

# The Potential for Cattle-Palm Integration Business Development in South Kalimantan, Indonesia

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**Abstract.** The demand for beef in the South Kalimantan region is still primarily met from outside the area. This condition is an opportunity to develop the beef cattle industry in the South Kalimantan region, supported by feed raw materials sourced from oil palm plantations through the integrated system of cattle palm. The study aims to analyze the potential of the cattle palm integration system in South Kalimantan. The data used are primary and secondary. The data were analyzed descriptively quantitatively with tabulation techniques and spatial maps, including feed potential, beef population, the potential addition of cattle population, and livestock capacity. The results showed that the ratio of palm plantation land area in South Kalimantan to the cattle population was 2.68, and the ability to accommodate cattle in oil palm plantation areas was 2,752,990 livestock units/ha/year. Based on the number of cattle units in South Kalimantan of 111,461 heads, the holding capacity cattle in oil palm plantations, and the number of livestock units that have been cultivated with the cattle palm integration system in South Kalimantan 4%, then the oil palm plantation area is still able to accommodate 96% from the capacity or additional potential of cattle as much as 2.641.529 heads/ha/year.

## 1 Introduction

Most of the population's need for beef in the South Kalimantan region is still met from outside the region, namely Sulawesi, East Java, NTB and NTT. The limited supply of these four regions, the increasing demand for meat in the South Kalimantan, and the cost and loss of body weight cattle during transportation cause the price to be unable to compete with imported meat products whose supply is increasing. The Indonesian government has launched a meat self-sufficiency program several times. Still, this program has not materialized, so imports of frozen meat and feeder cattle for fattening continue to this day [1]. One of the reasons for the difficulty of achieving the beef self-sufficiency program is that

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the number of cattle population developed by local farmers is insufficient for meat consumption in Indonesia [2].

The population of beef cattle in Indonesia from 2015 – 2021 is increasing but shows a trend that tends to be stagnant. In 2015, the beef cattle population in Indonesia was 15.42 million heads and continued to grow positively to reach 18.05 million heads in 2021 (17.06%). Meanwhile, on the consumption side of beef and buffalo or national meat demand in 2022, it is estimated at 695.39 thousand tons with a population of around 274.86 million people (2.53 kg/capita/year). In 2022, the availability of beef and buffalo in Indonesia will still experience a deficit of 258.69 thousand tons due to the low production of beef and buffalo itself of 695.39 thousand tons [3].

The average import of Indonesian beef periodically continues to increase [4]. Forecasting beef production, consumption, and imports for the 2021-2026 period shows that beef production and consumption have increased by 2 percent per year, so beef production has not been able to meet consumption needs. Beef imports increased by 3 percent annually, or 214,220 tons [5]. The volume of cattle imports amounted to 153.000,04 in 2020, rising to 144.483,71 in 2022, and the volume of beef imports of 3.614 tons in 2018 increased to 214.658,11 tons in 2021. The average volume of beef imports during 2021 is 17.888,18 tons per month [3]. The imbalance between beef production and consumption levels can illustrate Indonesia's inability to optimize the potential of beef cattle agribusiness in producing domestic beef. The government imports feeder cattle, beef, Brazilian beef, and Indian buffalo meat to meet the demand for this meat. However, the large number of cattle and meat imports will consume quite a lot of the country's foreign exchange, so the best effort to meet consumption needs is to increase the local beef cattle population.

The government has implemented several programs through the Ministry of Agriculture to increase domestic cattle and buffalo population and production. In early 2000, the government established the Beef and Buffalo Meat Self-Sufficiency Program, followed by efforts to increase births through Breeding and Artificial Insemination (Gertak Birahi dan Inseminasi Buatan / GBIB) in 2015-2016. 2017-2019, it continued with Special Efforts for Obligatory Breeding Cows (UPSUS SIWAB). In early 2020, the Ministry of Agriculture launched a program to increase the production of Cattle and Buffalo Mainstay of the Country (SIKOMANDAN) [6]. In addition, the Indonesian government to develop and increase domestic beef production through several programs and policies, including controlling excessive slaughter of female cattle, breeding and reproduction technology, feeding strategy, developing simple farming technology, empowering farmers, technology transfer, intensive feedlot system, and integration of cattle breeding with oil palm plantation or productive plantation businesses [7]. The government has optimized the integration system policy for cattle breeding with oil palm plantations because the program for producing beef is closely related to the availability of quality feed, while currently, the potential for land for the availability of animal feed is decreasing along with the change in the function of cultivates land to non-cultivation due to increasing in population. Efforts to reduce imports of cattle and meat are simultaneous to achieve self-sufficiency in beef in Indonesia [8].

