Swot analysis of development of beef cattle – palm oil integration in Indonesia

Firman RL Silalahi1,2,5, Abdul Rauf3, Chairani Hanum1, and Donald Siahaan4

1Agricultural Extension College of Medan, Jl. Binjai Km. 10 Medan, Sumatera Utara, Indonesia.
2Study Program of Natural Resources and Environmental Management, Graduate School, University of Sumatera Utara, Jln. Prof. Maas, Medan, 20155, Indonesia.
3Faculty of Agriculture, University of Sumatera Utara, Jln. Prof. A. Sofyan No. 3, Medan, 20155, Indonesia.
4Indonesia Palm Oil Research Institute, Jl. Brigjen Katamso No. 51, Medan, 20158, Indonesia.
5Corresponding Author E-mail address: firmansilalahi@pertanian.go.id

Abstract. Based on the estimation to meet the beef needs of Indonesia until 2020 is still imports, because it has not been self-sufficient. To meet the beef needs that continues to increase, one of the strategies undertaken was the development of integration of beef cattle – palm oil. In order to arrange the strategy of developing integration of beef cattle – palm oil that effective and efficient, it is necessary to identify the factors of strength, weakness, opportunity, and threat. The objective of this research is to identify factors of strength, weakness, opportunities, and threats in the development of integration of beef cattle – palm oil in Indonesia. The research method used is survey to locations of integration implementation in several provinces in Indonesia and literature study. This research have identified internal and external factors. Internal factors of strengths is availability of biomass from palm oil industry, availability of adaptive local cattle, and the availability of human resources of breeders. Internal factors of weakness is low productivity of local cattle, and mastery of feed making technology from palm oil biomass is still low. External factors of opportunities is meet the increasing need of beef, the capacity of the palm oil plantation area is still very large, and development of environmentally palm oil plantations. And external factors of threats is the entry of imported beef is cheaper and more quality, and concern in damaging palm oil plantations.

1. Introduction

In 1978 the last year Indonesia was able to export beef cattle, and since 1990 Indonesia has begun importing breeding cattle for beef production activities and fulfilling national beef meat needs [1]. In 2017 the total population of Indonesia is 260 million and the amount of beef consumption is estimated at 729 tons, which is equivalent to a population of 4.1 million beef cattle. To fulfill it, it cannot rely on domestic production, because the production capacity is only 2.5 million head of cattle [2]. Based on data from the Central Bureau of Statistics, the prognosis of domestic beef production in the period of 2017 was recorded at 354,770 tons, while the estimated beef demand reached 604,968 tons, so as to meet the shortages as much as 39-40 percent was met through imports, both in the form of imported cattle and meat [3]. Based on the prediction of Indonesian beef production until 2020 it has not been able to meet the consumption needs of beef, even with greater growth than the growth of beef.
consumption which is 1.93% per year and it is estimated that there will still be a beef deficit of 0.17% [4].

Indonesia is the country with the largest palm oil plantation in the world, with an area of 11.914 million ha in 2016 [5]. The resources available in the palm oil industry can be used for cattle breeding activities, one of which is as a raw material for cattle feed. The resources that can be used are biomass from the palm oil industry, namely leaves and midribs, grasses between palm oil plants, and by product of palm oil processing, namely palm kernel cake and palm oil sludge [6].

In livestock business, one of the most important factors that must get attention is cattle feed, both in terms of quantity, quality, anti-nutrition, price, and availability [7]. Around 60 - 70 percent of the costs in cattle breeding are cattle feed costs [8]. To reduce the cost of cattle feed can be done by feeding procedures, which is them by implementing integration with agricultural activities. Where feed sources can be provided from the by-product of agricultural produce. By looking at the potential of existing palm oil plantations, the Indonesian Ministry of Agriculture since 2003 has been promoting the development of integration of beef cattle - oil palm [9].

Based on the results of various studies on the development of beef cattle farms through a system of integration of beef cattle – palm oil can multiply well by utilizing biomass originating from the palm oil industry. The beef cattle – palm oil integrated production systems in Malaysia are considered as success sustainable integrated agricultural production systems [10]. However, an implementation strategy is needed for the development of integration. To design of integration development strategies, knowledge the strength and weakness as internal factors and the opportunity and threat as external was needed. By conducting this study can be an input in efforts to determine policies for the development of efficient and sustainable integration.

