Modernizing Madura Cattle Farming for National Food Security: Emile Durkheim's Social Solidarity Perspective

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Abstract. Ensuring a national meat supply is essential for Indonesia's food security. Madura cattle, a valuable genetic resource, have faced challenges such as traditional farming practices, supply chain gaps, and insufficient Government support. Addressing these issues is vital for enhancing Madura cattle's role in national food security. This study uses Emile Durkheim's social solidarity framework to explore the potential and challenges of Madura cattle farming as a national food source. An exploratory and participatory qualitative approach was employed, involving researchers as active stakeholders in developing Madura cattle farming. a) The current population of over 1 million Madura cattle is maintained through traditional methods, limiting their contribution to farmer-breeders' welfare and national meat supply. b) Modernizing management and technology in Madura cattle farming could enhance its role in food security, alleviate poverty, improve farmer-breeders' welfare, preserve Madurese cultural practices, maintain genetic purity, and meet national meat demands. Modernization of Madura cattle farming is crucial for increasing its contribution to the national meat supply and supporting socioeconomic development. Emile Durkheim's social solidarity framework underscores the importance of collaborative efforts among stakeholders to achieve sustainable food security.

Keywords: Madura cattle farming, national food security, Emile Durkheim, Social Solidarity

1. INTRODUCTION

National resilience has a broad scope and correlates with various social elements of society, such as food security. The issue of food security continues to emerge on a global scale. At the national level, various food-related problems also continue to attract attention, including the availability of beef to supply the national meat demand. There is a gap between the availability and the demand for national meat because the supply could have been more optimal, and a significant portion still relies on imports.

Madura cattle are one of the endemic livestock originating from Madura Island. This local breed has played a significant role in meeting the national meat demand. Madura

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is the most significant contributor to beef production in East Java, which is the centre of the beef cattle population in Indonesia, providing 27.36% of the total national beef cattle population (Ministry of Agriculture, 2022). The number of beef cattle in East Java has consistently grown. In 2018, the population was 4,637,970 heads; in 2019, it was 4,705,067 heads; in 2020, it increased to 4,823,970 heads; in 2021, it was 4,928,987 heads; and in 2022, it reached 5,070,240 heads (Ministry of Agriculture, 2022). Of this total, Madura Island becomes the most significant contributor to beef demands. In 2017 alone, the total cattle population in Madura was 974,548 heads (Firmansyah & Sunyigono, 2020). This number has continued to increase, reaching 1,096,084 heads in 2022. The majority of this population consists of the local breed, Madura cattle.

The large number of cattle in Madura is attributed to small-scale subsistence breeding practices, which are traditional and involve very small-scale operations. The agrarian Madurese community, where most of the population are farmers, almost entirely raises Madura cattle. This is because, according to tradition, cattle are used to help with farming activities, utilizing agricultural waste for feed and serving as a form of savings. Cattle are considered alternative savings because they can be sold more efficiently when the owner faces urgent needs.

As it is shared among the people of Madura, the community in Sumenep regency also has an emotional connection to cattle. This closeness makes cattle unique and leads to good livestock care. Robbins et al. (2023) believe that good care of cattle correlates directly with good production outcomes. For dairy cattle, proper care results in excellent milk production in quantity and quality (Smid et al., 2023). Similarly, good care of beef cattle results in high-quality beef, which includes benefits such as low-fat content, balanced meat proportions, and exceptional taste (Munro et al., 2017; Carvalho et al., 2020).

Various approaches are needed in managing cattle, including maintaining genetic quality (Brito et al., 2021). Kirkland et al. (2017) believe that preserving cattle genetics ensures that superior traits remain consistent over time. Consumers can quickly identify beef quality from well-preserved genetics through characteristics such as colour and tenderness. Additionally, cattle with high genetic quality possess several other advantageous traits (Johnson et al., 2018). Maintaining genetics extends to behaviour and management practices (Andric et al., 2019). Managing the feeding process, observing cattle behaviour in daily activities, adhering to appropriate housing standards, and fostering a close relationship between farmers and cattle are ways to ensure cattle welfare (Sandoe et al., 2023). Ensuring cattle welfare through this approach is a way to create high-quality outputs, both in beef and dairy (Johansson et al., 2023).

The cattle farmers in Sumenep have been carrying out these activities as part of their daily routine. Their close relationship with the cattle they raise is a distinctive pattern of interaction that fosters good relationships and leads to sound output from their cattle. Even though this area has a high cattle population raised in dedicated care from the farmers, this still needs to improve the general economic status of the farmer-breeder community. They still have low income from their cattle. This is due to the characteristics of the local communities of the farmers-breeders who generally rely on small-scale traditional livestock farming. Farming is still subsistence-based, only for personal

needs, with the average farmer-breeder household raising only two cattle. This is generally the case throughout Madura Island. Marketing is also less than optimal because there is no proper market institution for marketing traditional cattle farming. Therefore, Madura's agro-industry, based on cattle commodities, has yet to develop optimally (Kutsiyah, 2018).