The government's seriousness regarding the integration of the oil palm plantation business with the beef cattle cultivation business is outlined in the Regulation of the Minister of Agriculture of the Republic of Indonesia No.105/Permentan/PD.300/8/2014 in Chapter 2 Article 4 states that (1) Smallholders and plantation companies can carry out the integration of oil palm-cattle business. (2) The integration of the palm-cattle business, as referred to in paragraph 1(one), is carried out to utilize the by-products of the oil palm plantation business and beef dung as fertilizer, bio-urine, and biogas as well as other benefits. (3) The by-products of oil palm plantations, as referred to in paragraph 2 (two), include palm kernel cake and palm sludge, which can be used to meet domestic feed needs [9]. The government must play

a significant role in facilitating the needs of farmer groups so that the cattle-oil palm integration program can run well [10].

Cattle farming with an integration pattern can provide positive socio-cultural and economic impacts. This integration system is advantageous because livestock can utilize grass and forage that grows wild or agricultural waste as feed. In addition, livestock produces manure as organic fertilizer to increase soil fertility. The integrated system can also improve farmers' income from compost production [11].

The cattle oil integration system (SISKA) is a farming activity that combines cattle and oil palm. The SISKA integration system is positively correlated and mutually beneficial [12]. SISKA aims to increase the income and welfare of farmers utilizing oil palm output and cattle results. The increase in farmers' income is expected to align with the achievement of business efficiency through utilizing livestock manure as fertilizer and the existence of a new source of income from the cattle business [13]. A crop-livestock integration system combines a plant farming system with a livestock farming system synergistically to form an effective, efficient, and environmentally friendly approach. Raising cattle in the oil palm plantation area maximizes the use of existing land, a crop-livestock integration system [14].

Indonesia's oil palm plantations were recorded at 14.62 millions hectares in 2021. This number grew 0.24% compared to the previous year, which covered an area of 14.59 million hectares [15]. 13 provinces have an LQ value greater than one, including Riau (1,75), Sumut (1,54), Jambi (1,33), Kalteng (2,00), Kaltim (1,66) dan Kalsel (1,64) [16]. South Kalimantan is an area with an LQ of oil palm plantations greater than one, so it has the potential to develop a cattle oil integration business. Based on research, the integrated system of oil palm livestock, benefits palm plantation farmers by increasing oil palm productivity and farming cost efficiency. The impact will be to provide farmers with more income from their plantations and the livestock they raise themselves [17].

Tropical cattle races have the potential to be developed in oil palm plantations as grazing areas at low cost. According to [18], Bali cattle grazed in oil palm plantation areas have good productivity. Oil palm leaves can be a feed source in semi-intensive and intensive businesses. Manure, solid and liquid, produced from cattle and given to oil plants can increase production [19,20]. There have been many practices of using manure to substitute inorganic fertilizers with the impact of increasing the income of oil palm farming [21]. The integration of cattle oil palm has a positive environmental impact because weed eradication in oil palm plantations using pesticides is reduced [22,23]. If this integration is developed, it can potentially increase the welfare of garden farmers, driving regional and national economies [17].

South Kalimantan, as an oil palm plantation area, has great potential to be utilized as a healthy beef cattle feed ingredient in this region. However, this potential is still not optimally used by oil palm breeders and plantation companies. The cattle livestock business carried out by people's farms mainly relies on natural grass. Oil palm plantation companies in this province have not integrated palm oil much for their companies or in partnership with the surrounding planters/breeders. Utilization of the oil palm plantation industrial area (IPKS) as grazing land for breeding businesses and utilization of palm oil mill by-products (palm kernel cake, palm solid), leaves, and palm fronds for manufacturing complete feed support fattening businesses that have not yet developed. Even though the technology for making complete feed for cows made from raw materials from the IPKS area is already available, several regions that have applied this technology have provided profitable results. Indonesia's oil palm-cow integration system is still very limited in its development because the development of oil palm plantations and the target of increasing the livestock population in an area is not followed by the cattle oil integration system [24].

In determining the policy for developing the integration of beef cattle and oil palm patterns in South Kalimantan Province in the future, it is necessary to analyze the potential to support the development of beef cattle with an oil palm-cow integration pattern.

## 2 Method

The research was conducted in February – June 2022. The location of the study was determined by purposive sampling, namely Tanah Laut and Tanah Bumbu Regency. The selection of these two regions is based on the area of oil palm plantations and cattle populations and the existence of oil palm plantation companies that have implemented an oil palm-cattle integration system program based on *plasma inti* livestock business partnerships in their areas.

The type of data used consists of primary data and secondary data. Preliminary data were obtained from respondents through group discussions with farmer/livestock group administrators using a semi-structured questionnaire and in-depth interviews with SISKAs entrepreneurs and related agencies. Secondary data was collected through documents obtained from various relevant agencies, both at the central and regional levels, such as the Directorate General of Livestock and Animal Health (Ditjen PKH) Ministry of Agriculture, Provincial and district/city Central Statistics Agency (BPS), Livestock and Animal Health Services province and district/city, provincial and district/city Plantation Office.