The objective of this research is to identify internal factors of strengths and weakness, and external factors of opportunities and threats in developing integration in Indonesia.

2. Material and Methods
The research method that has been used is descriptive research using SWOT analysis as an evaluation of data. Data collection has been done by means of interviews and literature studies. Interviews have been conducted for plantation companies and breeders who have implemented integration in various districts which have become centres of integration in Indonesia. Respondents are recommended by the department that handles integration. The interview locations were Deli Serdang, Langkat, and Batu Bara Regencies in North Sumatra Province; Tanjung Jabung Barat Regency in Jambi Province, Siak Regency and Pelalawan Regency in Riau Province, and Kotawaringin Barat Regency in Central Kalimantan Province. Literature study from research reports, reports of program, journals, and books. Data collected, then classified and analysed. Data is classified into internal factors and external factors. Furthermore, internal data is divided into internal factors of strength and internal factors of weakness. And external data is divided into external factors of opportunity and external factors of threat

3. Results and Discussion

3.1. Internal factors of strength

3.1.1. Availability of biomass from palm oil industry
Feed that can be obtained from palm oil plantations sourced from natural vegetation that grows in the area and palm oil plants. Natural vegetation that grows in palm oil plantations usually emits ferns, puzzle grasses, legumes, bushes, and reeds. In immature palm oils, forage plants are very diverse and lose more. Conversely, the older the age of oil palm plants, the fewer the number and types of grasses that grow. This happens because young palm oil, tree size and midrib are still small so that the sun's rays on the land between palm oil plants are still free. Forage crop production in fresh conditions between plants under palm oil trees aged 3 and 6 years in Semboja District, Kutai Kartanegara Regency is 13,168 kg per hectare and 6,380 kg per hectare [11]. Palm oil plantations have great potential to support livestock development, namely the availability of cover crops and weeds. In palm oil plantations aged 1 - 2 years, crop cover crops can reach 5.5 - 9.5 tons of BK / Ha [12].
Palm oil midribs and leaves resulting from harvest pruning activities can be used as cattle feed. In general it is assumed that the palm oil cropping pattern is 9 mx 9 m and there are around 138 trees and each tree produces 22 midribs per year. From a palm oil midrib it is assumed that 0.5 kg of fresh leaves can be obtained, so that there will be 1,528 tons of one hectare of palm oil plantations. Assuming a midrib weighing 7 kg, 21,252 tons of fresh midribs from one hectare will be obtained. From one hectare of palm oil plantations has the potential to produce 0.66 tons of dry matter from leaves and 1.64 tons of dry material from palm fronds as feed ingredients [13].

In the processing palm oil into crude palm oil and palm kernel oil a by-product is produced in the form of palm kernel cake and palm oil sludge [14]. Palm oil sludge is obtained from processing to produce crude palm oil, while palm kernel cake is a by-product of processing palm kernel oil. In processing fresh fruit bunches with a capacity of 30 tons/hour is 21.97 percent crude palm oil, 6.4 percent palm kernel oil, 8 percent crude fibre and 7 percent shell [15]. Out of one hectare of palm oil plantation crops can be produced 1,132 kg of palm oil sludge, 514 kg of palm kernel cake, and 2,681 kg of extracted fiber for each year [16]. In the form of dry matter, the potential of cattle feed from by-products is crude palm oil and palm kernel oil from one hectare palm oil annually is 0.5 tons of palm kernel cake and 1.1 tons of palm oil sludge [13].

Table 1 presents the potential of cattle feed that can be obtained from Indonesia’s palm oil plantations in 2016. It is assumed that a cattle with 250 kg requires feed of 7.5 kg/day or 2.7 tons/year or as much as 3% of body weight. With the potential available, if the leaves and midribs are used as cattle feed instead of grasses, it can supply the needs of as many as 10 million head of cattle.

