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# Biological-Technical (Biotechnical) Analysis of Local Wisdom-Based Cattle Breeding to Increase the Economic Productivity of Indigenous Papuan Households in Nabire

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**Abstract:** This study aims to analyze the influence of biotechnical, sociocultural social capital, and cattle husbandry techniques on improving the household economy of Indigenous Papuans (OAP) in Nabire Regency. The study used a quantitative approach with a survey method involving Indigenous Papuan cattle breeders as respondents. Data were collected through questionnaires, interviews, observations, and documentation, then analyzed using descriptive statistics and analysis of relationships between variables. The results showed that the sociocultural social capital of the Indigenous Papuan community was in the good category, as reflected in strong social relationships, trust, cooperation, and support for cultural values in livestock activities. Cattle husbandry techniques were also in the fairly good category, although some limitations were still found in the application of more modern husbandry management. These conditions contributed positively to improving the household economy, as indicated by the increased ability of families to meet the needs of life, education, health, and business development. This study concluded that sociocultural social capital and cattle husbandry techniques are important factors that support each other in improving the economic welfare of Indigenous Papuan cattle breeder households in Nabire Regency. Therefore, cattle farming development needs to be carried out through strengthening social capital based on local wisdom and increasing the technical capacity of livestock breeders in a sustainable manner.

**Keywords:** Cattle breeding techniques; Cattle farming; Household economics; Indigenous Papuans; Sociocultural social capital

## Introduction

Cattle farming in Indonesia is a strategic sector that plays a role in providing animal protein and improving the welfare of rural communities (Rustinsyah, 2019). However, the cattle farming system in Indonesia is still dominated by small-scale, small-scale farms with limited technology (Asikin et al., 2020). The low average livestock ownership indicates limited production capacity and efficiency of livestock farming businesses (Manyike et al., 2025). This condition results in the cattle farming business's contribution to household income being suboptimal. Furthermore, the development of cattle farming is also influenced by socioeconomic factors such as education level, experience, and access to capital (Ahmadzai et al., 2025). Limitations in the application of husbandry technology also contribute to low livestock productivity. This indicates that cattle farming development requires an approach that is not only technical but also social. Therefore, integrating social and technical aspects is crucial to increasing the success of livestock farming businesses (Alderkamp et al., 2025; Arhin et al., 2024). Based on initial observations in Nabire Regency, cattle farming managed by Indigenous Papuans (OAP) remains traditional and household-based. Livestock ownership is relatively small and not yet intensively managed, resulting in low productivity. Simple husbandry systems result in

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suboptimal production, resulting in an insignificant economic contribution to household income. Furthermore, cattle hold strong social and cultural values for Indigenous Papuans. They are viewed not only as a source of income but also as a symbol of social status and part of traditional activities. This influences livestock management patterns, which are not solely profit-oriented. Therefore, livestock development approaches must consider local cultural aspects.

Sociocultural aspects play a crucial role in determining livestock husbandry patterns in local communities (Yang et al., 2022). Cultural values, social norms, and beliefs influence how communities manage cattle (Sarma et al., 2025). Social capital, such as mutual cooperation and social networks, can strengthen the sustainability of livestock businesses (Hua & Brown, 2024). This shows that cultural factors are inseparable from the economic activities of livestock (Astaman et al., 2022). However, cultural ties can also be a barrier to the adoption of technological innovation (Yordanova & Todorova, 2025). A non-economic orientation in livestock farming leads to low business efficiency (Okello & Luttah, 2022). Therefore, an approach is needed that integrates cultural values with technical innovation (Agoraki et al., 2024). This integration is key to increasing livestock productivity and welfare. Cattle farming techniques are a key factor in determining the success of livestock farming businesses. Feed management, health, reproduction, and housing significantly influence livestock productivity (Sadaoui et al., 2025). However, most smallholder farmers still use traditional methods with limited technology. This results in low efficiency and livestock production (Omotayo et al., 2025).

The implementation of good husbandry techniques has been shown to increase livestock income. Improving livestock management capacity is a crucial factor in the success of livestock farming (Assefa et al., 2024). Furthermore, extension support and access to technology can accelerate productivity increases. Therefore, husbandry techniques are important variables in improving the household economy of livestock farmers. Cattle farming contributes significantly to household income. Income from livestock farming can be a primary or supplementary source of income for meeting family needs (Barwani et al., 2023). This economic contribution is particularly important for rural communities (Arifin et al., 2020). Therefore, cattle farming has significant potential to improve community welfare. However, household economic growth is not solely influenced by livestock numbers. Management efficiency, experience, and access to resources are also determining factors. Business scale and production costs also influence livestock farmers' income levels. Therefore, a comprehensive approach is needed to improve livestock households' economic well-being. Various studies have shown that cattle farming has high economic potential. Income analysis indicates that cattle farming is economically viable and profitable. Another study by Nugroho et al. (2025) also confirms that cattle farming can improve the welfare of rural communities. This demonstrates the importance of developing the livestock sector. However, most research still focuses on technical and economic aspects. Research by Mumtaz & Nadeem (2022) that integrates socio-cultural aspects is still limited. However, cultural factors play a significant role in livestock farming behavior. Therefore, more comprehensive research is needed.