The data obtained are tabulated to calculate the carrying capacity and create spatial data on the potential for integrating cattle oil palm by district/city containing feed potential, cattle population, and potential for increasing the cattle population. These data were then analyzed in a quantitative descriptive manner.

Spatial data on the potential for cattle oil integration business mentioned above with the following formula :

1. The average area of all oil palm plantations (community, private, and government plantations) in South Kalimantan Province over five years (X ha):

$$X = \sum_i^5 5/i \quad (1)$$

Percentage of Immature Plants (TBM), Mature Plants (TM), and Damaged Plants (TR) in the average area of oil palm plantations :

$$A = \% TBM = [TBM / X] \times 100\% \quad (2)$$

$$B = \% TM = [TM / X] \times 100\% \quad (3)$$

$$C = \% TR = [TR / X] \times 100\% \quad (4)$$

2. The availability of dry matter (BK) from an oil palm plantation area can be calculated as follows : [25]

### 2.1 Vegetation under plants (TBM)

- a. BK produced by plant vegetation under immature plantation corps (TBM) is 3,8 tons/ha/year, so the BK available is:

$$BK \text{ vegetation} = T = 3,8 \times A \times X \quad (5)$$

- b. If it is assumed that the average weight of one adult cow equivalent to one livestock unit (ST) is Y kg and consumption per day of 1 ST is 2% of body weight (Y), then every 1 ST requires 0.02 Y kg dry matter (BK) per day.

- c. Based on the assumptions in point b, vegetation in oil palm plantations of T tons of BK per year can provide feed for = {T kg/ (0.02Y x 365)} ST. In other words, from 1 ha of TBM oil palm, the resulting production of natural grass vegetation has a carrying capacity (K):

$$K = [T \text{ kg} / (0,02Y \times 365)] / (A \times X) \quad (6)$$

## 2.2 Palm Oil Plant Frond:

- In every hectare of an oil palm plantation, there are 130 oil palm trees [26]. It is assumed that each oil palm tree (TBM, TM, TR) can produce 22 fronds/year with an average weight of 7 kg/frond or 20,020 kg/ha/year (22 fronds x 130 trees x 7 kg). If the content of BK from palm fronds is 26.07%, then the BK produced in a year is 5,219 kg/ha, then in one year, the available BK from palm fronds is 5,219X tons.
- The potential BK can feed for  $\{5,219X \text{ tons}/(0,02 Y \times 365)\}$  ST. In other words, from 1 ha of oil palm plantations, the by-products in the form of fronds produced have a carrying capacity (L):

$$L = \{5,219X \text{ ton}/(0,02 Y \times 365)\} / X \text{ ST/year} \quad (7)$$

## 2.3 Fruit Bunches – FFB is processed into CPO and PKO

- The industrial by-products of CPO and PKO from 1 ha of oil palm plantations produce 1,223 kg of palm sludge, 509 kg of palm kernel cake, 2,678 kg of pressed fiber, and 3,386 kg of empty fruit bunches [25]. However, empty oil palm bunches can be used as organic fertilizer with nutrients needed by soil and plants, so it is no longer used for animal feed [21].
- If BK palm sludge is 24,07%, BK palm kernel cake 91,83%, and BK pressed fiber 93,11% [26], then in every hectare of oil palm plantations, 3.255 of BK can be produced, namely from:  $[(1.223 \times 0,2407) + (509 \times 0,9183 + (2.678 \times 0,9311))]$ . Based on the yielding plantation land in equation (3), the amount of BK that can be produced annually is  $B \times X \times 3.255 \text{ kg} = U$  million tonnes. Based on the potential of BK, the feed can be provided for  $\{U/(0,02Y \times 365)\}$  ST.
- Based on point b, from 1 ha of palm oil TM plantation, the by-products produced have a capacity of (M):

$$M = \{U/ (0,02Y \times 365)\} / (B * X) \quad (8)$$

## 2.4 Vegetation under plants (TM and TR)

- TM and TR oil palm plantations can still be used as a feed source as grazing land. Each hectare of TM-aged oil palm plantations can accommodate two cows, whereas in TR plantations, only one cow [27].
- Based on point a, the number of livestock that can be accommodated for TM land is:

$$(V) : V = 2 * B * X \quad (9)$$

- The number of livestock that can be accommodated for TR land is (W)

$$W = 1 * C * X \quad (10)$$

Based on equations (2) and (6); (1) and (7); (3) and (8); (9); and (10), the carrying capacity of oil palm plantations in South Kalimantan is (KT):

$$KT = \{(2) * (6)\} + \{(1) * (7)\} + \{(3) * (8)\} + (9) + (10) \quad (11)$$

Suppose it is assumed (topographical effects, already being used, and others) that the calculated carrying capacity is only 70% that can be utilized, then the carrying capacity of livestock in oil palm plantations is only (0.7 KT). This estimated value can be disaggregated by district/city.