Approaches for management improvement need to be taken. Wendimu et al. (2023) exemplified that some farmers still apply mixed farming systems in various countries. Integrative acts are carried out in these agricultural systems between crop cultivation and livestock products. This system has its advantages because the availability of crops cultivated within the integrated farming can be utilized as a food supply for the cattle. Additionally, economic stability is better maintained because this type of community-based cultivation system tends to have a higher level of security during economic shocks. However, significant development is challenging due to relatively weak management aspects. Therefore, management improvements with professional management, institutional refinement from upstream to marketing and downstream distribution, and increasing the scale of livestock farming are efforts that can be undertaken to develop Madura cattle farming. Various innovative steps in livestock farming must also continue to be taken to meet the future needs of the beef industry.

The limitations in community-based livestock farming must be seriously addressed to create better livestock farming. There are gaps in the supply chain, such as price instability, caused mainly by personal negotiations that partly depend on supply and demand and are also influenced by cultural factors and religious holidays. The optimization of human resources must also be distributed to be more productive and create production effectiveness. Innovations in livestock farming need to be continually enhanced. Speaking of innovations, recently, there have been innovations to develop Madura cattle, such as constructing a corn silage plant to meet the feed requirements for Madura cattle. With these various aspects, if modernization and industrialization of Madura cattle are undertaken, there is an opportunity to develop Madura cattle, which can significantly contribute to the national beef needs, aiming for self-sufficiency in beef.

The TNI-AD has gone through a long historical journey in civil-military relations, especially assisting non-war operations. The history of the TNI shows that the birth of the Indonesian national army began with the participation of the people in defending independence in the form of the struggling soldiers, continuing to the new order with the dual function of the ABRI. After the reform, this role was strengthened by TNI Law number 34 of 2004, where article 7b mentioned 14 TNI duties in Military Operations Other Than War (OMSP). The Ministry of Agriculture made a memorandum of understanding on December 4, 2024, regarding TNI assistance to increase national food security. The involvement of the TNI-AD, especially Kodim 0827/Sumenep, in the development of agriculture and livestock in Madura is the actual participation of TNI soldiers in the implementation of military operations other than war in helping the difficulties of the community, especially in Madura, where in Madura the TNI soldiers in the region are highly respected so that the program implemented will be easier for the community to follow, especially farmers and cattle breeders.

Although it has been carried out traditionally, Madura cattle farming has made a real contribution, contributing more than 5% to fulfilling national meat needs. If implemented in a modern way, the percentage will increase sharply, so it significantly impacts meeting national meat needs. Modernization assisted by the TNI-AD has proven to have shown success figures. If this program is adopted as a national policy, the modernization of Madura cattle farming can become Indonesia's food security axis.

2. RESEARCH METHODS

Kodim 0827/Sumenep (Military District Commander 0827/Sumenep) is pivotal in developing Madura cattle in Sumenep. The researchers are also part of Kodim 0827/Sumenep. Therefore, this research is participatory or action research. This research also employs an exploratory qualitative method in which the data were collected qualitatively by implementing some procedures, such as observation, interview, ethnography, and focus group discussion.

The observation was conducted from June 2022 to March 2024. The researchers periodically observed the traditional livestock farming practised by farmer-breeders. On the other hand, the interviews were conducted with farmers, entrepreneurs, financiers, soldiers, and the local Government using unstructured interviews. Moreover, ethnography involved collecting the data by observing the culture of the Sumenep community, which regards Madura cattle as a social identity, economic value, cultural preservation, pride, and cultivation commodity. Focus group discussions were conducted by inviting the farmers, entrepreneurs, financiers, soldiers (Babinsa Kodim 0827/Sumenep), and the local Government officials of Sumenep.

This research is an empirical case study conducted in Sumenep Regency. The analysis technique employs Emile Durkheim's qualitative theory of social solidarity as the primary analytical tool in this study. From the observations made after the qualitative data were collected, the level of connectivity among the farmer-breeders and other actors in modernizing livestock farming was measured based on mechanical solidarity and organic solidarity parameters, correlated with the concepts of collective consciousness and interdependence.

The research methods carried out above brought accurate data, precise analysis, and good research results, which will assist stakeholders in improving future Madura cattle breeding development.

3. LITERATURE REVIEW

3.1 Social Solidarity

This research used Emile Durkheim's theory of social solidarity to explore innovations in national food self-sufficiency activities. Solidarity is a cohesion in society that unites them, a feeling shared by each member of society that they are part of a whole. Social solidarity is a fundamental way to measure the strength of society, specifically how people feel connected to one another.

Durkheim argued that there were many ways to connect individuals and communities. Among them are educational programs, social programs initiated by the Government, and law. These things can help regulate and integrate individuals into society (Durkheim, 1997).

According to Durkheim, there are two different types of social solidarities in society: first, Mechanical Solidarity for pre-modern societies (which in this research will be replaced with the term Traditional Societies; second, Organic Solidarity for modern societies (which in this research will be replaced with the term Industrial Societies) (Durkheim, 1997).

