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Location Quotient Analysis in Determining Leading Livestock in Aceh Tamiang District

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Abstract: The study aims to identify leading livestock commodities in Aceh Tamiang District using the Location Quotient (LQ) method with data from 2015-2023. Results indicate that the highest LQ values for different livestock types vary across sub-districts: Tenggulun for cattle (2.35), Sekerak for goats (3.07), Banda Mulia for sheep (3.09), Bandar Pusaka for kampung chickens (1.63), Rantau for broilers (1.99), Kuala Simpang for breeder chickens (2.46), and Karang Baru for ducks (2.46). These variations are influenced by natural resources, infrastructure, technology, and skilled labor. Collaboration between local government and industry is essential to boost production and regional income.

Keywords: Aceh Tamiang, Livestock, Location Quotient (LQ), Poultry, Superiority.



Introduction

The Food and Agriculture Organization (FAO) of the United Nations estimates that 690 to 783 million people will be undernourished by 2022. This is an increase of over 122 million people compared to the period before the COVID-19 pandemic (FAO et al., 2023). In Central Africa and South Asia, 10% to 30% of children are protein malnourished (Wu et al., 2014). Globally, 165 million children under the age of five are growth-retarded (Sarma et al., 2017). This malnutrition highlights the urgent need to find sustainable solutions to food insecurity, in particular, the availability of high-quality food protein for human consumption (Henchion et al., 2017).

Animal protein sources play an important role in meeting human nutritional needs (Gomes et al., 2020; Nabarro & Wannous, 2014). Protein is one of the main elements needed by the body for the growth process, cell repair, and maintaining optimal metabolic function. It is estimated that about one-third of the total protein consumed by humans comes from livestock products (Nabarro & Wannous, 2014). Food products of animal origin contribute about 18% to total calorie consumption and 25% to world protein consumption. In addition to being a source of high-quality protein, animal foods such as meat, milk and eggs also provide essential micronutrients, including vitamin A, vitamin B-12, riboflavin, calcium, iron and zinc, which are difficult to obtain in sufficient quantities from plant sources alone (Mottet et al., 2017).

The global population is predicted to experience significant growth, reaching about 9.7 billion by 2050, which is an increase of about one-third compared to the population in 2015. By 2050, the agricultural sector will have to increase production by 60% from the current supply of 8.5 billion tons annually of food, feed, and fibre to meet the needs of the global population (FAO, 2014). This population surge poses great challenges in various aspects of life, especially in providing enough food to meet human needs.

Achieving the SDG target of ending hunger by 2030 is undoubtedly a major challenge facing the world today. Despite efforts, projections show that nearly 600 million people will still face hunger by 2030. The problem is fueled by complex factors such as climate change, conflict, economic instability, and social injustice (FAO, 2014). The ongoing conflict in Ukraine has exacerbated this, causing turmoil in food and energy markets.

Aceh Tamiang Regency has a land area of 1,957.02 km². The district had a population of 301,492 people in 2022, with a population rate of 1.33% (BPS, 2023). Aceh Tamiang District has enormous natural resource potential in the livestock sector. Climatic conditions and a strategic location adjacent to Medan City support this. The development of superior livestock commodities can play an important role in driving the regional economy. In the current era of regional autonomy, each region is encouraged to utilize its regional potential to improve the welfare of the community by developing leading economic sectors. One way to identify priority sectors or subsectors in a region is through Location Quotient (LQ) analysis. Location Quotient analysis is a tool used to determine superior livestock sectors by comparing the contribution of a particular commodity to the regional economy with its contribution at the regional or national level (Fironika et al., 2023). This approach allows local governments to focus efforts on developing livestock commodities that have comparative and



competitive advantages so as to increase production and provide added value to the livestock industry in Aceh Tamiang.

This research is very important to be done as a reference for the development of the livestock sector and as a reference for the selection of superior livestock in various regions in order to fulfil animal protein globally. This research has never been conducted, but similar research has been conducted by Fironika (2023) in Aceh Province and Rahayu (2024) in Magetan Regency. The purpose of this study was to determine the types of superior livestock commodities in each sub-district in Aceh Tamiang District.

Research Results

The results of research conducted in Aceh Tamiang District show that the types of livestock commodities raised are cattle, buffaloes, goats, sheep, native chickens, broilers, laying hens, and ducks. The results showed that the highest number of livestock cultivated during 2015-2023 was native chickens with 1,220,668 heads, followed by laying hens (890,541 heads), broilers (658,920 heads), cattle (496,413 heads), goats (248,012 heads), ducks (226,625 heads), sheep (103,294 heads) and the lowest number was buffaloes (2,924 heads) (Table 1).

