



A Study of Farmer Profiles under Climate Change Conditions in Sumenep District Indonesia

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ABSTRACT: The purpose of the study was to determine the profile of beef cattle farmers in Sumenep District and to determine the economic activities of beef cattle farming in Sumenep District before and during climate change which includes the ease of selling beef cattle, selling prices, and business profits. The research was conducted using a survey method with sampling techniques using purposive sampling with the criteria of farmers who have been doing beef cattle farming for at least two years with active livestock groups and have a minimum of two years of farming experience. Farmers who were used as respondents amounted to 150 respondents. The analysis used is descriptive with mode measurement or the most frequently occurring value. The results showed that beef cattle farmers in Sumenep district mostly have three beef cattle on their farms (65% or 97 people). Most respondents were between 15 and 64 years old (83%), had primary school education (36%) and had the most farming experience in the 20 to 30 years age range (42%). A total of 35% of respondents had three family members. Before climate change, farmers found it easy to sell their products, the selling price was good and it was easy to make a profit. Whereas during climate change, farmers found it difficult to sell their products, selling prices were lower and it was difficult to make a profit.

KEYWORDS: Beef cattle, Climate Change, Farmer profile, Livestock business

INTRODUCTION

Climate change is becoming an urgent global challenge with significant impacts on key sectors, such as livestock, agriculture, forestry and fisheries. These impacts are expected to intensify in the future, affecting the quality and availability of natural resources. These industries are particularly vulnerable to climate change due to their reliance on resources that are susceptible to such changes. As a result, agricultural productivity is threatened, potentially jeopardizing food self-sufficiency or food security efforts, especially in developing countries such as Indonesia, Thailand and Vietnam (Feleke et al., 2016). The impacts of climate change are also felt by smallholder farmers in poor and least developed countries. In Indonesia, climate change is reflected in climate variations, for example, significant changes in rainfall in some provinces on the island of Java (Avia, 2019). Studies show that the livestock sector worldwide faces serious challenges due to climate change, affecting key factors such as water availability, animal productivity, reproduction and livestock health. Food security in developing countries, including Indonesia, is threatened as the efficiency of animal protein production is limited by heat stress, which is likely to be a major factor. Although Indonesia is considered the largest consumer of meat, especially beef cattle, the majority of the 17 million beef cattle can only supply about 45% of domestic beef consumption (Greenwood, 2021).

Sumenep district on Madura Island faces serious challenges from climate change, especially in the beef cattle sector, which is the main source of income. The district is among the areas with a high risk of climate change disasters. Air temperature data for 2022 shows an average increase, with temperatures in Sumenep district ranging from 27.24°C-29.32°C. Rainfall patterns have also changed, with the highest amount in February and the lowest in September (Meteorology, Climatology, and Geophysics Agency, 2022). Drought is a serious threat in Sumenep district, especially in the island sub-districts. Ayinde et al. (2011) stated that climate change, particularly rainfall patterns, significantly affects livestock productivity. This condition is further exacerbated by unpredictable weather, which can disrupt the diet and welfare of livestock, as well as extreme heat, which can cause heat stress and livestock death. Climate change also impacts the availability of feed and natural resources, vital for beef cattle farming. This creates an urgency to mitigate the increasing intensity and impact of climate change. Appropriate responses are needed, particularly through adaptation, to help farmers deal with extreme weather conditions and climate variations. Adaptation measures in the livestock sector are key to sustaining the agricultural sector, protecting the livelihoods of the poor and strengthening food security (Tesfaye & Seifu,



2016). The cost of climate change to beef cattle farming in Indonesia is enormous with a 20% reduction in livestock production projected by 2050 in Southeast Asia. In addition, climate change can cause economic losses in beef cattle farming such as decreased production yields and decreased livestock productivity. Therefore, the researcher aims to review the profile of beef cattle farming during climate change in Sumenep District which includes farm profiles based on age, education level, farming experience, household size, farmer business scale and farmer economic activities during climate change.