Palm kernel cake and palm oil sludge contain high enough protein, so it can be used as raw material for making cattle feed. With proper processing and treatment can be used as a mixture in the manufacture of concentrate feed. If it is assumed that one cattle needs 7.5 kg/day or 1.8 kg of dry material/day, it takes 0.66 tons of palm oil sludge dry material in one year. With the palm oil sludge potential that can be produced from the palm oil industry in Indonesia in 2016, it is able to provide cattle feed for the needs of 19 million head of cattle.

Table 1. Cattle feed potential from biomass of the palm oil industry

| Biomass of the palm oil industry | Cattle feed potential Per hectare (tons of dry / year) | Cattle feed potential in Indonesia (tons of dry / year) |
|---------------------------------|-----------------------------------------------|-----------------------------------------------|
| Midrib                          | 1.64                                          | 19,538,960.                                   |
| Leaves                          | 0.66                                          | 7,863,240.                                    |
| Palm Kernel Cake                | 0.5                                           | 5,957.00                                      |
| Palm Oil Sludge                 | 1.1                                           | 13,105,400.                                   |
| Total                           | 7.5                                           | 89,355,000.                                   |

3.1.2. Availability of adaptive local cattle

Indonesia has local cattle, namely Bali cattle, Madura cattle, Javanese cattle and Aceh cattle, and cross-bred cows, like ongole breed. Indonesian local cattle are accustomed to living in the tropics and are able to consume forage around palm oil plantations. Table 2 shows that in North Sumatra Province cattle farmers who carry out integration generally maintain local cattle, namely aceh cattle and ongole brees. Based on interviews, farmers generally prefer the type of aceh cattle and ongole breeds, because these types are most suitable to be raised in palm oil plantations, on the grounds that it is easy to provide cattle feed, not easy to get sick, weather resistant and easy to sell. While based on surveys in the provinces of Riau, Jambi and Central Kalimantan, generally the cattle used are bali cattle and ongole breed. The superiority of bali and ongole cattle can be used as beef cattle, cattle workers, easy maintenance, and can utilize low quality forage.
Table 2. Types of cattle used in integration activities

| No | Location                        | Types of Cattle                        |
|----|---------------------------------|----------------------------------------|
| 1  | North Sumatra Province           | Aceh Cattle, Ongole Breed              |
| 2  | Riau Province                    | Bali Cattle                            |
| 3  | Jambi Province                   | Bali Cattle                            |
| 4  | Central Kalimantan Province      | Bali Cattle, Ongole Breed              |

Farmers in North Sumatra prefer Aceh cattle and ongole breeds, and farmers in Riau, Jambi and Central Kalimantan provinces prefer bali cattle and ongole breed. Considerations are easily adaptable to cattle feed derived from palm oil biomass, easy to get livestock germs, not susceptible to disease, preferred by the community, and easier in marketing. While simental and brahman cattle have several weaknesses, namely the body is too large so it is difficult to market, susceptible to disease, and difficult to adapt to cattle feed derived from palm oil plants. Development of bali cattle can be done with an intensive, semi-intensive, and extensive pattern and proven to be able to increase the productivity and population of Balinese cattle. Balinese cattle have been used in the integration of cattle-palm in PT Agricinal - Bengkulu, because they have the advantages of being adaptable [17]. It has been reported [18] Bali cattle have proven adaptive and productive, and are very suitable to be developed in the area of palm oil plantations. Bali cattle are preferred because the feed is easy and can develop well [19]. Other advantages Bali cattle have a high fertility rate and able to adapt well to the environment of palm oil plantations, which is shown by good production performance, reproductive, and the productive age of more than 10 years [20].

3.1.3. Availability of human resources of breeders

Cattle cultivating activities on palm oil plantations have long been carried out in Indonesia. According to the results of interviews with farmers who carry out cattle breeding on palm oil plantations in North Sumatra Province, that they already have experience around 30-40 years since the establishment of palm oil plantations in North Sumatra Province. For example in Deli Serdang District, Langkat Regency, and Batu Bara District, the communities around the plantations have implemented cattle ranching by grazing cattle on large private plantations and large state plantations, even on smallholder plantations. Many communities around palm oil plantations have been integrating cattle ranching on palm oil plantations since the existence of palm oil plantations, where people use grasses on palm oil plantations. Actually, people really want to use the grass in the palm oil plantation, but it is often prohibited by the plantation owners.