The distinction between the two types of Social Solidarity does not mean that a Traditional Society will implement 100% Mechanical Solidarity while an Industrial Society will implement 100% Organic Solidarity. Implementing these two types of Social Solidarity in a society is a spectrum.

In a society that exhibits Mechanical Solidarity, the cohesion and integration of its members come from the homogeneity of individuals. They feel connected through the types of work, qualifications and competencies from education or training, religious beliefs, ancestry or forefathers, and similar or identical lifestyles. Mechanical Solidarity typically occurs in small-scale and traditional societies and is based on primordial relationships (tribe, race, and religious beliefs), even based on kinship ties within family networks.

On the other hand, in a society that exhibits Organic Solidarity, the cohesion and integration of each individual or group as a member stems from a sense of mutual dependence on one another, which is a manifestation of the competencies and qualifications of their respective areas of specialization (skills and expertise). Although individuals perform different tasks and often have different values and interests, the order and solidarity of society depend on their reliance on each other to perform their designated tasks.

The term "Organic" in the concept of Organic Solidarity refers to the interdependence of component parts. Therefore, Social Solidarity is maintained in more complex societies through the mutual dependence of its components. An example can be seen in a community where farmers produce food to feed factory workers, who manufacture tractors, which enable the farmers to produce food. As members of society, they can complement each other. This is a characteristic of industrial societies.

Besides introducing the terminology of Mechanical Solidarity and Organic Solidarity, Durkheim also introduced the concept of Collective Consciousness and the concept of interdependence in his theory of social solidarity. According to Durkheim, the type of solidarity will correlate with the type of society, whether it is a society with Mechanical Solidarity or Organic Solidarity. The two types of solidarity can be distinguished based on morphological and demographic characteristics, the norms present, and the intensity and content of Collective Consciousness (Collins Dictionary of Sociology, p. 405–06).

Durkheim defined collective consciousness as the reason and how individuals or groups that are different from each other can come together and form a society. This happens because the collective consciousness of a society refers to a set of beliefs, values, and common behaviours found in that society (Durkheim, 1997).

Regarding the term 'independence,' Durkheim explained that society could exhibit more organic and more complex solidarity when there is greater mutual dependence between individuals and groups. Individuals or groups rely on others to complete their tasks and work. This independence will foster a robust collective consciousness (Durkheim, 1997).

By adapting Durkheim's perspective for this research, the Madurese community is identified as a traditional society, where the dominant solidarity is classified as mechanical solidarity. Given the diverse involvement of stakeholders in the Madurese cattle farming sector, the Madurese community in this sector is also considered appropriate for identification as an industrial society, where the prevailing solidarity is organic solidarity. Critically, this research will use the analytical framework of social solidarity introduced by Emile Durkheim, including the concepts of mechanical solidarity and organic solidarity, collective consciousness, and interdependence to answer the following research question: "Why does the development of Madurese cattle farming have the potential to be a source of national food, and how can national food independence be achieved?"

3.2 Madura Cattle

Madura cattle are one of the tropical cattle breeds in the world and are endemic livestock native to Madura Island. They are extensively cultivated in various regions around Madura, especially in East Java. However, they have recently spread to Kalimantan and other islands. Historically, this type of cattle is a crossbreed between Bali cattle and wild Banteng, each with superior qualities. However, there are also elements of Zebu cattle in the crossbreeding process. Nonetheless, from various approaches, Madura cattle are a genetic resource and a superior commodity from Madura, the salt island.

This type of cattle is relatively easy to breed and has various advantages. The superior quality of Madura cattle includes their genetic ability to adapt to the tropical climate with high adaptability. Some diseases like hoof diseases and rinderpest are common threats to cattle farmers. However, it will not threaten Madurese farmers because this breed is resistant. The same goes for feed, as they can still rely on low-quality feed as a source of consumption. In terms of quantity, their feed requirements are also lower than other cattle breeds, especially the imported ones.

This local breed has significantly contributed to various forms of utilization, primarily as beef cattle for meat consumption. As a beef cattle commodity, Madura cattle can meet the local meat needs and serve as one of the main contributors to national meat demand. According to several reports, Madura cattle have the potential to be developed as an export commodity.

3.3 Cattle Farming as a Food Source

As is generally the case with the people in Madura, the local community in Sumenep has a traditional culture closely tied to the cattle. Cattle are an inseparable part of their lives. The people there prefer not to own other possessions rather than not having cattle.

To meet the feed needs of their cattle, there is a saying that it is better to go without food than to be unable to buy feed for the cattle. Indeed, cattle hold such a special place in the community.

As a farmer who also doubles as a cattle raiser, the community in Sumenep, Madura, tends to engage in cattle farming using traditional systems. This system has its strengths and weaknesses. One of its strengths is genetic purity because traditional farming systems typically avoid crossbreeding. In livestock farming, maintaining genetic purity is interpreted as an effort to preserve its superior traits (Brito et al., 2021). Kirkland et al. (2017) believe their superior traits will remain unchanged by preserving cattle genetics. A crucial aspect of beef production is maintaining the proportional volume of carcasses (Carrillo et al., 2021). Crossbreeding, which combines multiple genetic traits of cattle, is sometimes relied upon to achieve higher yields, especially in increasing cattle size to produce higher meat volumes (Residiwati et al., 2020). However, this approach often fails to preserve the original superior genetic traits. Preserving cattle genetics is an effort to maintain meat quality (in the case of dairy cattle, it includes maintaining milk quality), fertility, longevity, disease resistance, climate tolerance, and adaptability to feed. The quality of meat from well-maintained genetics can be easily identified by consumers, including its colour and tenderness. Additionally, cattle with high genetic advantages possess several other beneficial traits (Johnson et al., 2018).