MATERIAL AND METHODS

Beef Cattle Business in Indonesia

Beef cattle business is part of the livestock sector. According to Asem-Hiablle et al. (2018), there are three types of beef cattle systems: cow-calf, cow-calf to stocker and cow-calf to finish. The cow-calf system produces weaned calves; cow-calf to stocker supplies cattle ready for fattening; while cow-calf to finish supplies beef cattle ready for slaughter. Beef cattle enterprise management involves seedling management, feed, housing, disease control and waste management. In breed management, breed selection, such as natural mating with local males or artificial insemination technology, can increase profits with cost and accessibility considerations (Lukuyu et al., 2019). Technologies such as artificial insemination and embryo transfer facilitate genetic improvement of beef cattle with the support of better animal health and transportation facilities (Sejian et al., 2013). Feed, the second area of management in beef cattle enterprises, can be provided in two ways: by releasing cattle on pasture or by feeding in pens from one's own or nearby land. Pasture feeding aims to allow cattle to obtain forage naturally throughout the year without additional feed (Dick et al., 2015). Cage feeding can utilize waste from various sectors, such as plantations, horticulture, agro-industry or agriculture. Cage management, which is the third management, pays attention to the principle of animal freedom to increase productivity and reduce stress or stress. Cages in beef cattle business are divided into group cages and individual cages. Location, construction, drainage, landfill, and supporting equipment are important aspects that must be considered in the construction of cages. Disease control and prevention, the fourth management, can be done by implementing biosecurity measures, such as health checks by veterinarians, quarantine, treatment, and vaccination of beef cattle (Brscic et al., 2015). Fifth, waste management in beef cattle enterprises involves managing farm waste into manure, which can be applied to agricultural land or sold (Asem-Hiablle et al., 2018).

Beef, as a major source of nutrition with high protein, B vitamins, and essential minerals such as iron and phosphorus, shows interesting consumption trends in Indonesia. According to the latest Central Bureau of Statistics, 2022 report, average beef consumption has fluctuated significantly in the past decade. In 2013-2014, consumption reached its lowest point, at around 0.005 kg per capita per week. However, recent data shows a marked increase, reaching 0.010 kg per capita per week in 2022, a record high in the last decade. The graph shows that between 2017-2021, consumption remained static at 0.009 kg per capita per week, reflecting the diverse dynamics of beef consumption in Indonesian society. Awareness of the importance of meat intake as a key source of nutrition is increasing, reflecting changing consumption patterns. In 2022, Indonesia's demand for beef and buffalo meat was 695.39 thousand tons (Directorate of Livestock Statistics, Fisheries and Forestry, 2022) while fresh beef consumption was 0.469 capita/year in 2020 (Directorate General of Animal Husbandry and Animal Health, 2021). Population increase, urbanization and income growth are the factors that trigger the increasing demand for more food (Davis & White, 2020). Increased demand provides opportunities for Indonesian farmers to increase population, beef production, and maintain food security. This opportunity is supported by the Ministry of Agriculture, which issued a revitalization program to increase domestic production and reduce meat imports (Hastutiek et al., 2022).

Climate change

Climate change has a negative impact on the livestock sector, including livestock. The impacts of climate change affect internal factors, such as reproduction and productivity, health, feed intake, animal welfare and external factors, such as water availability, forage quality and quantity, feed costs, increased frequency and types of plant diseases or pests, decreased performance and health of farmers (Amamou et al., 2018). Productivity disruptions pose a new threat to meeting food demand. Furthermore, livestock health is compromised due to the increased severity and prevalence of stress-induced livestock diseases resulting from water and pasture shortages (Ayal et al., 2018). Climate change affects livestock welfare by causing heat stress that can lead to economic losses, such as increased maintenance costs. Other effects of climate change also occur downstream of livestock farming, including processing, storage, transportation, retail sales and consumption of livestock products (Godde et al., 2021). Climate change



will result in more dramatic future consequences, such as the threatened distribution of natural vegetation and biodiversity, erosion and storms, all of which will affect human life.

Impact of business economic activities

Beef cattle are livestock raised to produce meat as the main product. Beef cattle meat has a high economic value and is important in people's lives. The success of beef cattle farming is highly dependent on the fulfillment of nutrition and animal health. Sudarmono and Sugeng (2008) stated that beef cattle are one of the meat producers that have high economic value and are important in people's lives. Ruminant livestock rearing, which is the driving force for income generation and employment, is vulnerable to this phenomenon due to its strong dependence on climatic conditions. Cattle farming holds great promise, but its level of contribution in supporting livelihoods and income is currently low due to factors related to climate change. Climate change has been recognized as having potentially severe impacts on livelihoods and incomes.