With area of palm oil plantations in Indonesia in 2016 there is the number of farmers involved in the plantation is 2,115,434 households. This is a potential workforce that can carry out integration of beef cattle - palm oil. According to interviews, generally palm oil farmers are eager to do a side business to supplement their income. They can do cattle farming activities by utilizing biomass in palm oil plantations. But many plantation companies have banned, because they assume cattle enter to plantations can damage palm oil. According to statistical data the number of Indonesian farmer in 2016 ranged from 4,078,362 people [21]. This farmer is a human resource that can also be used for the cattle farming business by implementing the integration of beef cattle – palm oil. The main problem in cattle farming is the problem of land and the provision of cattle feed ingredients. If the integration of cattle breeding activities in palm oil plantations can be carried out, then this human resource can be utilized

3.2. Internal weakness factors

3.2.1. Low productivity of local cattle

Table 3 shows the growth of local cattle weight on integration activities. It is seen that local cattle growth is relatively low. Aceh cattle that are raised in the province of North Sumatra, body weight growth is only around 0.25 kg/day and Bali cattle that are raised in the provinces of Riau, Jambi and Central Kalimantan growth around 0.4 kg/day. It has been reported [22], Bali cattle fed with palm oil midrib
has daily weight gain ranging from 0.3-0.42 kg/day. Ongole breeding cattle that were raised semi-intensively in North Sumatra Province were only about 0.5 kg in weight gain, while ongole breeding cattle in Kalimantan Province ranged from 0.7. According to report [23] daily weight gain of ongole breeding fattened with sorghum based feed is 0.73-0.82 kg. Imported cattle, for example simental, brahman, and limousines that have been widely cultivated by the community with concentrated feed growth can reach 1.5 kg/day.

Table 3. Local cattle productivity in integration activities

| No | Location                  | Cattle Type     | Weight Growth (kg) | Integration Pattern |
|----|---------------------------|-----------------|-------------------|---------------------|
| 1  | North Sumatera Province  | Aceh Cattle     | 0.25              | Semi Intensive      |
|    |                            | Ongole          | 0.5               | Semi Intensive      |
|    |                            | Breeding        |                   |                     |
| 2  | Riau Province             | Bali Cattle     | 0.4               | Extensive           |
|    |                            | Ongole          | 0.4               | Semi Intensive      |
| 3  | Jambi Province            | Bali Cattle     | 0.4               | Intensive           |
|    |                            | Bali Cattle     | 0.4               | Intensive           |
| 4  | Central Kalimantan Province| Bali Cattle   | 0.4               | Extensive           |
|    |                            | Ongole          | 0.7               | Intensive           |
|    |                            | Breeding        |                   |                     |

3.2.2. Mastery of cattle feed making technology palm oil biomass is still low

In Table 4 presented the composition of cattle feed from by-product of palm oil industry that used by the community. It is seen that the composition of the feed used varies. There are no standards applied by the community in processing palm oil biomass-based feed. Based on interview results, farmers generally have never received training on cattle feed processing made from by-product of palm oil industry. In this way, farmers generally have not mastered feed processing technology, so to make cattle feed, they just try based on experience. The farmers do not know the exact nutritional content of the food they make.

Table 4. Composition of cattle feed from by-product of the palm oil industry biomass

| No | Feed Composition                                        |
|----|---------------------------------------------------------|
| 1  | Chooped of palm midribs and leaves and palm kernel cake 88, 6 percent |
| 2  | Chooped of palm midribs and leaves 90 percent           |
| 3  | Chooped of palm midribs 75 percent                     |
| 4  | Palm kernel cake, palm oil sludge, and Chooped of palm midribs percent |

Utilization of biomass Palm oil requires certain treatment to get maximum results. It has been reported [24], that palm kernel cake contains 37% crude fibre and 14% crude protein has palm oil sludge. The use of palm kernel cake as feed is limited due to high crude fibre. If left in the open air, palm oil sludge quickly smells rancid and is overgrown with fungi. To use this treatment is required fermentation process with moulds of Aspegillus niger [25]. Meanwhile, to utilize palm fronds and leaves, it is necessary to reduce the size to be easily consumed by cattle. Sticks on leaves must be crushed so as not to damage the rumen in the stomach of the cattle. The midrib is chopped so the size is smooth so the cattle is easy to chew.