### 3 Result and Discussion

#### 3.1 Spatial data on the potential of cattle palm integration business

South Kalimantan Province is one of the producers of palm oil development centers in Indonesia. Data from the Ministry of Agriculture noted that the total area of oil palm plantations in South Kalimantan reached 426,475 hectares, with a total production of crude palm oil (CPO) reaching 1.1 million tonnes. Of the total land area, oil palm plantations in South Kalimantan consist of large private companies covering an area of 313,545 hectares, Large State Enterprises covering an area of 6,489 hectares, and 106,441 hectares are being cultivated for smallholder plantations [28]. The usability of oil palm land can be increased; one of the ways is by carrying out business integration of oil palm plantations and cattle breeding. The application of oil palm-cattle integration (SISKA) can benefit both commodities. Oil palm plantations will benefit from reduced costs for weed control and the use of inorganic fertilizers. The cattle commodity can also feed the palm oil processing industry waste.

The Provincial Government of South Kalimantan aims to achieve beef sufficiency as a manifestation of South Kalimantan becoming a national food barn. This target is becoming more strategic, where South Kalimantan can support animal food supply for the IKN area in East Kalimantan.

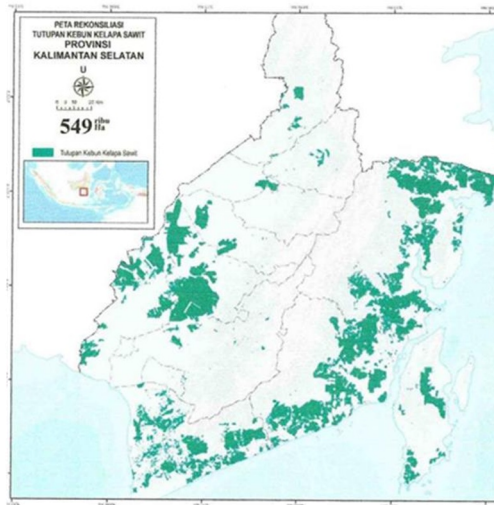
To realize this target, the South Kalimantan Provincial Plantation and Livestock Service Office has designed a Super Priority Program, namely Sistem Integrasi Kelapa Sawit – Sapi Berbasis Kemitraan Usaha Ternak Inti Plasma (SISKA KUINTIP). This priority program is supported by Governor Regulation 053 of 2021, concerning the Acceleration of Self-Sufficiency in Beef Cattle through the Integration of Palm Oil and Cattle Based on Nucleus-Plasma Livestock Business Partnerships. Thus, the adequacy of beef supply is accelerating, which is expected to be achieved in 2024. Currently, there are already 7 (seven) companies, or only 7.1% of oil palm plantations in South Kalimantan, that have conducted the SISKA business, which is the implementation of the SISKA KUINTIP Program from 98 units of companies engaged in the plantation business.

South Kalimantan Province has 13 regencies/cities with the distribution of oil palm and cattle plantations, as shown in Table 1, where there are two regencies/cities that do not have oil palm plantations, namely Hulu Sungai Tengah and Banjarmasin.

**Table 1.** Spatial distribution of oil palm plantations and cattle population in South Kalimantan, 2021[29]

District/city	Oil Palm Area (Ha)	Cattle population (heads)
Tanah Laut	164,205	102,654
Kota Baru	562,651	16,490
Banjar	7,796	18,867
Barito Kuala	18,903	8,070
Tapin	63,34	7,235
Hulu Sungai Selatan	19,290	5,395
Hulu Sungai Tengah	0	7,155
Hulu Sungai Utara	6,558	777
Tabalong	19,497	3,477
Tanah Bumbu	275,068	20,667
Balangan	8,116	2,110
Banjarmasin	0	2,279
Banjarbaru	172	2,424
South Kalimantan	1,145,590	197,600

The total plantation area reaches 1,145,590 ha, and the total cattle population is 197,600 heads. If added to the dairy cattle population, there are 101 heads. The total cattle population is 197,701 heads. If we consider the ratio of plantation area to cattle population, it is 5.80. This means that a cow, in comparison, is 5.80 ha of oil palm land. This figure shows that the potential for cattle development in oil palm plantations is still possible throughout South Kalimantan because the spread of oil palm plantations covers almost all areas of the province. Conditions are favorable for SISKAs development because investment for SISKAs development can provide a multiplier effect on economic growth that is more equitable to all parts of the South Kalimantan Province. The oil palm plantation cover map in Figure 1 below clearly illustrates the distribution of oil palm plantation areas in South Kalimantan.



**Fig. 1** Map of oil palm plantation cover in South Kalimantan, 2019 [30]

### 3.2 Oil palm plantation spatial data

The condition of oil palm plantations in various districts/cities in South Kalimantan has varied dynamics. There are those whose area of oil palm plantations tends to increase from year to year, those whose area tends not to increase but does not decrease, and those whose area tends to decrease from year to year, as shown in Table 2.

