Economic Analysis of Cattle Breeding around the Recently Created Dairy Basin in the Hodh Chargui Region, South-Eastern Mauritania †

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† Presented at the 9th International Seminar (MGIBR) Management and Genetic Improvement of Biological Ressources, Tlemcen, Algeria, 20–22 April 2024.

Abstract: (1) Background: Milk is an important product in Mauritania both for livelihood and food and nutritional security. (2) Methods: In this study, we examine the economic performance of cattle farms in the Hodh Chargui region using data from a cross-sectional survey of 50 farms conducted in 2023. (3) Results: The results showed that the most significant cost item was animal feed (54%), followed by labor (40%) and charges induced by health and watering (3% each). In terms of income, the sale of young males accounted for the largest portion (48%), followed by the sales of dry cows (20%), lactating cows (17%), adult males (8%), and milk (7%). The average gross margin was MRU 131,697.82 ± 509,571.84 (equivalent to USD 3300.69 ± 12,771.22) per breeder per year. Out of the farms surveyed, 46% (23/50) reported a positive gross margin, while 54% reported a negative gross margin. (4) Conclusions: These results indicate a wide range of profitability, from lowest to highest, and suggest the need for improved management of cattle farms in Hodh Chargui in order to enhance their economic efficiency.

Keywords: cattle breeding; economic performance; economic indicators; Mauritania

1. Introduction

Livestock farming is an essential economic activity in Mauritania’s agricultural production systems. Animal husbandry is vital, because animals serve multiple functions in the socio-economic life of breeders. Despite the large number of ruminant herds, estimated at 21,885,689 heads, including 1,945,413 cattle [1], the country still imports milk and dairy products. Mauritanian dairy imports accounted for 18% of the value of imported food products in 2014 [2]. This situation has prompted the Mauritanian government to implement policies aimed at increasing national milk production. In order to meet the growing demand for animal proteins, the authorities have focused on the livestock sector. As a result, various incentive measures, such as the establishment of experimental farms and the promotion of dairy industries, have been implemented [3]. The objective of this study was to conduct an economic analysis assessing the conditions of cattle farming and its economic efficiency in the Hodh Chargui region.
2. Materials and Methods

2.1. Description of the Study Area

Our study was conducted in the wilaya of Hodh Chargui (Figure 1), located in southeastern Mauritania. The geographical coordinates of the area are latitude 16°37′2.4″ North and longitude 7°15′58.96″ West. It covers an area of 182,700 km², which represents 17.7% of the national territory (1,030,700 km²). The wilaya is bordered by the Tagant and Adrar wilayas to the northwest, Mali to the south and east, and the Hodh Gharbi wilaya to the west. The Hodh Chargui region is administratively divided into 9 districts, 31 communes, and 2057 community groupings. The estimated population of the area is 527,973, which accounts for 12.4% of the total population based on 2021 projections.

The region has great potential for livestock production, which has always been and continues to be the main source of income for the local population. The estimated number of cattle in 2021 was 1,205,400 head. In 2017, the government created a dairy pole with the aim of better exploiting this enormous potential. The pole consists of collection centers spread around the Mauritanian Dairy Products Company (SMPL) based in Néma, the regional capital city of Hodh Chargui. The SMPL has a processing capacity of 30,000 L per day.

2.2. Data Collection and Analysis

Fieldwork was conducted on 50 cattle farms during July and August 2023. Prior to the fieldwork, a survey form was developed, tested, and improved. Respondents were selected based on their willingness to cooperate. The survey was carried out through a single visit to complete the questionnaire. The form included questions covering all socio-technical and economic aspects of cattle farming. To facilitate data entry and analysis, the questionnaire was coded, allowing for easy input into an Excel spreadsheet on a farm-by-farm basis. All quantitative and qualitative data were analyzed using SPSS 27.0 software. To enhance interpretation of the breeders’ responses, the results are presented in the form of graphs and tables. Descriptive statistics such as arithmetic means, standard deviations, headcount, and frequency distributions were calculated for all variables studied.

