

Integrated Palm Oil and Livestock Farming Enhances Productivity in Central Kalimantan

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Abstract. This study, conducted in Kotawaringin Barat and Lamandau Districts of Central Kalimantan, aimed to investigate the patterns and implications of integrating oil palm cultivation with livestock farming. Utilizing qualitative research methods, including interviews and direct observations, three distinct integration patterns were identified: integrated (33.33%), semi-integrated (66.67%), and semi-integrated partnership (8.33%). The integrated pattern encompasses a closed-cycle system involving oil palm cultivation, cattle raising, complete feed processing, and organic fertilizer production. In contrast, the semi-integrated pattern harnesses only solid palm oil by-products for cattle feed and fertilizer blends, while the semi-integrated partnership involves collaborations between private palm oil entities and farmer groups, facilitating cattle and feed support. Remarkably, the application of produced organic fertilizer increased palm oil productivity by approximately 25% and yielded a benefit-cost (R/C) ratio of 4.0 for horticultural crops. Monthly organic fertilizer production ranged between 1-20 tons, with distribution across palm oil (33.3%), horticultural crops (8.3%), and other crops (58.3%). Additionally, liquid organic fertilizer production spanned 1000-4000 liters/month. The integrated approach, rooted in the palm oil sector, has led to the emergence of sustainable commercial units that bolster economic growth. Given its eco-friendly and popular adoption, formal legal backing from local authorities and further engagement between palm oil enterprises and farmer groups is recommended to ensure longevity and broader implementation.

1 Introduction

Agricultural development in Indonesia is directed towards sustainable agricultural development [1, 2] and is a commitment of world countries that must be obeyed and implemented [1]. This is not easy to apply because the concept of sustainable development is multi-dimensional so that its implementation must be an integrated cross-sectoral and multi-disciplinary program at the central and / or regional levels [1].

Sustainable agriculture answers many obstacles faced by farmers, especially resources and ensures environmental sustainability. The use of various kinds of chemicals added

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during fertilization and when spraying pests, in the long term and continuously has a negative impact on the environment, namely the impact on soil fertility and the development of soil biological elements. The introduction of the future concept is organic-based agriculture [3]. This agriculture relies on natural ingredients and biological agents in the form of microbes, without the use of chemicals. Organic agriculture is including the use of organic fertilizers [3]. The long-term use of organic fertilizers is to preserve soil organic matter and improve soil quality, [4, 5]. The concept of organic agriculture is maintained and developed through a sustainable agricultural system involving an interrelated combination of soil, crop production and corresponding livestock.

According to [3] the term sustainable agriculture system is better known as LEISA (Low external Input Sustainable Agriculture), which is an agricultural system that seeks to minimize the use of inputs (seeds, chemical fertilizers, pesticides, and fuels) from outside the ecosystem, which in the long run can endanger the survival of agriculture. The word sustainable means maintenance and prolong which means to maintain for a long time. That is, it must be realized and can be applied for a long time. [6] said there are four trends that encourage the implementation of sustainable agricultural systems, namely changes in farmers' attitudes, demand for organic products, the relationship between farmers and consumers, and policy changes. The government's efforts to be able to implement sustainable agriculture are through an integrated cultivation approach between livestock and crops, especially with the palm oil plantation industry. The palm oil-cattle integration program started from 2007-present (12 provinces and 17 districts). Integration between cattle and cocoa began in 2007-2010 (11 provinces and 18 districts), integration of cattle with sugarcane began in 2009-2012 (11 provinces) and integration of cattle with coconut began in 2013 (1 province, 1 district) [7]. The Ministry of BUMN is no exception in developing the cattle palm oil integration business, in accordance with the Ministry of BUMN Letter Number S-50 / D1. MBU / 2012 dated February 22, 2012 concerning the Pattern of Integration of Cattle Farming in Oil Palm Plantations and Letter of the Minister of BUMN Number S-240 / MBU / 2012 dated May 9, 2012 concerning the Assignment of the Implementation of the Palm Cattle Integration Program [8]. Various studies show that integration activities are economically profitable but the adoption rate of the pattern is still low.