Spatial data on the distribution of oil palm plantations in regencies/cities in South Kalimantan for 2017 - 2021 in Table 2 shows that districts that have experienced an increase in the area of oil palm plantations are Kotabaru and Barito Kuala Regencies, districts whose plantation area has decreased are Tabalong and Hulu Sungai Selatan regencies, while the other districts/cities as a whole tend to have the same area of oil palm plantations. The location of oil palm plantations has decreased due to changes in the function of oil palm plantations to become coal mining lands in Tabalong Regency. In contrast, in Hulu Sungai Selatan Regency, the change in commodities developed from oil palm plantations to rubber or coconut plantations because the oil palm plants were old.

The form of oil palm plantations, according to their control in South Kalimantan, generally consists of three categories: community plantations, state plantations, and private plantations. The spatial distribution of the three plantation categories is shown in Table 3, where the most dominant oil palm plantations are oil palm plantations owned by private companies with an area of 313,545 ha or 73.32%, followed by smallholder plantations covering 107,582 ha or 25.16%. The narrowest are state plantations that cover only 6,489 ha

or 1.52% of the total area of oil palm plantations in South Kalimantan and are only found in Tanah Laut, Kotabaru, and Banjar Regencies. This type of plantation control influences the implementation of the integration policy of cattle oil in South Kalimantan. In simple terms, it can be stated that for state plantations, the SISKA adoption process should be easier to implement, primarily if it is carried out with an approach supported by regulations that oblige companies to do so.

**Table 2.** Spatial data on the distribution of oil palm plantations in the district/cities of South Kalimantan, 2017-2021 [31]

District/City	Total area (ha)				
	2017	2018	2019	2020	2021
Tanah Laut	73,145	73,121	73,121	73,260	164,205
Kota Baru	154,676	155,103	155,754	155,813	562,651
Banjar	20,710	21,402	21,388	21,146	7,796
Barito Kuala	20,748	20,985	21,296	21,340	18,903
Tapin	55,018	55,361	56,452	56,482	63,334
Hulu Sungai Selatan	13,362	13,294	13,264	13,209	19,290
Hulu Sungai Tengah	0	0	0	0	0
Hulu Sungai Utara	3,829	3,829	3,829	3,829	6,558
Tabalong	5,638	5,549	4,386	4,380	19,497
Tanah Bumbu	73,865	73,865	74,045	74,565	275,068
Balangan	2,278	2,278	2,275	2,785	8,116
Banjarmasin	0	0	0	0	0
Banjarbaru	145	145	156	159	172

In contrast, private companies require more intensive efforts to invite them to participate in the SISKA program. It takes more time and effort to convince companies of the benefits they can get by implementing SISKA. However, in general, private plantation companies with a large area scale, if they succeed in convincing the central management, then the area of oil palm plantations involved in the SISKA program can be more prominent. For smallholder plantations, the difficulty is mainly due to the ownership of oil palm plantations on a smaller scale, as well as with many plantation owners/holders. Efforts of persuasion and outreach to invite them to join in implementing SISKA are certainly more complex and have higher dynamics.

**Table 3.** Forms of oil palm plantations according to their control in South Kalimantan, 2021 [32]

District/City	Land tenure (ha)		
	Community plantation	State plantation	Private plantation
Tanah Laut	12,460	3,406	57,799
Kota Baru	31,977	2,333	121,628
Banjar	5,228	750	15,188
Barito Kuala	3,958	0	17,624
Tapin	12,860	0	43,614
Hulu Sungai Selatan	2,745	0	10,389
Hulu Sungai Tengah	0	0	0
Hulu Sungai Utara	1,605	0	2,222
Tabalong	167	0	4,213
Tanah Bumbu	35,338	0	39,168
Balangan	1,085	0	1,700
Banjarmasin	0	0	0
Banjarbaru	159	0	0
South Kalimantan	107,582	6,489	313,545



The spatial description of oil palm plantations in South Kalimantan that is related to productivity based on age group is the category/group of Immature Plants (TBM), Mature Plants (TM), and Damaged Plants (TR), as shown in Table 4. This table shows that the largest area of oil palm plantations is in the TM group, covering 377,222 ha of the total area of oil palm plantations. The size of oil palm plantations included in the TBM group is 48,113 ha, and the rest is included in the TR group, covering an area of 2,283 ha. When viewed from the spatial distribution in districts/cities, most palm oil plantations classified as TM are in Kotabaru. Tanah Laut, followed by Tanah Bumbu, while the fewest are in Banjarbaru City and Balangan District. Most oil palm plantations in the TBM group are in Kotabaru District, Banjar, and the least in Barito Kuala. Thus, if oil palm plantations with TBM later reach TM age, the composition of districts/cities in the largest TM group will not change much. The structure is the same; only the number of areas has changed. The largest will still be Kotabaru Regency, Tanah Laut, and Tanah Bumbu.