Research method

The research method chosen was a survey approach using a questionnaire, which was distributed to beef cattle farmers in Sumenep District who have been running their businesses for at least two years and are members of livestock groups, and have a minimum of two years of farming experience in the area. Sugiyono (2019) states that a questionnaire is an effective data collection tool by providing a series of questions or written statements to respondents to answer. Respondents are asked to provide written answers to the questions asked. The questionnaire can be given directly to beef cattle farmers in Sumenep District to explore information about farmer profiles including farmer age, farmer education, farming experience, household size and farm business scale.

The sampling technique used in the study used purposive sampling technique as the selection of respondents. Purposive sampling is a sampling technique with certain considerations (Sugiyono, 2019). So, farmers who are incidentally met by researchers if the farmer is considered suitable can be sampled (Sugiyono, 2019). The data analysis used is descriptive analysis. Descriptive analysis is an analysis that describes data that has been processed so as to produce information that is clear and easy to understand. Descriptive statistics is the process of analyzing data by describing the available data without intending to generalize the conclusions drawn. Measurements can be reviewed from the minimum value, maximum value, most frequently occurring value, average and standard deviation (Sugiyono, 2019). The measurement used is the value that appears most often or mode (mode). Mode or mode is the value that appears most often from a set of data (Junaidi, 2014).

RESULTS AND DISCUSSION

Breeder profile by age

This study showed a diversity of farmer characteristics based on age. There were no farmers in the 0-14 years age group in the study location, while the age group above 64 years recorded the second highest number of unproductive farmers (17%). The dominance of productive age is seen in the 15-64 years age group, reaching 83% (125 people), because they have physical strength, mature thinking, tendency to make quick decisions, and openness to innovation and technology. This makes it easier for them to manage and develop their beef cattle farming business effectively. Siregar (2009) states that a person's productive age, 20-65 years, reflects a high interest in learning. Farmers at this age are able to make efficient decisions in developing beef cattle farming.

Table 1. Percentage of Farmer Age

No	Age	Number of Farmers (People)	%
1	0-14	0	0%
2	15-64	125	83%
3	>64	25	17%
Amount		150	100

Siregar (2009) states that a person's productive age, 20-65 years, reflects a high interest in learning. Farmers at this age are able to make efficient decisions in developing beef cattle farming. Hartono (2006) emphasizes the importance of farmer age in effective and efficient decision-making. Young farmers tend to adopt innovations and technologies more quickly despite limited



farming experience. The younger generation has the enthusiasm and desire to explore new things, facilitating the adoption of innovations and technologies in the livestock business. On the other hand, in old age, there is resistance to innovation and technology due to the tendency to maintain conservative thinking and traditional values. Challenges arise in changing their mindset regarding the latest innovations and technologies due to the strong emotional attachment and traditional values in this age group.

Farmer profile by education

From the results of this study, there is a diversity of farmer characteristics based on education level. The highest percentage was found at the primary school education level at 36%, followed by junior high school (28%), senior high school (27%), bachelor's degree (8%), and master's degree (1%).

Table 2. Percentage of Farmer Education

No	Education level	Number of Farmers (People)	%
1	Elementary school	54	36%
2	Junior high school	42	28%
3	Senior high school	40	27%
4	Bachelor	12	8%
5	Master	2	1%
Amount		150	100

The education level of farmers in Sumenep district tends to be low, mainly dominated by primary school graduates. This is due to various factors such as dropping out of school, lack of awareness of the importance of education and economic constraints. Farmers see animal husbandry as a way to increase their knowledge, skills, experience and income, so they do not continue formal education to a higher level. This thinking is in line with the view that skills can be acquired through informal daily farming experiences. Although there is a different view that education level reflects the skills and knowledge of farmers (Makatita, 2014), it can be an obstacle in developing beef cattle farming, especially in adopting new technologies. Low levels of education can lead to a decrease in farmer performance, especially in addressing issues related to beef cattle farming, such as the impact of climate change on resources. Therefore, access to further education and improving farmers' education levels are critical in dealing with changes and developments in the livestock sector.