The traditional cattle breeding system, which involves ancient methods and is built upon the emotional bond between the farmers and their cattle, effectively addresses various problems. Several conditions indicate that the cattle lack nutrients, experience a decline in health (Wagner et al., 2018), or require additional nutrition during pregnancy, which the farmers in Sumenep understand. They provide supplementary consumption in traditional herbal mixtures formulated from palm sugar, galangal, and turmeric, which are given to the cattle as additional feed besides green fodder. The herbal mixtures for the cattle are given as needed. In other circumstances, the cattle are given appetite stimulants and natural leaves that aid digestion.

The traditional cattle breeding system has its cultural and aesthetic values. However, this traditional cattle breeding system cannot be relied upon in terms of quantity. As a source of national animal protein from ruminant meat, cattle farming must be conducted with modern management. Modernization leads to increased production (Fraser et al., 2014). The use of technology and modernity is directly proportional to increased production. This includes improvements in housing, feed quality, and supply chains (Deolu-Ajayi et al., 2023). Major beef-exporting countries have implemented modern management and appropriate technological touches to achieve self-sufficiency in meat and have a surplus for export (Li et al., 2024). Modern livestock management also leads farmers to feed innovations such as corn silage. Feed improvements have been proven to significantly increase yields in Brazil (Bernardes et al., 2024). Progress is achieved through a system in many fields, including livestock farming. Innovation is the key to feed, management, partnership programs, financing, and human resource development, as large livestock companies in Europe do (Marescotti et al., 2021).

Thailand is one of the beef-producing countries that breed purebred cattle. The country has experienced rapid economic growth over the past decade, with livestock farming being the most significant contributing sector, operated with a modern system. The beef

produced in Thailand is exclusively managed to meet domestic consumption needs. From 2015 to 2020, Thailand continued to increase its production and aimed to target Malaysia, Indonesia, and other members of the ASEAN Economic Community (AEC) as markets for its beef. To achieve this target, integration has been carried out across all sectors involved in beef production in Thailand (Bunmee et al., 2018).

Furthermore, the global demand for beef continues to increase (Beudou et al., 2017). This demand can be met if production is enhanced (Mann, 2018) with optimal management (Henchion et al., 2017). This kind of production system will be related to the level of beef demand (Sharma et al., 2016). Modern culture, which has introduced various innovations in enjoying beef, has become a significant factor in the segmented demand for beef (Coyle & Mckinstry, 2023). This segmented demand for beef also has specific impacts on the trade and distribution of beef, continually requiring professional provision at the cultivation level (Kannan et al., 2016).

4. RESULT

East Java has become the largest beef-producing province in Indonesia and also has the largest cattle population in this country. More than 20% of East Java's cattle are on Madura Island.

Table 1. Number of cattle population (heads) in 2018–2022.

Areas	2018	2019	2020	2021	2022
Sampang	215.664	215.772	216.450	217.129	219.107
Bangkalan	226.917	241.457	259.943	276.487	287.932
Pamekasan	194.297	194.195	194.299	194.308	200.955
Sumenep	367.382	372.623	377.124	383.059	388.090
Jawa Timur	4.637.970	4.705.067	4.823.970	4.928.987	5.070.240
Indonesia	16.432.945	16.930.025	17.489.333	17.977.214	18.610.148

Source: Kementan 2022a, BPS Jawa Timur 2019, BPS Jawa Timur 2021, BPS Jawa Timur 2023

The table above shows changes in the cattle population year by year at the regency level in Madura, at the provincial level in East Java, and the national level. All the data indicate an increase in population, particularly in East Java, the leading centre for beef cattle breeding in Indonesia, which consistently has the highest population at the national level. Narrowing down further, Madura is the region with the highest cattle population in East Java, with a population exceeding one million heads, or more than 20% of the cattle population in East Java. Within Madura itself, the highest cattle population is in Sumenep Regency, accounting for 35,4% of the total population on Madura Island.

However, the high cattle population does not correlate with the welfare of the farmers in Sumenep. This is because cattle management there is still conducted traditionally. Management in cattle breeding has a significant impact on generating profits for farmers. Subsistence farming by the community has been one of the obstacles to improving

their welfare. If livestock farming were conducted modernly with professional management, it would be the key to improving the welfare of cattle farmers in Sumenep, Madura (Mahardi, 2024).