Meanwhile, based on ownership status, the area of oil palm plantations according to age group can be seen in Table 5. It is known that private companies manage the largest area for the TM and TBM age groups, while the TR age group is found chiefly in smallholder plantations. This picture indicates that smallholder oil palm plantations have not been appropriately managed and require replanting activities to keep oil palms productive. However, when replanting activities must be carried out, the farmers will not receive any income from selling the FFB, so this activity cannot be carried out. For this reason, an alternative source of income is needed for replacing costs, offered by the integration of oil palm and cattle farming (SISKA).

**Table 4.** Area of oil palm plantations by age group and crop productivity in each district/city in South Kalimantan, 2021 [32]

District/city	Plant age group						Total	Total
	TBM	TBM	TM	TM	TR	TR		
	ha	%	ha	%	ha	%	Ha	%
Tanah Laut	4,679	6.35	68,891	93.52	95	0.13	73,665	100
Kota Baru	12,82	8.22	143,1	91.70	119	0.08	156,044	100
Banjar	11,326	53.51	8,934	42.21	906	4.28	21,166	100
Barito Kuala	9,568	44.33	11,993	55.57	21	0.10	21,582	100
Tapin	3,127	5.54	53,179	94.17	168	0.30	56,474	100
Hulu Sungai Selatan	582	4.38	12,47	9.82	373	2.80	13,302	100
Hulu Sungai Tengah	0	0	0	0	0	0	0	0
Hulu Sungai Utara	127	3.32	3,700	96.68	0	0	3,827	100
Tabalong	5	0.11	4,363	99.61	12	0.27	4,380	100
Tanah Bumbu	5,043	6.77	68,906	92.48	559	0.75	74,508	100
Balangan	804	28.87	1,951	70.05	30	1.08	2,785	100
Banjarmasin	0	0	0	0	0	0	0	0
Banjarbaru	28	17.61	131	82.39	0	0	159	100
South Kalimantan	48,113		377,49		2,283		427,881	100

The spatial distribution of the number of units of these private plantation companies in the districts/cities in the Province of South Kalimantan is shown in Table 6. Most of these oil palm plantation companies are in the Kotabaru Regency area, with 27 companies, followed by the Tanah Laut and Tanah Regencies. There are 19 and 18 company units, respectively. Some plantation companies already process CPO, PKO, or both, namely CPO and PKO. Most CPO processors are also in Kotabaru Regency (20 units), while most PKO processors (3 units) are in Tanah Bumbu Regency.

There are already oil palm plantation companies in South Kalimantan that use solid and BIS. There are 20 oil palm plantation companies in Kotabaru Regency and eight (8) units in Tanah Laut and Tanah Bumbu Regencies. Most oil palm plantations that use BIS are in Tanah

Bumbu District (3 units), Tanah Laut (2 units), and Tapin (1 unit). There is one (1) unit each of the oil palm plantation companies in Tanah Bumbu and Tanah Laut Regencies. However, in the latest developments in 2021 based on data from the South Kalimantan Provincial Plantation and Livestock Service Office (2022), there are seven (7) oil palm plantation companies in South Kalimantan that have joined in running the cattle oil integration program driven by the Siska Supporting Program (SSP), which is part of the palm oil company Buana Karya Bhakti (BKB).

**Table 5.** Oil palm area by ownership status and age plant category in South Kalimantan, 2021 [32]

Ownership status	Area (ha)			Jumlah
	TBM	TB	TR	
1. Community plantation	20,939	84,360	2,283	107,582
2. State plantation	1,391	5,098	0	6,489
3. Private plantation	25,781	287,764	0	313,545
Total	48,111	377,222	2,283	427,616
Age composition (%)	11.25	88.22	0.53	100

**Table 6.** Number of oil palm plantation companies in South Kalimantan Province, 2020 [32]

District/city	Oil Palm Plantation Companies, 2020						
	Amount (unit)	Plantation area (ha)	CPO Process(unit)	Solid utilizing (unit)	PKO process (unit)	BIS utilizing (unit)	SISKA (unit)
Tanah Laut	19	55,988	8	8	2	2	1
Kota Baru	27	199,764	20	20	-	-	-
Banjar	3	26,386	1	1	-	-	-
Barito Kuala	11	47,336	1	1	-	-	-
Tapin	9	69,836	4	1	1	1	-
Hulu Sungai Selatan	4	52,519	1	1	-	-	-
Hulu Sungai Tengah	-	-	-	-	-	-	-
Hulu Sungai Utara	1	2,684	-	-	-	-	-
Tabalong	4	16,394	2	2	-	-	-
Tanah Bumbu	18	116,455	8	8	3	3	1
Balangan	2	3,792	-	-	-	-	-
Banjarmasin	-	-	-	-	-	-	-
Banjarbaru	-	-	-	-	-	-	-
Kalimantan Selatan	98	591,154	45	42	6	6	2

The existence of a CPO processing unit with solid by-products and a PKO processing unit with BIS by-products has excellent potential as a complete feed raw material. The development of a complete feed industry on the scale of farmer groups and companies will support the development of an intensive pattern SISKA business, particularly for fattening businesses. This pattern will produce relatively high meat productivity by raising crossbreed cattle between local, Limousin, and Simmental cattle. To encourage plantation companies to utilize solid and BIS as complete feed raw materials, it is necessary to support feed formulation technology, which is currently available at research institutes and has even been practised in several groups of livestock farmers. On the other hand, CPO and PKO processing companies should provide access to livestock farmer groups who need these two products.