The purpose of this study is to provide an overview of sustainable agricultural activities through the integration of livestock with the oil palm plantation industry in the community

2 Methodology

The location of the study is determined by purposive sampling method, namely West Kotawaringin and Lamandau Regency, Central Kalimantan. Several farmer groups in the location have carried out the integration activities cattle and palm oil industry.

The sampling technique (informants) used is purposive sampling. Purposive sampling technique is a sampling technique with certain considerations [9]. This research uses qualitative methods by interview and direct observation. A total of 12 informants are used in this study consisting of farmer groups, P4S and KUD which in their farming activities utilize the by-products of the oil palm plantation industry. Data and information are carried out qualitative and quantitative descriptive analysis.

3 Results and discussions

3.1 Group of farmers profile

The respondents' main livelihoods were oil palm plantations and cattle raising. The scale of cattle rearing business is around 5 - 20 heads (58.33%) and the scale of 100 - 150 heads (41.67%). The average age of respondents, each represented by the chairman, ranged from 40-45 years with all education being high school. Have an average breeding experience of more than 15 years. According to [10] there is a relationship between the level of education and experience to the rate of technology adoption. All respondents (100%) had attended bimtek and training on oil palm-cattle integration activities at local locations. 4 respondents (33.33%) had received training assignments outside the local government. Communication between respondents is mostly done informally, but smoothly and very rarely done formally through official meetings, so the flow of information between farmer groups is relatively smooth. Access to technology resources according to [11] will affect technology adoption. For this reason, the union of farmer groups (Gapoktan) has begun to be initiated to increase the active role of each farmer group, especially in terms of transferring information and technology, obtaining feed and fertilizer ingredients and product marketing. As reported [12] that the development of Gapoktan was motivated by weak access of farmers to financial institutions, marketing institutions, providers of agricultural production facilities, and sources of information.

3.2 The model of sustainable agriculture

Sustainable agriculture is organic farming [3]. A total of 12 respondents (farmer groups) all run organic farming (100%) with different management according to the financial capabilities of each farmer group. In terms of technological capabilities in agriculture, it can be said to be evenly distributed because communication between farmer groups is very good so that technology transfer is runs well between farmer groups. Transfer of technology is occur when each farmer group is visits each other to see each other's activities. Because the abundant local resources in the research site are by-products of the oil palm plantation industry such as solid palm oil, palm kernel cake, boiler ash, and fiber as a source of feed ingredients and organic fertilizer ingredients, their agricultural activities take advantage of this potential through an integrated agricultural approach between cattle and palm oil plantations. The palm oil plantation industry according to [13] holds potential for the development of agricultural bioindustry.

The activities of farmer groups in the integration activity include: (1) processing of complete feed (fiber sources and protein sources) based on palm oil mill (PKS) by-products with a production of 1-20 tons / month (33.33%) at a price of 2500 / kg, (2) single feed as additional feed from PKS by-products in the form of solid palm (66.67%), (3) processing of solid organic fertilizer (POP) made from PKS by-products and cattle dung with a production of 1-20 tons / month (100%) at a price of 1000 / kg, (4) processing of liquid organic fertilizer with production of 1000 – 4000 liters / month (41.67%) at a price of 2000 / lt, (4) cattle breeding (100%), and (5) smallholder palm oil plantations (100%). In addition to these main activities, several farmer groups carry out side activities to diversify income in the form of maggot cultivation (25%) and horticultural crops (8.33%). Organic farming management applied is classified into 3 patterns, namely (1) integrated approach (33.33%), (2) semi-integrated (66.67%) and (3) semi-integrated partnership pattern (8.33%).

3.2.1 Integrated agricultural approach to the palm oil and livestock

There is an uninterrupted cycle between the palm oil production sub-system and the livestock (cattle) production sub-system. Output in the form of by-products from palm oil becomes input from livestock and vice versa (Figure 1). With this approach, low external input sustainability (LEISA) can be applied and increase the added value of utilizing by-product of palm oil industry as animal feed and as organic fertilizer [13]. A total of 4 farmer groups (33.33%) are carried out this integrated agricultural. These farmer groups have financial capabilities and stronger networks as well as agricultural tools and machinery to make complete feeds and organic fertilizers compared to other farmer groups, so they cannot implement ideal integrated farming activities.