2.3. Calculating the Economic Performance of Cattle Farms

This section focuses on calculating economic indicators for cattle farms in the Hodh Chargui region. The economic performance of these farms is determined by both the total expenses incurred and the revenue generated.
2.3.1. Cattle Breeding Costs

This section involves identifying the costs associated with cattle raising. These costs include expenses for purchasing concentrates available on the market and providing water to the animals. Additionally, the costs for labor costs and health care are taken into account. Health care costs encompass medication, veterinary examinations, treatments, and vaccinations. It should be noted that the costs for artificial insemination are not included, as the State covers these expenses to encourage breeders to adopt new breeding technologies. The total cost \( \left( C \right) \) can be calculated using Equation (1).

\[
C_{\text{Total}} = C_{\text{Food}} + C_{\text{Labor}} + C_{\text{Veterinary}} + C_{\text{Watering}} \tag{1}
\]

2.3.2. Revenue from Cattle Breeding

The main sources of revenue \( (R) \) for breeders are primarily generated through the sale of milk and various categories of animals. The total revenue can be determined using Equation (2).

\[
R_{\text{Total}} = R_{\text{Sale of milk}} + R_{\text{Sale of Lacting Cows}} + R_{\text{Sale of Dry Cows}} + R_{\text{Sale of Young Males}} + R_{\text{Sale of Mature Males}} \tag{2}
\]

2.3.3. Gross Margin for Cattle Breeders

By calculating the parameters in Equations (1) and (2), we can estimate an economic indicator that provides insight into the economic profitability of cattle farms. This indicator is known as the gross margin \( (GM) \) for breeders, as shown in Equation (3).

\[
GM = R_{\text{Tot}} - C_{\text{Tot}} \tag{3}
\]

3. Results

The sample of the surveyed breeders owned a total of 12,321 head of cattle. The average number of cattle per breeder was 251 ± 420.76 head, with a minimum of 11 and a maximum of 1770.

3.1. Characterization of Cattle Farming Performance and Economic Indicators

3.1.1. Study of Economic Costs Related to Cattle Farming

The evaluation of costs and all expenditure items related to cattle farming is important for understanding the course of economic activities and their relationship with the development framework of the study region. There are four types of expenses related to cattle farming:

- **Feed costs**: These expenses include the market value of feed rations given to cattle. These costs along the supplementation period and the availability of pasture in the rangelands. The breeders surveyed had a total feed cost of MRU 8,332,600 per year (USD 208,837.09). On average, each breeder spent MRU 166,652 ± 259,530.67 per year (USD 4176.74), with a range of variation from MRU 12,000 (USD 300.75) to 1,800,000 (USD 45,112.78) per year.
- **Workforce costs**: These charges are estimated based on the employee’s status (seasonal or permanent), monthly salary, and duration of work. Shepherds are permanent employees who work throughout the year, while shepherds’ helpers are occasional workers. Breeders pay a monthly wage ranging from MRU 1000 (USD 25.06) to 10,000 (USD 250.6), depending on whether they are permanent or seasonal workers. The average annual salary for breeders is MRU 214,772.72 ± 375,233.48 (USD 5382.77)/year.
- **Health costs**: Most breeders do not allocate sufficient funds to spend enough on the health of their animals, except for certain diseases whose treatment is subsidized by the state. However, the subsidies are not enough to cover all breeders. In fact, sanitary expenses account for less than 3% of the total expenses. The breeders surveyed reported a total expenditure of MRU 700,050 (USD 17,545.11) per year, with an average estimated cost of MRU 15,218.47 ± 30,315.68 (USD 381.41) per breeder per year. The
costs of sanitary charges vary greatly, ranging from MRU 500 (USD 12.53) to 180,000 (USD 4511.27) per breeder per year.

- Watering charges: Due to the widespread extensive livestock farming in Hodh Chargui, the provision of water for animals primarily depends on surface water sources such as permanent or temporary ponds, and on boreholes and pastoral wells, which are typically free of charge. However, there are instances, particularly during transhumance, when breeders are required to pay for the watering of their animals. These charges can reach 3% of the overall expenses associated with raising cattle.