This has been regulated in South Kalimantan Governor Regulation No. 053 of 2021 concerning the Acceleration of Self-Sufficiency in Beef Cattle through the Integration of Palm Oil and Cattle Based on Nucleus-Plasma Livestock Business Partnerships.

### 3.3 Livestock capacity in oil palm plantations

Based on the area of oil palm plantations and their distribution in each district/city in the South Kalimantan region, as well as looking at the need for feed and other livestock needs, the carrying capacity of livestock in the plantation area (livestock unit/ha/year) is based on calculations using technical coefficients as shown in Table 8. Overall, the oil palm plantations in South Kalimantan can accommodate integrated livestock of 2,752,991 ST/ha/year. This amount can be spread across all regencies/cities that have oil palm plantation areas in their respective areas. The size of oil palm plantations is the largest, so the highest livestock holding capacity is in Kotabaru Regency, as much as 1,013,928 ST/ha/year. The lowest livestock holding capacity is in Banjarbaru City, with as much as 1,008 ST/ha/year. Two districts/cities in South Kalimantan, namely Hulu Sungai Tengah Regency and Banjarmasin City, do not have oil palm plantation areas in their areas. Their livestock capacity is nil.

If we look at the cattle population in South Kalimantan in 2021 of 154,529 [31], South Kalimantan has the potential to increase its population by 1681% of the existing population. With the increase in population, the opportunity to become an ageing supplier to the IKN area can be realized. In addition, the economy will increase for business actors and the regional budget (APBD).

### 3.4 Cattle population spatial data

The cattle population is spread across all districts/cities in the South Kalimantan region with varying amounts. The spatial distribution of the cattle population can be seen in Table 8, where the highest cattle population in South Kalimantan is Tanah Laut District from 2017 to 2021. During this period, there are dynamics in the population size, with an average population number per year of 71,978 heads. The second largest cattle population is Tanah Bumbu Regency, with the lowest cattle population of 16,027 heads, the highest of 20,416 heads, and an average population of 18,867 heads/year. The third largest cattle population is Banjar Regency, with a total population range of 15,345 – 18,984 heads, with an average of 17,939 heads/year.

**Table 7.** Livestock holding capacity in the oil palm plantation industrial area in South Kalimantan, 2022 [31]

District/city	Livestock holding capacity (ST/ha/year)
Tanah Laut	480,917
Kota Baru	1,013,928
Banjar	118,769
Barito Kuala	126,981
Tapin	369,204
Hulu Sungai Selatan	86,299
Hulu Sungai Tengah	0
Hulu Sungai Utara	25,195
Tabalong	29,041
Tanah Bumbu	484,606
Balangan	17,042
Banjarmasin	0
Banjarbaru	1,008
Kalimantan Selatan	2,752,990

Table 8 also shows fluctuations in the cattle population between districts/cities from 2017 – 2021. The total cattle population in all districts/cities in South Kalimantan decreased in 2019, and there has been an increase in the livestock population again in 2021 in all districts/cities. The decline in the cattle population in 2019 is thought to be closely related to the Covid 19 pandemic, which has had a huge impact on the economic activities of the community and the region, while the increase in the cattle population again in 2021 is thought to be in line with the decreasing intensity of the Covid 19 pandemic and the growing return to public economic activity.

**Table 8.** Cattle population by district/city in South Kalimantan Province, 2017-2021 [31]

District/city	Population (heads)					Average
	2017	2018	2019	2020	2021	
Tanah Laut	75,642	82,536	59,011	65,654	77,045	71,978
Kota Baru	14,394	15,560	10,913	12,490	12,769	13,225
Banjar	17,980	18,520	15,345	18,867	18,984	17,939
Barito Kuala	8,546	8,357	4,921	6,053	7,998	7,175
Tapin	6,751	6,477	5,658	7,235	8,330	6,890
Hulu Sungai Selatan	5,136	5,028	2,651	3,395	4,796	4,202
Hulu Sungai Tengah	6,604	6,810	5,604	7,155	7,335	6,702
Hulu Sungai Utara	757	769	702	777	719	745
Tabalong	3,320	3,825	3,619	3,477	3,767	3,602
Tanah Bumbu	20,416	20,112	16,027	18,667	19,111	18,867
Balangan	2,084	2,051	1,452	1,553	1,507	1,729
Banjarmasin	222	227	503	279	53	257
Banjarbaru	2,367	2,276	2,314	2,424	2,913	2,459