The novelty of this research lies in the integration of socio-cultural social capital and cattle husbandry techniques. This study examines not only economic aspects but also cultural factors that influence livestock farming. This approach provides a new perspective on livestock development. Thus, this research has both theoretical and practical contributions. Furthermore, this research was conducted among indigenous Papuan communities in Nabire Regency. This local context provides added value in understanding the dynamics of culture-based livestock farming. This research also fills a gap in previous research. Therefore, this study has high relevance. The purpose of this study is to analyze the influence of sociocultural social capital and cattle husbandry techniques on improving the economic well-being of Indigenous Peoples (OAP) households in Nabire Regency. This study also aims to identify supporting and inhibiting factors in livestock farming. Thus, this research is expected to provide a scientific contribution. Furthermore, the results can inform policy. The urgency of this research lies in the importance of a culture-based approach in livestock development. Livestock development that does not consider sociocultural aspects tends to be less successful. Therefore, this research is highly relevant to improving the welfare of Indigenous Peoples (OAP). Therefore, this research has strategic value for regional development.

## Method

This research uses a quantitative approach with a survey method, aiming to objectively and measurably analyze the influence of independent variables on the dependent variable. The quantitative approach was chosen because this study aimed to examine the relationship between sociocultural social capital and cattle husbandry techniques on improving the economic well-being of Indigenous Papuan (OAP) households. The research design employed was explanatory research, which explains the causal relationship between variables through hypothesis testing. This research was conducted in Nabire Regency, Central Papua Province, an area with cattle farming activities managed by

Indigenous Papuan (OAP) communities. The research location was selected purposively, considering the presence of Indigenous Papuan cattle breeders and their relevance to the research objectives. The study period was planned for three months, encompassing the preparation phase, data collection, data processing, and report preparation.

The population in this study was all Indigenous Papuan (OAP) cattle breeder households in Nabire Regency. This population includes cattle breeders who actively raise cattle, both on a small and medium scale. The research sample was determined using a purposive sampling technique, which selects samples based on certain criteria, such as: being an Indigenous Papuan (OAP), owning and raising cattle, and actively running a livestock business for at least the past year. The sample size can be determined using the Slovin formula or adjusted to field conditions, taking into account the level of data representativeness. Therefore, the sample in this study totaled 60 cattle breeders. The data collection technique in this study used a questionnaire. This method was used to obtain quantitative data related to sociocultural social capital variables, cattle raising techniques, and household economic conditions. The questionnaire was structured using a Likert scale to measure respondents' perceptions.

The data analysis technique in this study used a quantitative statistical approach, namely: Descriptive Analysis. Used to describe the characteristics of respondents and the conditions of each research variable; Instrument Testing. Includes validity and reliability tests to ensure the research instrument is suitable for use; Classical Assumption Testing. Includes tests for normality, multicollinearity, and heteroscedasticity to ensure the regression model meets statistical assumptions; Multiple Linear Regression Analysis. Used to determine the effect of sociocultural social capital (X1) and cattle husbandry techniques (X2) on household economic growth (Y). The regression equation model used is:

$$Y = a + b1X1 + b2X2 + e \quad (1)$$

Where:
Y = Household economic growth
X1 = Sociocultural social capital
X2 = Cattle husbandry techniques
A = Constant
b1, b2 = Regression coefficients
e = Error

## Result and Discussion

*Description of Sociocultural Social Capital Variables*

Based on the tabulation of data on cultural and social factors, the following descriptive statistics were obtained.

**Table 1.** Description of sociocultural social capital variables

| Indicator | Mean |
|---|---|
| X1 | 2.75 |
| X2 | 4.42 |
| X3 | 3.15 |
| X4 | 4.03 |
| X5 | 3.63 |
| Average | 3.60 |

Table 1 shows that the average sociocultural social capital score reached 3.60, which is considered good. The highest score was found in indicator X2 (4.42), while the lowest score was found in indicator X1 (2.75). These findings indicate that the indigenous Papuan community in Nabire Regency has relatively strong social ties, particularly in terms of cooperation, social networks, and social support in livestock farming activities. This social capital is a crucial resource in supporting the sustainability of cattle farming businesses managed by livestock farming households. In the context of indigenous Papuan communities, social capital not only serves as a means of strengthening social ties but also serves as a mechanism for information exchange, labor assistance, and support in livestock management. The existence of strong social networks allows farmers to gain access to information, assistance, and business opportunities that can increase livestock productivity.

The results of this study align with research by Zhang et al. (2023) and Solikin et al. (2019), which found that social capital in the form of trust, norms, and networks plays a crucial role in the success of dairy cattle farming because it strengthens cooperation, access to capital, and information exchange among farmers. This finding is further supported by research by Mathanda et al. (2025) and Ari et al. (2024), which explains that social capital, through trust, networks, and norms, can improve the welfare of group members and support the sustainability of economic activities in rural communities. Therefore, the stronger the sociocultural social capital possessed by the Indigenous Papuan community, the greater the opportunity for household economic improvement through cattle farming. The high average social capital score indicates that social relationships, trust, norms, and social networks are well-maintained within the community in Nabire Regency.