This aligns with the theory proposed by Durkheim (1997) about social solidarity in mechanical societies. The traditional community of Sumenep or Madura predominantly still holds strong traditions where one of the social functions of raising cattle is a matter of honour. Often, the economic function is overshadowed. This function is closely related to the role of cattle as a factor of cohesion and integration in Madurese society, where people are interconnected by the commonality of their work, characterized by homogeneity as both farmers and livestock breeders.

Strengthening the role of institutions is crucial to addressing traditional management practices. Kodim 0827/Sumenep has partially implemented the institutional role in the development of Madura cattle, covering the entire supply chain from upstream to downstream. Capital management, feed provision, and marketing can be managed through a partnership scheme between Kodim Sumenep, farmers, and the private sector. This institutional approach fosters innovation, one example being the innovation in feed provision that has already been discussed.

This collaboration scheme has led to the initiation of a corn silage factory with a production capacity of 40 tons per day. This factory will serve as a model for establishing additional factories, providing a solution to the challenge of cattle feed requirements. With the projected increase in cattle production, the need for healthy feed with balanced fibre content, adequate nutrition, and sufficient quantity must be met. This need is addressed through institutional mechanisms, such as the partnership scheme implemented by Kodim 0827/Sumenep (Mahardi, 2023). This is because feed has long been a significant challenge for farmers.

Feed availability for the cattle is very abundant during the rainy season. However, feed becomes very difficult to obtain when entering the dry season. During the rainy season, cattle farmers engage in the activity called Ngarit (foraging for grass traditionally, which will later be used as feed for the cattle). They commonly do this activity at least twice daily, with higher intensity during the rainy season. Only some of the grass collected is given to the cattle on the same day. Half of it will be dried for feed preservation as a stock for the next dry season. This preserved feed is called Cangkarok. Cangkarok will be provided as feed when the land has dried up, and fresh grass is no longer available. This continues while waiting for the rain to come. However, problems often arise during prolonged dry seasons when Cangkarok is unavailable.

To address the problem of feed shortages above, corn silage offers an alternative solution since it can be produced in large quantities during the harvest season and has a shelf life that may last for years. Traditionally, feeding cattle with grass depends on the rainy season. Providing cattle feed in silage combined with concentrate satisfies hunger and promotes high average daily growth (ADG), potentially reaching over 1 kilogram.

Table 2. Average Daily Gain (ADG) Madura cattle in modern farm

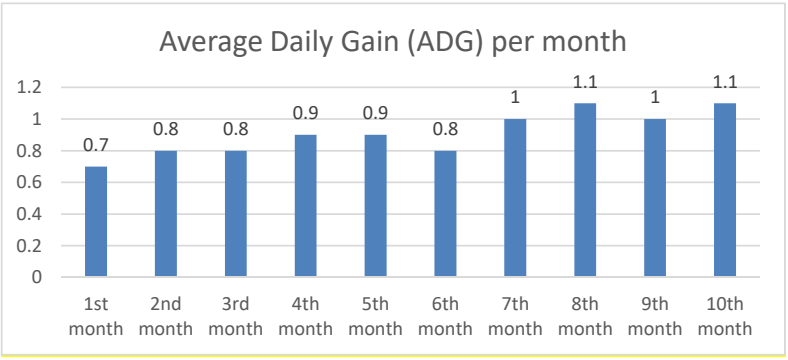
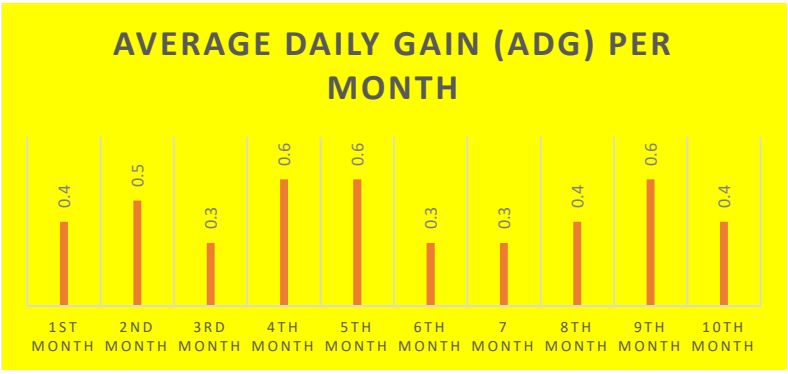


Table 3. Average Daily Gain (ADG) Madura cattle in traditional farms



The same rearing pattern is used to raise Madura cattle both traditionally and modernly. Farmers buy calves from the market and raise them for about ten months, then sell them again at a much heavier weight. The difference is in the daily weight growth. In traditional farms, the average weight growth rate is slower and fluctuates. Meanwhile, the growth rate of cattle weight in modern farms is faster and tends to be stable.

These two conditions are influenced by various factors, one of which is feed. In traditional farms, the feed used varies according to availability. During the rainy season, forage feed is abundantly available. However, during the dry season, the feed provided is grass/dry leaves or other types of feed available. Changes in the type of feed will have an impact on cattle adaptation related to decreased appetite. In addition, when there is a condition in which cows have decreased appetite, are affected by diseases, and have other harmful conditions, the diagnosis made by the farmer is traditionally carried out using conjecture, so the treatment is not always appropriate.