**Table 9.** Beef cattle population based on age structure by district/city in South Kalimantan province, 2017-2021 [32]

District/city	Beef cattle population based on age structure (heads)			
	Average population (heads)	Mature (52,81%) (heads)	Young (27,79%) (heads)	Calf (19,40%) (heads)
Tanah Laut	71,978	38,011	20,003	13,964
Kota Baru	13,225	6,984	3,675	2,566
Banjar	17,939	9,474	4,985	3,480
Barito Kuala	7,175	3,789	1,994	1,392
Tapin	6,890	3,639	1,915	1,337
Hulu Sungai Selatan	4,202	2,219	1,168	815
Hulu Sungai Tengah	6,702	3,539	1,862	1,300
Hulu Sungai Utara	745	393	207	144
Tabalong	3,602	1,902	1,001	699
Tanah Bumbu	18,867	9,963	5,243	3,660
Balangan	1,729	913	481	336
Banjarmasin	257	136	71	50
Banjarbaru	2,459	1,299	683	477
South Kalimantan	155,769	82,262	43,288	30,219

Based on Table 8, using the population structure reference from the Directorate General of PKH in 2017, it is possible to calculate the number of cattle in the Livestock Unit (ST) or animal unit measurements by sorting out the share of the cattle population according to age (Table 9). After that, each age level was converted from head units to livestock units (Table 10). One mature cattle is valued at 1 ST, young cattle at 0.5 ST, and calf at 0.25 ST. Table 10 shows that for the Province of South Kalimantan, the area's carrying capacity is 2,752,990

ST/ha/year. It can be seen that the number of livestock units that currently exist is 111,461 ST. Thus, the potential for additional livestock populations in South Kalimantan is still wide open because of its total carrying capacity; the number of livestock units that fill it is only around 4.0%. This means this area can still accommodate 96% of the capacity or 2,641,529 ST/ha/year.

**Table 10.** Estimated population of beef cattle, carrying capacity and potential for additional population by district/city in South Kalimantan Province, 2022 [31]

District/city	Population (ST)				Carrying capacity IPKS (ST)	Potential addition (ST)
	Mature	Young	Calf	Total		
Tanah Laut	38,011	10,002	3,491	51,504	480,917	429,414
Kota Baru	6,984	1,838	642	9,464	1,013,928	1,004,464
Banjar	9,474	2,493	870	12,837	118,769	105,552
Barito Kuala	3,789	997	348	5,134	126,981	121,847
Tapin	3,639	958	334	4,931	369,204	364,273
Hulu Sungai Selatan	2,219	584	204	3,007	86,299	83,292
Hulu Sungai Tengah	3,539	931	325	4,795	0	-4,7952
Hulu Sungai Utara	393	104	36	533	25,195	24,662
Tabalong	1,902	501	175	2,578	29,041	26,463
Tanah Bumbu	9,963	2,622	915	13,500	484,606	471,106
Balangan	913	241	84	1,238	17,042	15,804
Banjarmasin	136	36	13	185	0	-185
Banjarbaru	1,299	342	119	1,760	1,008	-752
South Kalimantan				111,461	2,752,990	2,641,526

## 4 Conclusion

South Kalimantan Province has oil palm plantations covering an area of 426,475 hectares with a total of 98 units of oil palm plantation companies that have the potential to produce feed ingredients from vegetation on plantation land in the form of leaves and palm fronds, as well as by-products in the form of BIS and solid for cattle feed. This potential can be increased by integrating cattle palm oil to increase profits in both farms. Areas with great potential to integrate cattle palm based on the area of oil palm plantations in South Kalimantan are Kotabaru, Tanah Bumbu, Tanah Laut, and Tapin.

The potential of animal feed ingredients in the oil palm plantation area in South Kalimantan can accommodate a population of 2.75 million ST (Livestock Units). If all cattle populations utilize feed from oil palm plantation areas through cattle palm integration efforts, then the cattle population in South Kalimantan can be increased by 2.64 million ST (Livestock Units). If by-products in the form of BIS and solid are assumed to be as much as 70% of the potential in South Kalimantan oil palm plantations can be used as animal feed, then the cattle population can be increased by 1.85 million ST (Livestock Units).

The obstacles to developing an integrated cattle oil palm business in South Kalimantan for farmers are: the area of oil palm plantations owned by farmers is limited so that the grazing space of cattle is also limited, farmers' access to palm oil processing by-products (BIS and solid) in oil palm plantation companies for animal feed is limited, the ability of farmers to technically integrate cattle palm oil and business capital to increase business scale is limited. An obstacle to developing the cattle palm integration business in South Kalimantan for plantation companies is the company's concern about the negative impact of conducting a cattle palm oil integration business. In contrast, the benefits that will be obtained from the industry are uncertain.

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