Considering that some oil palm plants are already 25 years old, many farmer groups under the auspices of the KUD carry out replanting activities. According to [14] the age of oil palm is more than 22 years, crop productivity will decrease because the age of the plant is above the age of maximum average productivity of oil palm and it is time for replanting. To provide alternative income as long as the oil palm plant has not yet produced, corn plant development is carried out between the sidelines of 1-year-old oil palm plants. To utilize corn production, laying hens are raised as an alternative income by utilizing part of their corn production for a mixture of feedstuffs.

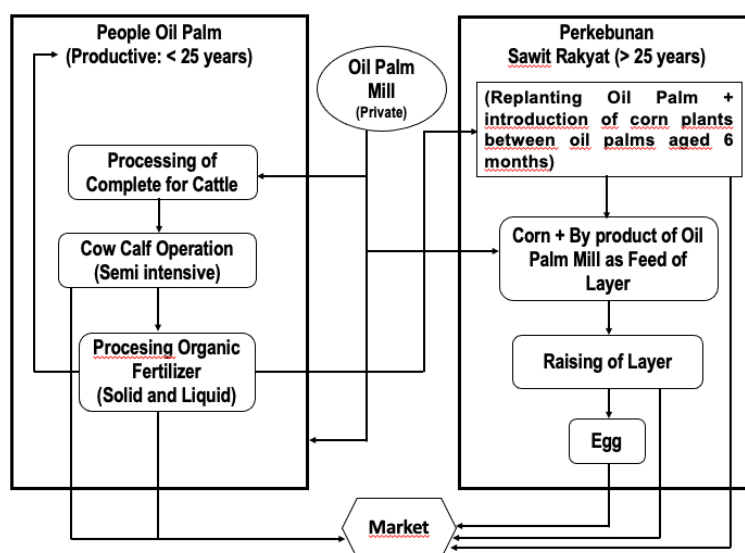


Fig. 1. Cattle raising approach with palm oil industry when palm oil plants is still produce and when some palm oil plants are replanted.

The commercial units raised are complete feed production, organic fertilizer production (solid and liquid), corn production, egg production, and production in cattle raising. The average daily weight gain of cattle (ADG) given complete feed reached 0.99 kg / head / day [15]. Most of the complete feed products are used for livestock themselves (41.7%) and a small part is bartered (8.3%) with cattle dung to other farmer groups that do not produce feed. In one of the KUD in West Kotawaringin Regency that manages several farmer groups with an area of 850 ha of palm oil plantations, the demand for organic fertilizer in 1 year reaches 1000 tons. Based on information from farmers and oil palm planters, the production of Fresh Fruit Bunches (FFB) after applying organic fertilizer, are increased by 6,121.54 tons / Ha / year or by 49.59%. [15] It was also reported that organic fertilization increased FFB productivity by up to 25%. [16] Even reported that with the use of liquid organic fertilizer, in the age of palm oil 2.5 years are capable to produce sand fruit. The data also

shows that palm oil plants fertilized with organic fertilizers show a tendency to increase productivity (Figure 2).

Meanwhile, in the raising of laying hens, the egg production produced is still unable to meet consumer demand, thus making promising agribusiness opportunities, which means that from an economic point of view it allows this activity to be sustainable.

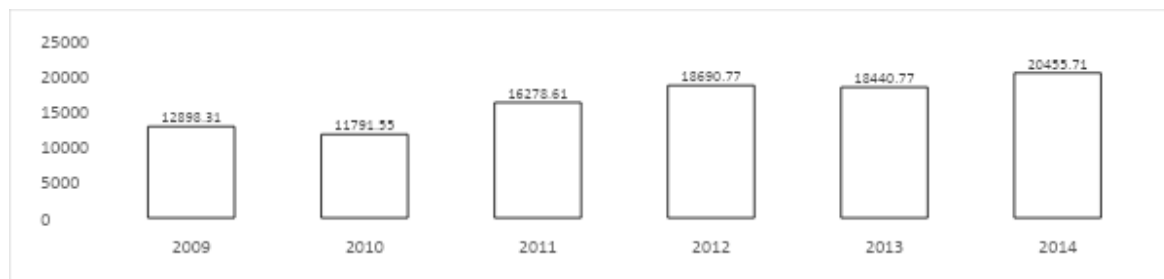


Fig. 2. The Development of palm oil production before organic fertilizer (2009-2010) and after organic fertilizer (2011-2014) [17]

Currently, one respondent has collaborated with palm oil private to buy 25 tons of solid organic fertilizer and 300 liters of liquid fertilizer to fertilize their palm oil plantation. To increase fertilizer production, it collaborates with farmwe groups in Kumai sub-district consisting of 18 villages and each village has 4-5 farmer groups. Respondents nurture and train these farmer groups to make fertilizer as it is produced, then all members of the farmer group deposit the fertilizer that has been produced to the respondents. Thus, respondents in addition to producing their own fertilizers as well as reservoirs and suppliers of organic fertilizer products to consumers.