Meanwhile, in modern livestock, by implementing an example, the feed used is silage, which is processed from forage (corn plants) and then combined with concentrate. Health workers on the farm pay attention to the content of the feed, and the type of feed is given regularly without changing other types of feed. In addition, the health condition of the cows is routinely controlled to avoid disease, loss of appetite, and several other bad conditions to be treated according to the diagnosis.

The innovation of corn silage as an effort to modernize the provision of feed for Madura cattle reveals that the community in Sumenep does not solely adhere to mechanical solidarity but also embraces organic solidarity. In this feed innovation, which demands modern management practices, farmer-breeders' homogeneity becomes interdependent with groups of corn farmers, financiers, entrepreneurs, and even the military in the food security program. This validates Durkheim's theory (1997) that mechanical and organic solidarity do not always exist independently in society but can sometimes blend into a spectrum that shifts its emphasis.

Furthermore, to preserve the genetic heritage of Madura cattle, the local Government has undertaken efforts to protect their genetics. Through Sumenep Regent Regulation No. 11 of 2018, the local Government has designated specific rural livestock areas in Sumenep Regency, focusing on Madura cattle. Out of 27 subdistricts, ten have been designated as rural livestock areas, such as Batang-Batang, Dungkek, Lenteng, Bluto, Pragaan, Ganding, Batuputih, Giligenting, Gayam, and Nanggunong. These special livestock areas are specified for cattle because cattle become the flagship livestock of Sumenep Recency, even around Madura Island. The cattle given particular policies are Madura cattle, the endemic livestock and a unique genetic resource native to Madura Island.

5. DISCUSSION

5.1 Between Social Identity and Economic Value

As animals become the commodities of livestock farming, cows are always associated with the need for meat (Metelkova et al., 2019). In other words, cattle farming is an activity that meets the demand for slaughtered animals. This is different from the Madura cattle. The people of Madura Island regard cattle as a social identity. The Madurese community has a unique cultural aspect, including in Sumenep. In rural areas, cattle are used as a means of transportation, known as Pajikaran cattle. In other circumstances, Madura cattle are used in a distinctive traditional sport called karapan sapi. This is a bull race competition among the residents who use a pair of male cattle. Then there is also the sapi sonok. This is a contest among the people of Madura Island to showcase the beauty of the cattle they raise. The sapi Sonok competition involves female cattle (Heryadi & Fitrianti, 2022). There are also other uses of Madura cattle as a social identity, such as Taccek and displaying female cattle. The difference is that the selection is based on age, body size, and phenotype, and the winner is considered a potential superior breeding stock.

Cattle have incredibly high value for the people of Sumenep from various economic and economic perspectives. Economically, it is clear that cattle serve as a form of savings for the community there. Most residents would prefer cattle to store wealth over other forms of savings. In a social context, cattle represent pride and dignity. In the socio-cultural life of the Sumenep community, dignity is the highest value in the social hierarchy. The Madurese people generally have a saying, "etembhang pote mata, angoan apotea tolang" (better to be pale-faced than to be pale-boned). This expression means that it is better to preserve one's dignity than to live in shame, and in this regard, a Madurese person's dignity is also reflected in the cattle they own (Ar Razy & Mahzuni, 2022). Therefore, cattle cannot simply be regarded as livestock; a noble value is attached to them that continues to be upheld (Boyland et al., 2016). Raising cattle is more than just an economic necessity. However, it has become a cultural conservation practice from generation to generation since ancient times, remaining closely tied to the customs they preserve (Srivastava et al., 2019).

Nevertheless, the primary use of Madura cattle remains for meat consumption. According to a report from the Central Bureau of Statistics (Balai Pusat Statistik/BPS), East Java had the highest beef cattle population. In 2020, 2021, and 2022, East Java had the largest beef cattle population, with 4.823.970 heads, 4.928.987 heads, and 5.070.240 heads, respectively. As a region within East Java, Madura contributes significantly, with most of the cattle population in Sumenep reaching 381.104 heads, the highest population among all regencies/cities in East Java (BPS Sumenep, 2023).

5.2 Germplasm as Superior Qualities in Cattle Breeding

Madura cattle are categorized as a superior genetic resource. As a local breed, Madura cattle possess various outstanding qualities. They have a high resistance to stress, environmental challenges, and diseases. This superior trait is essential in the context of distribution. The mortality of cattle during transport has been a common issue. However, in the maintenance process, the cattle's resistance to seasonal changes and ease of care are key factors in successfully implementing livestock farming. These superior qualities have long been present in Madura cattle. Another advantage is their high fertility rate. An additional important factor linked to environmental conditions and climate anomalies is the issue of feed (Schwanke et al., 2023). Madura cattle have the advantage of being highly adaptable to low-quality feed. They are also resilient to the hot tropical climate (Kutsiyah, 2018) and resistant to diseases caused by climate anomalies (Polsky & Keyserlingk, 2017).