When viewed based on the LQ value based on the type of cattle in each sub-district in Aceh Tamiang District, the LQ value >1 is found in Tenggulun Sub-district (2.35), Banda Mulia (1.75), Tamiang Hulu (1.64), Seruway (1.41), and Kejuruan Muda (1.04). Based on livestock type, LQ >1 values are found in Banda Mulia (4.11), Bandar Pusaka (3.12), Sekerak (2.96), Karang Baru (2.89) and Bendahara (2.45) sub-districts. Based on goats, the LQ >1 value is found in Sekerak (3.07), Tamiang Hulu (2.79), Bandar Pusaka (2.51), Banda Mulia (2.3), and Seruway (1.32) sub-districts while the LQ=1 value is found in Bendahara sub-district. Based on the type of sheep, the LQ >1 value is found in the sub-districts of Banda Mulia (3.09), Bandar Pusaka (2.55), Sekerak (2.29), Seruway (2.21), Tamiang Hulu (2.19), Bendahara (1.7), and Tenggulun (1.04) (Table 2).

Based on the analysis of poultry livestock, the LQ >1 value for kampung chicken is found in Bandar Pusaka sub-district (1.63), Sekerak (1.44), Kejuruan Muda (1.24), Rantau (1.21), Karang Baru (1.08), Banyak Payed (1.05), and Banda Mulia (1.02). When looking at broiler livestock, the LQ >1 value is found in Rantau Sub-district (1.99), Banyak Payed (1.46), and Kuala Simpang City (1.02). The type of breeder chicken livestock that has an LQ >1 value is found in Kuala Simpang City (2.46), Tamiang Hulu District (1.43), Karang Baru (1.33), Seruway (1.28), Tenggulun (1.2), Kejuruan Muda (1.15), Banyak Payed (1.15), and Bendahara (1.14). while when viewed on the type of livestock ducks/ducks, LQ >1 value is found in the sub-districts of Karang Baru (2.46), Sekerak (2.42), Bendahara (1.46), Seruway (1.15) and Banda Mulia (1.11), and Bandar Pusaka (1.09) (Table 2).

Table 1

Number of livestock in Aceh Tamiang District in 2015-2023

No	Livestock Type	Year									Total	Average
		2015	2016	2017	2018	2019	2020	2021	2022	2023		
1	Cattle	62,836	65,548	65,548	76,821	41,179	47,182	46,249	44,315	46,735	496,413	55,157
2	Buffalo	652	548	548	284	174	190	153	180	195	2,924	325
3	Goat	20,889	23,270	23,270	30,653	12,699	12,997	40,311	40,787	43,136	248,012	27,557
4	Sheep	6,815	10,399	10,399	12,851	5,095	5,133	16,719	17,306	18,577	103,294	11,477



5	Backyard Chicken	152,401	172,450	172,450	172,930	100,382	112,600	133,850	103,096	100,509	1,220,668	135,630
6	Broiler Chicken	76,700	141,754	141,754	152,900	14,603	105,900	4,707	7,039	13,563	658,920	73,213
7	Laying Chicken	2,000				2,223		177,548	270,704	438,066	890,541	178,108
8	Duck	26,753	33,643	33,643	29,912	21,775	20,935	15,231	18,334	26,399	226,625	25,181
Total											4,074,022	

Table 2

Location Quotient (LQ) value of livestock in Aceh Tamiang District from 2015-2023

No	District	LQ									
		Cattle	Buffalo	Goat	Sheep	Backyard Chicken	Broiler Chicken	Laying Chicken	Ducks		
1	Tamiang Hulu	1.64	0.13	2.79	2.19	0.35	0.44	1.43		0.78	
2	Bandar Pusaka	0.84	3.12	2.51	2.55	1.63	0.35	0.33		1.09	
3	Kejuruan Muda	1.04	0.49	0.78	0.66	1.24	0.98	1.15		0.49	
4	Tenggulun	2.35	0	0.97	1.04	0.61	0.91	1.2		0.67	
5	Rantau	0.63	0	0.8	0.27	1.21	1.99	0.67		0.66	
6	Kuala Simpang City	0.11	0	0.49	0.32	0.77	1.02	2.46		0.27	
7	Seruway	1.41	0.29	1.32	2.21	0.84	0.58	1.28		1.15	
8	Bendahara	0.99	2.45	1	1.7	0.96	0.97	1.14		1.46	
9	Banda Mulia	1.75	4.11	2.3	3.09	1.02	0.66	0.41		1.11	
10	Karang Baru	0.98	2.89	0.56	0.68	1.08	0.48	1.33		2.46	
11	Sekerak	0.85	2.96	3.07	2.29	1.44	0.44	0.05		2.42	
12	Manyak Payed	0.93	0.41	0.63	0.34	1.05	1.46	1.15		0.67	

The results of the research conducted show that many livestock LQ values in Aceh Tamiang District are >1 (Table 2). This shows that Aceh Tamiang District is very prospective in livestock development. Research conducted by Handayani & Safrida (2023) also showed that the culture of Acehnese people likes to consume meat. This LQ value also shows that the livestock sector is part of the driving force in the regional economy. The same thing was also shown by research conducted by Julia Kardin et al. (2023) conducted in Aceh Province. Many interrelated factors, including the availability of natural resources such as fertile land, influence the superiority of a region in the livestock sector. The relationship between land fertility and livestock production involves various aspects, including nutrient recycling, crop-livestock integration, and overall farming system productivity. Fertile land significantly increases the efficiency of livestock production, as nutrient-rich soils support the growth of high-quality forage essential for livestock health and productivity. Research conducted by Bai et al. (2018) showed that approximately 0.3 to 0.6 ha of land per livestock unit is required for the effective recycling of manure nutrients, depending on the level of soil fertility and environmental conditions.