Another advantage of using organic fertilizer is that the soil becomes fertile which is indicated by the amount of worm feces that appear on the soil surface. In addition, the grass under the stands of palm trees also grows with great potential for cattle grazing areas, thus environmental aspects will be better maintained.

3.2.2 Semi-integrated farming approach of livestock and palm oil industry

Farmer groups that apply this pattern only use one of the by-products of the palm oil mill (PKS) in the form of solid palm oil for additional feed for cattle, for a mixture of fertilizer with cattle dung and as a growing medium for maggot and horticultural crop development (Figure 3). In this groups are only have agricultural tools and machines to process organic fertilizers, but do not have to process complete feed. The use of solid palm oil as additional feed for cattle can reduce the amount of grazing and a single feeding to cattle is provides ADG 0.7 kg/head/day [18]. Solid palm oil as a single feed for additional cattle is still applied in Pangkalan Lada District, West Kotawaringin District. Every week 7 dump truck of solid palm oil (8 tons capacity every dumb truck) is distributed to 7 farmer group [19].

The use of fertilizer is only for themselves, mainly for grass fertilizer and horticultural crops. The application of organic fertilizer and cattle urine that has been processed first on horticulture crops shows that chili farming provides higher profits with a production of 10.5 kg / m² compared to without organic fertilizer only 2.6 kg / m². Relatively similar conditions were also reported in eggplant farming where those given organic fertilizers (solid and liquid) gave much higher profits of 128,030,000 compared to those without organic fertilizer of 4,507,500 per planting period. [20] reported that the use of organic fertilizer in hortikutura crops gave an R/C ratio of 4.0 compared to without the use of organic fertilizer R/C ratio of only 2.0.

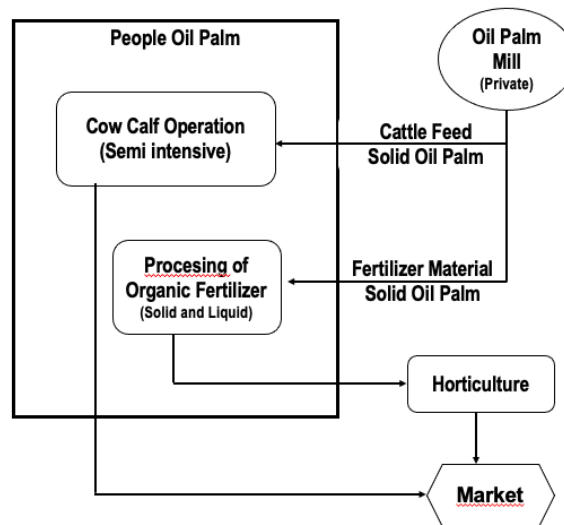


Fig. 3. Semi-integrated farming approach of livestock and palm oil industry

3.2.3 Semi-integrated farming approach with partnership pattern

The partnership pattern is carried out between palm oil private which also conducts cow calf operation activities with farmer groups. The partnership pattern built is that farmer groups (Poktan) get the 20 cows. The first born calf belongs to the Poktan and the second calf belongs to the partner, and so on for a certain period of time. In addition, Poktan receives complete feed assistance made by partners with the main ingredients of Palm Oil Mill by-products such as solid palm oil, Palm Kernel Meal (PKM), fronds, etc. This pattern benefits Poktan because it gets feed assistance. To support the need for more adequate feed, Poktan also produces its own feed made mainly from Palm Oil Mill by-products namely solid palm oil (Figure 4). This group does not produce complete feed, a source of fiber and a source of protein, but produces organic fertilizer with raw materials from the by-products of the palm oil industry and cattle manure.