The genetic traits of superior value have led the Government to give special attention to protecting Madura cattle as an indigenous germplasm of Indonesia (Tribudi et al., 2020). In order to maintain these superior qualities, ensuring the availability of high-quality sires and dams poses challenges (Vries, 2017). A structured selection system is necessary (Mrode et al., 2019). There are various indicators used as standards to determine the quality of dams, such as based on weaning weight and yearling weight (Rodrigues et al., 2021).

The superior quality of cattle must be maintained as it directly correlates with the quality of beef as its product. Based on several perspectives, consuming processed beef

is not just about fulfilling dietary needs but also a lifestyle choice. According to Hizakova et al. (2020), some groups of farmers consider the quality of cattle as a source of satisfaction. High-quality cattle determine profitability as farmers have flexibility in setting prices. However, other factors supporting husbandry practices are also crucial (Govignon-Gion et al., 2015). The environment plays a significant role in determining the success of husbandry (Gerber et al., 2015). This highlights that superior genetic qualities must be supported by husbandry practices such as providing appropriate feed (Pauler et al., 2020).

Sumenep is a region in East Java known as a primary centre for beef production and a key area for maintaining the genetic purity of Madura cattle. There are rural livestock farming areas in Sumenep where specific infrastructure and facilities have been developed, such as roads, clean water, electricity, fuel, and telecommunications. Other facilities include vehicles, processing equipment, and distribution tools. These efforts aim to enhance the livestock sub-sector to make the products more competitive and become flagship products. As a result, regional economic growth is also stimulated, leading to improved welfare for farmers.

Sumenep has a very high cattle population, particularly in its administrative region, Pulau Sapudi, which is noted for having the highest cattle density in the world at 175 heads per square kilometre. On this island, Madura cattle are germplasm, and the community does not allow other types of cattle to enter Pulau Sapudi to prevent genetic crossbreeding.

5.3 The Projection of Madura Cattle Breeding in Sumenep

According to 2019 data, the population of Madura cattle reached 1.004.226 heads, equivalent to 5.7% of all cattle varieties nationally. This number is projected to continue increasing, especially given the community's enthusiasm for raising and breeding cattle. Madura Island is projected to become a centre for cattle husbandry in East Java, with Sumenep as a key potential area.

One of the factors hindering cattle farming projections in Sumenep is the dry season and the threat of drought disasters. This limits farmer households' ability to raise cattle to only 1 to 4 heads due to the scarcity of feed during the dry season. Since early 2023, Kodim 0827/Sumenep, as an extension of the Indonesian National Army (Tentara Nasional Indonesia/TNI), has played a vital role in ensuring food security in Indonesia, collaborating with the Ministry of Agriculture. Kodim 0827/Sumenep has been actively planting hybrid corn by utilizing idle and uncultivated land for decades, aiming to address the cattle feed issue in Sumenep (Mahardi, 2023).

This performance and efforts have led to integrated agriculture, which has long been an issue for developing multiple fields simultaneously (Rehman et al., 2017), at least in agricultural and livestock farming (Lal, 2020). Cattle farming impacts other fields in a symbiotic mutual relationship (Asresie & Zemedu, 2015). Integrated (organic) farming brings benefits from two sectors.

To anticipate the limitations in traditional cattle breeding, the management of cattle breeding and its related institutions need more development to significantly improve the local economy (Jamal & Gordon, 2024). Cattle farming, traditionally a cultural or

sideline activity, can be transformed into a commercial venture. This transformation has been initiated by Kodim 0827/Sumenep, collaborating with the private sector, specifically CV Pelita Samondung Agro (PSA), as a commercial cattle farm in Sumenep. This farm's management is conducted professionally and modernly, focusing on cattle fattening. As a commercial farm, the number of cattle raised often reaches up to 150 heads.

If it is related to one of the points in the results section of this paper, there is a difference in ADG between traditional and modern Madura cattle. Cattle traditionally raised by the community have low and fluctuating ADG rates. Meanwhile, cattle raised in a modern way by CV Pelita Samondung Agro (PSA) have a much higher and more stable ADG rate. With this modern farm, the weight of the cattle produced at the end of each maintenance period will be much heavier. This is economically beneficial for livestock actors and increases beef production. If drawn to the national scope, the success in changing the pattern of traditional livestock to modern livestock, if it becomes a Government policy to be applied in various other regions, will encourage significant national meat production to support national food security. Of course, this must be followed by supply chain policies, market availability, and other mutually exclusive policies, including institutions and management in cattle rearing. Every aspect, from upstream to downstream, must support and relate to each other.

Institutional arrangements in cattle trade management have become the key instrument for improvement (Firmansyah & Sunyigono, 2020). Institutional structure in cattle trade management will significantly impact various aspects, including the farmers' bargaining position in livestock marketing (Falkowski et al., 2017). Until now, livestock farmers have had a weak bargaining position because the cattle market is controlled by intermediaries known as blank (someone who channelled the cow from farmer-breeder to the buyer in Madura) (Zakiyyah & Hayati, 2022). Therefore, institutional structure plays a crucial role in helping the farmers-breeders sell their cattle and distribute them from the upstream to the downstream. In modern livestock systems, these institutions regulate structures down to the role of law (Cockshaw, 2021). Institutions create better management in cattle farming, including marketing management (Hohler & Kuhl, 2015). Farmers can optimize their profits because these institutions can shorten the distribution and minimize the role of blank in the distribution process, resulting in a shorter distribution chain from farmer to consumer (Salsabilah & Widodo, 2022). Kodim 0827/Sumenep initiated the direct purchase of cattle from farmer-breeders at their homes and conducted educational activities through weight-based purchasing. On a small scale, this has educated farmer-breeders about fairer and more transparent cattle trade management.