*Description of Cattle Breeding Technique Variables*

Data on cattle breeding adoption rates show the following results.

**Table 2.** Description of cattle breeding technique variables

| Indicator | Mean |
|---|---|
| X1 | 4.35 |
| X2 | 2.97 |

| | |
|---|---|
| X3 | 2.83 |
| X4 | 3.12 |
| X5 | 2.63 |
| Average | 3.18 |

Based on Table 2, the average cattle husbandry technique scored 3.18, which is considered quite good. The highest score was found in indicator X1, at 4.35. This indicates that most farmers have implemented several basic husbandry practices quite well. However, several technical aspects still scored relatively low, particularly indicator X5 (2.63), indicating that the application of modern livestock technology and management still needs improvement. The results of the study indicate that cattle husbandry techniques contribute to improving household economics. Although most farmers still use simple husbandry systems, there is a tendency for farmers who implement better husbandry techniques to achieve higher economic returns. Good husbandry techniques allow for increased livestock productivity through more effective management of feed, animal health, reproduction, and pen management. This increased productivity ultimately impacts household income (Wagenberg et al., 2017; Bernabucci et al., 2025).

These research findings align with the findings of Oral & Yıldız (2025) and Mohammadzadeh et al. (2025) who explained that livestock management characteristics, human resource capacity, and the ability to adopt better husbandry practices are important factors in improving the performance of smallholder cattle farming businesses. Furthermore, research by Jimoh et al. (2023) and Sodiq et al. (2019) also shows that improved livestock management systems increase the productivity and income of smallholder beef cattle farms. Therefore, increasing the capacity of livestock farmers through training and technical assistance is an important strategy for improving the economic well-being of indigenous Indonesian cattle households (Swastika et al., 2024; Sofyan et al., 2020).

*Description of Household Economic Improvement Variables*

The analysis of the economic impact variables reveals the following data.

**Table 3.** Description of household economic improvement variables

| Indicator | Mean |
|---|---|
| Y1 | 3.90 |
| Y2 | 4.02 |
| Y3 | 3.98 |
| Y4 | 3.10 |
| Y5 | 3.63 |
| Average | 3.73 |

Table 3 shows that the average increase in household income reached 3.73, which is considered good. These results indicate that cattle farming has made a positive contribution to the household economic conditions of Indigenous Peoples (OPA) in Nabire Regency. Income from the cattle business is used to meet family needs, children's education costs, healthcare needs, and other social needs. The study found that sociocultural social capital and cattle husbandry techniques are two complementary factors in improving the household economics of Indigenous Peoples (OPA) farmers in Nabire Regency. Strong social capital encourages collaboration, knowledge exchange, and social support among farmers (Zhou et al., 2024; Mgema et al., 2025). Meanwhile, good husbandry techniques increase livestock productivity and business efficiency. The combination of these two factors has a greater impact on increasing household income and well-being (Nontu et al., 2025; Win et al., 2019).

Research by Tengapoe et al. (2024) and Yusriadi (2025) shows that strengthening social capital can help farmers overcome technical limitations, expand access to resources, and improve the sustainability of livestock businesses. Social capital has even been shown to have a significant impact on the performance of smallholder livestock businesses. In the context of the indigenous Papuan community in Nabire Regency, the success of cattle farming development is determined not only by the technical aspects of cattle husbandry, but also by the ability to leverage the sociocultural social capital that is deeply rooted in community life. Therefore, livestock development programs in Nabire Regency need to integrate technical and sociocultural approaches to sustainably improve the household economy (Sugiarto et al., 2024; Mapiye & Dzama, 2024).

## Conclusion

Based on the research results, it can be concluded that sociocultural social capital and cattle husbandry techniques play a significant role in improving the household economy of Indigenous Papuans (OAP) in Nabire Regency. Sociocultural social capital, reflected through trust, cooperation, social networks, norms, and cultural values, supports the sustainability of livestock farming businesses and strengthens farmers' access to necessary resources. Furthermore, the implementation of good cattle husbandry techniques contributes to increased livestock productivity and business efficiency, thus increasing household income. The results indicate that the stronger the sociocultural social capital possessed by farmers and the better the cattle husbandry techniques implemented, the higher the level of household economic improvement achieved. Therefore, developing cattle farming businesses among Indigenous Papuans in Nabire Regency needs to be carried out by strengthening community social capital based on local wisdom and increasing the capacity of farmers to

implement more effective and sustainable husbandry techniques to promote sustainable community welfare.

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**Author Contributions**
T.G.P. contributed to the research conceptualization, methodology development, formal analysis, field investigation, data curation, and writing the original draft of the manuscript; E.D. contributed to the validation of research instruments, research resource management, data collection and verification, and writing, reviewing, and editing the manuscript; S.I. contributed to the field investigation, data curation, analysis of research results, data validation, and writing, reviewing, and editing the manuscript. All authors have contributed substantially to this research, reading, and approving the final version of the published manuscript.

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**Conflicts of Interest**
The author declares no conflict of interest.

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