Generally the farmers only carry out the chopping of leaves and midribs with a single process, which is to put the leaves and midribs at once in the chopper but the results are less smooth. Until now there are not many farmers who have a chopped machine that is capable of producing midrib up to a size that is suitable for consumption. The method of farmers for feeding is also different. Some farmers rely solely on grasses that grow around palm oil and other farmers process midrib, palm kernel cake and palm oil sludge to be used as concentrates, but the composition is not based on correct studies.
3.3. External opportunity factors

3.3.1. Meet the increasing need of beef
Based on data from 2000 - 2015 there has been an increase in meat consumption by 57.4 percent. The consumption of beef per capita in 2000 was 1.525 kg, then in 2015 it increased to 2.40 kg [26]. Although the consumption of per capita beef in Indonesia compared to developed countries is still relatively small. At celebrations or religious holidays the consumption of beef can soar very high and be followed by rising prices. With the progress and increase in people's income, increased consumption of beef is believed to continue to increase.

Every year Indonesia's beef consumption per capita increases by 1.40 percent and with existing conditions it is expected to increase 4.8 percent until 2024 [27]. This is an opportunity that can be achieved through integration activities. So far, to meet the needs of cattle, the government imports beef and breeding cattle

Since 2013 - 2016 the price of beef has generally experienced an upward trend. There has been an increase in meat prices by 13.17% per year [26]. The price increase is on religious holidays and national holidays, where public meat consumption is increasing. This is an opportunity to develop an integration of beef cattle - palm oil cattle. Especially with the integration of cattle maintenance costs will be cheaper.

3.3.2. The capacity of the palm oil plantation area is still very large
In the period 1980 - 2016 there has been a growth in the area of palm oil plantations in Indonesia by 10.99 percent per year. In 2016 it is estimated that the area of palm oil plantations in Indonesia is 11.914 million hectares, whereas in 1980 it was still an area of 294.56 thousand hectares. This vast palm oil plantation land can be used as a cattle breeding location. Plants that grow between palm oil plants can be used as a source of forage for livestock. If it is assumed that every one hectare of palm oil plantations can be used as a grazing place for one cattle [28], then with an area of 11, 914 million hectares of palm oil plantations available, it can be used as a grazing place for approximately 11.914 million head of cattle. This capacity is a very promising opportunity to be implemented.

3.3.3. Development of environmentally palm oil plantations
Beef cattle - palm oil integration activities are synergistic efforts in utilizing available resources in time and space. This effort can also increase revenue growth from communities around the palm oil area. Diversification efforts from integration activities can encourage the economic growth of farmer who previously only received revenue from the sale of fresh fruit bunches. Some of the benefits for the smallholders who implement the integration system are planters can use cattle to transport, plants between palm oil and palm oil processed by-product can be used for cattle feed, manure from cattle can be used to improve the environment for growing palm oil, and cattle become life savings for farmer [29].

Assuming that everyone hectare of palm oil plantations can contribute as much as one head of cattle, then with the area of Indonesian palm oil plantations 11, 914 million hectares in 2016 can accommodate 11.914 million head of cattle. Each cattle produces faeces and urine which can be processed into organic fertilizer for plants. It can be assumed that one cattle produces 8-10 kg per day, in a year of about 2.6 -3.6 tons, and this is equivalent to 1.5-2 tons of organic fertilizer [30]. Such organic fertilizer can be used to fertilize one hectare of palm oil for a year. So farmer do not use anorganic fertilizer again. Furthermore, if an average of one cattle produces 9 liters urin per day [31], then if it is collected and processed properly it can produce around 38,336 billion liters of liquid organic fertilizer. This is a very large potential to produce solid and liquid organic fertilizers for environmentally and sustainable agriculture.