Water availability is also an important factor supporting the excellence of the livestock sector in various regions. Livestock farming is one of the largest consumers of water, using about 20% of total global freshwater resources. All sub-districts in Aceh Tamiang have rivers. This is very supportive of animal husbandry in this district. Samad et al. (2024) stated that there are two major watersheds in Aceh Tamiang District, namely the Susun Kanan River and the Susun Kiri River. Effective water management is needed not only to maintain livestock production but also to improve water use efficiency, which is the ratio between the yield of livestock products and the amount of water needed in their production (Amole et al., 2021). In areas of water scarcity, increasing livestock water use productivity (LWP) is



critical. Some strategies to increase LWP include optimizing feed use, improving grazing management, and implementing water harvesting techniques (Adegoke & Abioye, 2016).

Knowing the leading livestock in Aceh Tamiang Regency is an important step in improving the economic viability of the livestock industry in each sub-district. Jiménez et al. (2018) research also shows that livestock productivity is the main factor driving the productivity of the agricultural sector in Colombia, supported by better production practices and investment in technology. These improvements not only boost economic growth but also maintain the competitiveness of the livestock sector in the face of changing market demands. The prominence of a region's livestock sector is also strongly influenced by government policies and regulations. These policies can affect various aspects of livestock production, including market access, resource allocation, and sustainability of practices. For example, in Merauke District, Indonesia, the potential for livestock development is closely related to government decisions based on livestock population data to formulate policies (Sumaryanti & Muchlis, 2024).

The performance of the livestock sector in a region is also greatly influenced by the availability of adequate infrastructure. This infrastructure includes various important elements such as transportation networks and processing facilities. Regions with better rural infrastructure tend to have superior performance in livestock production. This is consistent with research conducted by Kumar et al. (2020) that the Western Uttar Pradesh region outperformed other regions in livestock growth due to better infrastructure, which supports agricultural productivity and access to markets.

The competitiveness of the livestock sector in a region is also increasingly influenced by the application of advanced technology, which contributes to increased productivity, sustainability, and animal welfare. The results show that every sub-district in Aceh Tamiang district still applies conventional technology. This results in livestock production that is not as good as using digital innovation. Digital innovation can improve production efficiency and competitiveness in domestic and global markets (Subach & Shmeleva, 2022). Vlaicu et al. (2024) also stated that technological developments have revolutionized traditional agricultural practices, especially in livestock technology, thereby increasing productivity and improving animal welfare practices.

Skilled labor also plays a very important role in the livestock sector in a region. It is needed to drive productivity increases, improve management, and ensure the sustainability of livestock operations. With a skilled workforce, decision-making processes and operational efficiency can be improved, which in turn supports the growth and sustainability of the sector. The results of interviews conducted with farmers in Aceh Tamiang District show that the practice of animal husbandry is based on direct experience and sources of information obtained from family and neighbors. Mngumi (2022) pointed out that a competent and skilled workforce is necessary to effectively manage various operational functions, thus contributing significantly to the success of the livestock sector.

Research and development (R&D) contributes significantly to the livestock sector through various forms of support, including financial investment, technological innovation, and cooperation between government and industry actors. This collaboration in the innovation system plays a crucial role in accelerating technological progress and knowledge transfer in the livestock sector, which in turn increases the sector's resilience to production risks (Waithaka, 2024). Meanwhile, the government of



Aceh Tamiang District has not yet collaborated with the industry, so the development of livestock technology in this area is still very slow. The adoption of environmentally friendly practices also has a significant impact on the excellence of the livestock sector. This not only plays a role in increasing productivity but also helps to reduce the negative environmental impact of livestock production. The integration of sustainable practices in each sub-district in Aceh Tamiang is key as it has a direct link to the health and productivity of livestock, which in turn impacts the economic benefits for farmers and the agricultural sector as a whole.

Conclusions

Based on the LQ value of cattle in each sub-district in Aceh Tamiang District, the highest LQ value is in Tenggulun Sub-district (2.35), goat cattle has the highest LQ value in Sekerak Sub-district (3.07). Sheep livestock has the highest LQ value in the Banda Mulia sub-district (3.09). Based on the analysis of poultry, the highest LQ value for kampung chicken is found in the Bandar Pusaka sub-district (1.63). Broiler livestock has the highest LQ value in the Rantau sub-district (1.99). Breeder chicken has the highest LQ value in Kuala Simpang City (2.46). When viewed in the type of duck livestock, the highest LQ value is in Karang Baru Sub-district (2.46). Development and cooperation between the industry, both local government, and farms in Aceh Tamiang Regency are needed to increase production and regional income.

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