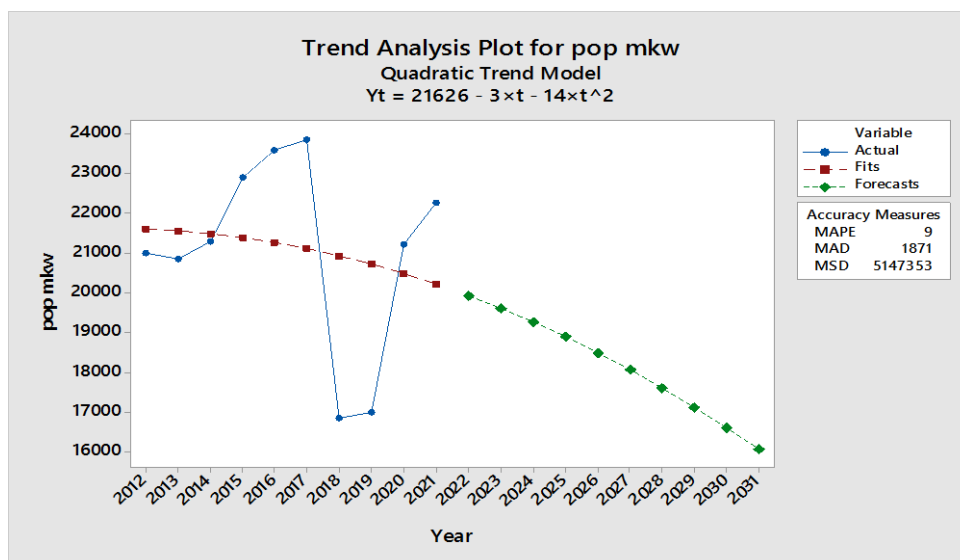

Figure 2. Graph of the quadratic model for beef cattle population.

The quadratic regression equation for beef production is $Yt = 1475291 - 440243t + 47760t^2$. The graph of the quadratic regression equation is presented in Figure 3.
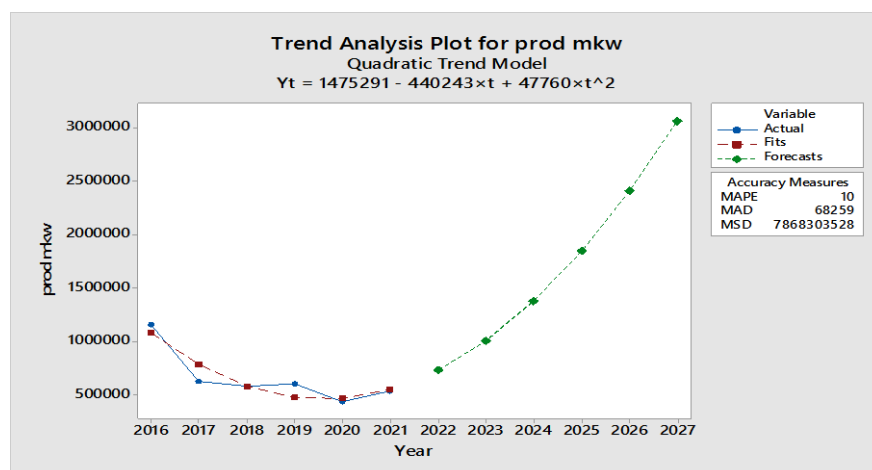

Figure 3. Graph of the quadratic model for beef production

The prediction of the beef cattle population is based on an appropriate regression model, so starting in 2026 the population will decline, while beef cattle production starting in 2025 will increase. According to Santoso and Nurfaizin (2017), people's need for beef increases every year along with the increase in population. In this case, the availability of beef is very dependent on the cattle population, so there must be a balance between the need for beef and the cattle population.

CONCLUSION

Based on the result and discussion, it can be concluded that the growth rate of the cattle population in Manokwari district is -0.364%, while the growth in beef cattle production is 13%. The trend model of cattle population and beef cattle production is the quadratic model. Based on the model, in 2026 beef cattle population in Manokwari started to decline, and vice versa, beef cattle production increased in 2025.

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