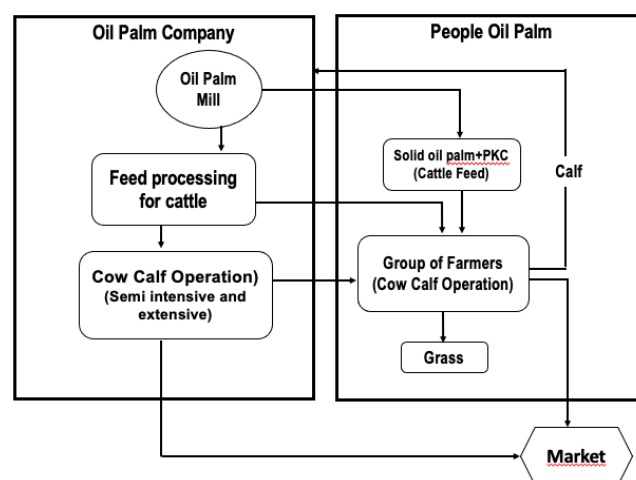


Fig. 4. Semi-integrated farming approach of livestock and palm oil industry with partnership pattern

Feed is a major problem in cattle breeding activities because it reaches 60-70% of production costs [21]. The pattern of cattle breeding partnerships according to [22] provides

negative benefits if there is no feed assistance from Partners. Similarly stated by [23] assuming the average calving interval is around 500 days and the feed cost of a cow is around Rp 4,000,-/day, then the cost of feed to produce calves is at least Rp 2,000,000,-. This is what causes investors to be reluctant to invest in cow-calf operations because the cost of producing a calf is greater than the price of the calf itself. With the innovation of feed technology and organic fertilizer processing using materials derived from by-products (waste), the cattle business performance can be further improved, namely through an integrated cattle approach with the palm oil plantation industry as has been done by respondents in Kotawaringin Barat and Lamandau Districts, Central Kalimantan.

3.2.4 Farm sustainability and problems

Based on field observations and discussion results, the sustainability of agricultural activities is reduced of cost of input production and the existence of commercial units that having markets. For example, organic fertilizer production besides being useful for farming itself is also absorbed by the market, corn production is always exhausted by market demand, egg production as well. The productivity of palm oil and horticultural crops increased. and income also increases.

Organic farming has been applied by all respondents to date with different cultivation management approaches according to their economic capabilities from each farmer group, especially in terms of the availability of agricultural tools and machines to process complete feed and organic fertilizers as well as networks in obtaining feed ingredients and marketing. This is shows that socially the application of the agricultural model is accepted by farmers, economically profitable as previously reported [13, 15] and an environmental aspect, the land is maintained fertility with the indiation of the emergence of worm houses around oil palm plants.

However, there are still some problems faced, namely feed ingredients and fertilizer ingredients are not easy to obtain even though their availability is very abundant in palm oil companies, due to certain policies from each company. Although there are also companies that make it easier for farmer groups to utilize the by products of their palm oil mills. There has not been full support from the government in the form of regulations, mainly to support oil palm-cattle integration activities and encouragement to palm oil private to participate in empowering farmer groups in the form of partnerships. Not all farmer groups can partner with palm oil private which conducting cow calf operation. This is needs its own approach with palm oil private. The support is expected to help facilitate the obtaining of feed ingredients, fertilizer materials, livestock and product marketing. Commercial units such as processing organic fertilizers, complete feed, etc. that are commercially oriented can only be carried out by farmer groups that are financially capable. Therefore, the government's support in financial in the form of low-interest credit schemes is highly expected.

Conclusion

The sustainable farming system that runs in the farmer groups are the integration of cattle with the oil palm plantation industry with a closed cycle model (33.33%), where there are commercial units that support their activities The integration of cattle with the oil palm industry, accepted by the farming community because it is economically profitable and environmentally oriented makes integration activities between livestock (cattle) and the oil palm plantation industry possible to be sustainable. Formal legal support from local government policies is needed so that oil palm-cattle integration activities can run smoothly

and sustainably, especially in terms of easier to take raw materials for making feed, fertilizer raw materials from the palm oil industry and marketing products from farmer groups. The local government should encourage palm oil private, which also conducts cow calf operation, to partner with farmer groups.

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