The palm oil plantation companies, weed control is currently carried out chemically. The cost elements needed for weed control are herbicide and labour. Weed control of 1 hectares requires 0.25 liters of herbicide per month, so that for 11,914 million hectares of palm oil plantations it needs 2.97 million liters of herbicide. This condition can be overcome by integration activities. In the integration
of grazing cattle in palm oil plantations, weeds will be controlled. In grazing, usually cattle will eat young grasses, so there is no high growth for grasses.

3.4. External threat factors

3.4.1. The entry of imported beef is cheaper and more quality
The availability of beef from domestic production is insufficient for the consumption needs of the Indonesian. To meet domestic beef needs, Indonesia imports beef and cattle. In the period 1996 - 2016, the highest beef imports reached 246,609 tons or equivalent to US $ 681,229 million in 2014 [26]. Imported cattle entering Indonesia mostly come from Australia, New Zealand and the United States. This is a challenge for domestic farmers, because the livestock business in the country where imported cattle are so advanced. So that it can produce quality cattle and lower prices. According to media sources it was reported that the quality of imported beef was better and cheaper than local beef. The advantages of imported beef are red meat, small and smooth meat texture, marbling, savory taste, and no smell [32]. In the beef trade market in Jakarta in April, the price of imported beef was Rp. 20,000 per kilo of local cattle [33]. The cattle breeding system in Indonesia is still small-scale, which is 2-5 head of cattle per farmer, so the maintenance costs are high. While the maintenance system in cattle producing countries such as Australia and New Zealand, a farmer raise cattle up to thousands heads of cattle [34]. While in Indonesia, for example, cattle that are cultivated in East Nusa Tenggara are less quality because they are not given enough food and poor health care [35].

3.4.2. Concerns damaging palm oil plantations
Development of integration activities is feared to damage palm oil plantations. The damages that people fear for integration activities are soil hardening, spread of disease, eating fallen palm oil fruit, eating young leaves, and succession of weeds [36]. Based on interviews with farmers, the prohibition of grazing cattle freely on oil palm plantations by plantation companies is due to damage to the physical properties of the land due to compaction. Soil compaction occurs as a result of continuous cow traffic which is grazed freely every day. If this event lasts a long time, in turn it will cause the development of the roots of palm oil to be hampered. Cattle are also suspected of being spreaders or carriers for the spread of Ganoderma boninense and bagworm. Livestock often rub their bodies into the trunks of oil palm, while Ganoderma mushrooms are usually on the trunk so that spores can stick to the body of the cattle and will be taken to where the cattle will go. Legs of a cattle can also carry Ganoderma spores that are at the base of the palm oil stem. Cattle nails can stab into the roots near the base of the stem. In addition to eating grass in space between palm oil and leaves, cattle also eat fallen palm oil fruit on tree plates and in the collection point so that it directly affects the loss of production. In immature plants, the negative impact is damage to leaves so that the yield of immature plantations becomes longer, the growth of non-uniform yielding plants, and the number of inserts to replace dead plants. For produced palm oil, this negative impact is more variety. In young plants, cattle are still able to reach midrib so that it will directly impact the decrease in photosynthesis effectiveness which results in limited photosynthetic allocation for fruit development, in addition to the long-term impact on decreasing sex ratio. Integration activities with large numbers of cattle grazing indicate the succession of weeds in space between palm oil. Paspalum conjugatum become very dominant, whereas soft ferns are very rare. This condition will result in a soil micro climate that becomes more susceptible to drought stress and reduced host plants for predators of palm leaf-eating caterpillar pests.

4. Conclusions
This research have identified internal and external factor. Internal factors of strengths is availability of biomass from palm oil industry, availability of adaptive local cattle, and availability of human resources of breeders. Internal factors of weaknesses is low productivity of local cattle, and mastery of cattle feed making technology from palm oil biomass is still low. External factors of opportunity is meet the increasing need of beef, the capacity of the palm oil plantation area is still very large, and development of environmentally palm oil plantations. External factors of threats is the entry of imported beef is cheaper and more quality, and concerns damaging palm oil plantations.
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