In order to evaluate all of these expenses, we have represented the share of each in Figure 2 for all of the cattle farms studied. Feed costs account for the highest percentage of total costs (54%), followed by wage costs (40%) and sanitary and watering costs (3%). These costs, including feed, labor, veterinary drugs and watering, are the most important due to the need for supplementation and the presence of permanent shepherds to manage the herds throughout the year.

![Figure 2. Distribution of costs for cattle farming.](image)

A distinction was made between intermediate expenses (food, sanitary, and watering expenses) and salary expenses in order to determine the proportion of each in the total cost of cattle rearing. It was found that 60% of expenses are attributed to intermediate expenses, while 40% are attributed to workforce costs.

3.1.2. Study of Income Generated by Cattle Farming

Figure 3 displays the percentage of revenue generated. Within the study sample, only 6.8% of income is generated from milk sales, while 93.2% comes from the sale of animals in all categories.

![Figure 3. Distribution of income generated by cattle farming.](image)
It should be noted that the sale of milk, as a purely commercial activity, began in 2017 with the establishment of the Mauritanian Dairy Products Company in Néma. According to the surveyed breeders, there is a significant turnover of MRU 445,241 (USD 11,158.92) per year. The average value per breeder per year is MRU 15,901.46 ± 24,530.3 (USD 398.52), with a range of MRU 1200 (USD 30.07) to 100,800 (USD 2526.31) per breeder per year. On the other hand, the sale of animals remains the primary source of income for all breeders and contributes significantly to their earnings. The turnover for this activity is MRU 1,184,199.29 ± 376,699.14 (USD 29,679.18) per year.

3.1.3. Economic Balance Sheet for Cattle Farms

After evaluating the various costs associated with feed, labor, animal health, and watering and estimating the income generated from the sale of milk and animals, we were able to assess the technical and economic performance of cattle farms in the Hodh Chargui region. The assessment was conducted using the gross margin, which takes into account both costs and income. The average gross margin calculated is MRU 131,697.82 ± 509,571.84 (USD 3300.69) per breeder per year. According to descriptive statistical analysis, 46% of farms report a positive gross margin ranging from MRU 2302 (USD 57.69) to 2,510,300 (USD 62,914.78) per breeder per year. On the other hand, 54% of breeders report a negative gross margin ranging from MRU −433,900 (USD −10,874.68) to −2076 (USD −52.03) per breeder per year (Figure 4).

![Figure 4. Distribution of gross margins of cattle farms.](image)

4. Discussion

The results of the present study demonstrate the significance of taking an economic approach to assessing the socio-economic importance of cattle farming in the Hodh Chargui region. Our study reveals that a major portion of expenditure in cattle farming is attributed to feed costs, amounting to 54% of the total, followed by salary costs, at 40%. These findings are comparable to those found by [4] in their study conducted in Uganda. Cattle sales generated an average annual revenue of MRU 1,184,199.29 ± 376,699.14 (USD 29,679.18) per year (93% of total revenue), while milk sales accounted for only around 7% of total revenue. According to the breeders, selling animals helps cover the costs of animal feed, labor salaries, animal health, and the needs of the breeder’s family. The contribution of milk to the breeder’s income may appear small and insignificant for a dairy cattle farm. However, the 7% milk sale rate indicates that dairy cattle farming has significantly developed in the Hodh Chargui region. Breeders who were previously herd owners have now become milk vendors due to the commercialization of milk production in recent years. This shift followed the establishment of the Mauritanian Dairy Products Company and the introduction of milk collection centers in 2017. Cattle breeding has demonstrated its economic impact in this region thanks to the direct income generated by the sale of milk (which accounts for 7%
of the breeders’ annual income) and income from the sale of animals (which accounts for 93% of the breeders’ annual income). It is also seen as a source of employment, accounting for 40% of total expenses spent on wages and salaries. The average gross margin of MRU 131,697.82 ± 509,571.84 (USD 34,330) per breeder per year is low compared to the maximum gross margin of MRU 2,510,300 (USD 62,914.78 ± 12,771.22) per breeder per year achieved by breeder number 131. However, it is important to note that these average figures hide significant disparities between farms. Out of the 50 farms studied, 23 were profitable and 27 were unprofitable. This can be attributed to factors such as the size and structure of the herd, different breeding and management strategies, the low productivity of the cows, low rate of animal sales, and inefficient use of inputs, particularly an excessive use of concentrates for feed and scarcity and expense of labor. The fluctuation in gross margin, ranging from negative to positive, among breeders indicates that the overall context of cattle farming still faces technical constraints and management challenges, resulting in economic difficulties. The values observed in this study align with findings from other studies conducted worldwide [5–10]. The breeders surveyed state they engage in breeding for economic purposes, such as selling milk and animals. Additionally, they also practice socio-cultural reasons. According to the respondents, cattle rearing is a deeply ingrained heritage in the region’s traditions, and it is seen as necessary regardless of living conditions.