Farmer profile by farming experience

The majority of respondents had a variety of farming experience, with the 20-30 years farming experience group reaching the highest percentage (42%), followed by the 10-20 years group (41%). The group with 5-10 years of experience ranked third highest (15%), while the group with more than 30 years of experience had the lowest percentage (2%).

Table 3. Percentage of Farming Experience

No	Length of Farming (Years)	Number of Farmers (People)	%
1	5-10	23	15
2	10-20	61	41
3	20-30	63	42
4	>30	3	2
Amount		150	100

Farmers with 20-30 years of experience accounted for the highest percentage, indicating that long experience contributes to the development of skills and a deep understanding of beef cattle farming. In the long term, such experience helps farmers make decisions quickly and appropriately, in line with the view of Anindiyasari et al. (2015) who emphasized that long farming experience can influence farmers' ability to maintain livestock health and produce quality meat. Fitriza et al. (2012) also highlighted that hereditary farming experience can improve the success of livestock enterprises, especially in terms of income and knowledge.



Farmer profile by household size

The results showed variations in farmer characteristics based on the number of family dependents. The group with 3 family members had the highest percentage (35%), while the group with 6 family members had the lowest percentage (3%). It can be concluded that the number of family dependents affects the farmer's income, with fewer dependents tending to increase income without reducing the welfare of the farmer's family.

Table 4. Percentage of Farmer Household Size

No	Number of Family Dependents (People)	Number of Farmers (People)	%
1	2	30	20
2	3	52	35
3	4	51	34
4	5	13	9
5	6	4	3
Amount		150	100

Sumbayak (2006) stated that the number of family dependents has an impact on the living expenses of farmers, encouraging them to develop livestock businesses for income optimization. The number of family members is a crucial parameter in determining farmers' income, affecting the complexity of needs and motivation for business development to overcome financial challenges. The more family members, the higher the expenditure and income demands, requiring efficient and effective decisions in the development of beef cattle farming (Hartono, 2006). Farmers' decisions are also related to adaptation to climate change; families with more members can make more effective decisions in the face of climate change (Amir et al., 2020).

Farmer Business Scale

Questionnaire data shows the scale of beef cattle farmers' businesses in Sumenep district, focused in Batuputih, Lenteng and Kalianget. The majority of farmers have a beef cattle population, with 4% (6 people) having 2 cows, 31% (47 people) having 4 cows and 65% (97 people) having 3 cows. From a total of 150 respondents, the beef cattle population reached 491 heads.

Table 5. Percentage Farmer Business Scale

No	Number of Livestock (Tail)	Number of Farmers (People)	%
1	2	6	4
2	3	97	65
3	4	47	31
Amount		150	100

Beef cattle farming is highly dependent on the number of cattle owned, which has a major influence on meat production as the main product vital to farmers' income. In addition to meat sales, additional income can be obtained from calf sales and utilization of manure as fertilizer, supporting the principle of sustainability. Dependence on the number of beef cattle not only affects production but also directly impacts farmers' income. According to Taslim (2011), dairy cattle ownership has a significant effect on farmers' income, so increasing the number of beef cattle can increase meat production and overall farmers' income.

CONCLUSION

Beef cattle farmers in Sumenep District have been breeding cattle for more than 20 years on average, but with a relatively small population scale of 3 heads with most farmers having a primary school education. Before the climate change period, farmers felt it was easy to sell their livestock, the selling price was good and it was easy to get business profits. Whereas during the climate change period, farmers found it difficult to sell their livestock, the selling price was lower and it was difficult to make a profit. Economic activities of beef cattle farming during climate change that have a direct impact on farmers are difficulties in selling and decreased business profits. Considering that many people have relatively low education, it is recommended for farmers to increase



informal education with training in livestock cultivation by paying attention to Good Agricultural Practices (GAP) and beef cattle farmers based on smallholder farms are advised to raise beef cattle above the scale of 4 heads by meeting sanitation standards and immediately reporting to animal health officers if livestock experience problems to minimize business losses.

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