From the various efforts mentioned above, the interventions carried out by stakeholders have had a positive impact, although they need to be developed more broadly. Livestock farming needs to be developed and enhanced professionally while still being based on local wisdom that has long been deeply rooted in Sumenep. Production increases must be supported by innovations in feed and marketing systems, such as digital platforms (Faturokhman et al., 2021). The modernization and transformation of livestock farming through institutional patterns implemented via professional management can be the primary approach to increasing beef production.

Some efforts, such as the improvement of cattle trade institutions, the innovation of feed like silage, and the modernization of livestock farming that connect various actors – from farmers and breeders, financiers, entrepreneurs, the Government, and TNI – represent a form of collective consciousness (Durkheim, 1997). This collective consciousness brings together these diverse actors to form a society with advancements in livestock farming. There is strong interdependence among each of these actors with varied interests; for instance, farmer-breeders need livestock advancements to improve their economic status; entrepreneurs and financiers need livestock advancements for-profit interests; the Indonesian National Army (TNI), represented by Kodim 0827/Sumenep, needs livestock advancements to fulfil the mandate for intervention in food security programs. The Government of the Republic of Indonesia, represented by the Sumenep Regency Government, needs these livestock advancements to meet national meat demand, especially if they can achieve national self-sufficiency in meat as an aspect of national food security, including animal food security and to improve the welfare of farmer-breeders in their region.

This collective consciousness brings together these diverse actors to form a society with advancements in livestock farming. There is strong interdependence among each of these actors with varied interests, such as farmers and breeders need livestock advancements to improve their economic status, entrepreneurs and financiers need livestock advancements for profit, the Indonesian National Army (TNI), represented by Kodim 0827/Sumenep, needs livestock advancements to fulfil the mandate for intervention in food security programs, and the Government of the Republic of Indonesia, represented by the Sumenep Regency Government, needs these livestock advancements to meet national meat demand. This is especially important for achieving national self-sufficiency in meat as an aspect of national food security, including animal food security, and for improving farmer-breeders' welfare in their region.

It has been planned to set up a pilot project in Sumenep where the modernization and industrialization of cattle farming will be implemented. With the various existing aspects combined with the latest innovations recently implemented, Madura cattle have the potential to grow further and contribute to national meat demand more optimally. The intensification of Madura cattle farming presents an opportunity to meet national beef needs and achieve self-sufficiency in meat, eliminating the need for meat imports. If these steps are taken wisely, the East Java Provincial Government's plan to turn Madura Island into a "Cattle Island" can be realized, which further can be followed by other regions that have become significant cattle farming centres after East Java, namely Central Java, South Sulawesi, and West Nusa Tenggara. Other areas can follow these three regions in Indonesia. Furthermore, if this succeeds, Madura cattle production can be drastically increased, with a high potential to achieve national meat self-sufficiency.

6. CONCLUSION

East Java, the province with the highest beef cattle production in Indonesia, has Madura Island as a centre for cattle farming, with the majority of the population in the Sumenep Regency. The production of Madura cattle has been increasing yearly, in line

with the rising demand for meat due to the growing population. However, the areas for improvement in Madura cattle farming include a reliance on the availability of natural grass during the rainy season, the continued practice of traditional smallholder farming, and market institutions that do not favour farmers, resulting in the market playing a dominant role. Sumenep, as a region with great potential for developing Madura cattle, needs to change its farming practices by modernizing, promoting healthy and fair market institutions, and implementing professional management. The feeding system, which relies on grass and depends on natural conditions, must shift towards silage feed. Smallholder farming, which operates as a sideline and on a subsistence basis, must transform into commercial farming with modern systems.

Based on the research that has been carried out, the TNI AD's significant contribution to the modernization of Madura cattle farming has progressed. An indicator of progress is that the weight of modernly raised cattle is much heavier, with a higher ADG rate than traditionally run farms. The institution of breeders on a production scale is also more professional. Then, the leading indicator of progress is silage, which has overcome the main problem so far, namely feed limitations. The innovation of corn silage as an effort to modernize the provision of feed for Madura cattle shows that the people of Sumenep adhere to mechanical solidarity and organic solidarity.

However, based on this research, something needs to be improved, namely supply chain and market policies. Increased production must be balanced with supply chains and markets that favour farmers so that their social status also increases. If these aspects are improved, this pilot project will be implemented in other areas with the potential for Madura cattle farming. This step can boost Madurese cattle production in Sumenep and, if implemented in other regions, has the potential to support national meat self-sufficiency.

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