5. Conclusions

This study highlights the economic performance of cattle farms in a typical Sahelian region. While there are strengths, there are also constraints that can be overcome. The analysis of various indicators and parameters since 2017 shows a clear trend in milk marketing and sales. However, the milk sales rate falls short of expectations when compared to the region’s potential and required breeding standards. This is due to the absence of a strong tradition of intensive dairy cattle breeding. The lack of expertise in breeding management, including genetics, reproduction, and feeding, hinders progress in the industry. The main issue in cattle farming is feed, which accounts for a significant expense (54%) due to the purchase of concentrates from the market. To address this problem, improving fodder production suitable for the region is needed. This would allow for the local production of feed with high nutritional value and good yield. The current situation of cattle farming in the Hodh Chargui region may lead to a gradual decline in the socio-economic importance of livestock farming in the future. It is therefore necessary for public authorities to invest more in supporting and supervising breeders, so that this sub-sector can fulfill its full potential. The state could provide incentives to improve the knowledge and skills of breeders, thus enhancing the efficiency of dairy cattle breeding and increasing their income. This would also contribute to strengthening food security in the country. To fully understand the economic impact of dairy farming, it is important to extend this study to the other dairy basins (Brakna and Trarza) in the country. Additionally, future studies should focus on the types of cattle breeds raised and explore, besides the actual cattle management, the potential of raising improved cattle breeds on milk productivity. This comprehensive approach will provide valuable insights into breed-specific management strategies and genetic improvements that could lead to substantial gains in dairy production.

Author Contributions: The authors Y.E.H. and M.O.A. contributed to the design of the survey and data collection and drafted the first version of the article. M.O.A. and S.B.S. carried out the statistical analyses. S.H., A.O.M.S.B. and M.D. contributed to the critical revision of the manuscript. All authors have read and agreed to the published version of the manuscript.

Funding: Funding was provided by The National Office for Research and Development of Livestock and Pastoralism (ONARDEP) in Mauritania.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data will be made available on request by the corresponding author.
Acknowledgments: We would like to express our gratitude to the Direction of the National Office for Research and Development of Livestock and Pastoralism (ONARDEP) for their generous financial support in facilitating this fieldwork. Additionally, we extend our thanks to the cattle breeders in the Hodh Chargui region who willingly participated in this survey and agreed to complete the questionnaires. It is our hope that this humble work will contribute to enhancing the productivity of their herds and, most importantly, to improving their quality of life by promoting a better understanding and utilization of cattle resources in Mauritania.

Conflicts of Interest: The authors declare no competing interests.

References
2. FAO; Union Européenne et CIRAD. Profil des Systèmes Alimentaires—Mauritanie. In Activer la Transformation Durable et Inclusive de nos Systèmes Alimentaires; Bruxelles et Montpellier: Rome, Italy, 2023. [CrossRef]

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