The activities of the integration of oil palm and cattle (ISAPI) by group of farmer and its development strategy in Lamandau district, Central Kalimantan Province

B N Utomo¹ and E Widjaja²

¹Indonesian Research Center for Veterinary Science, Jalan RE. Martadinata 30 Bogor 16114,
²Indonesian Assessment and Development Institute for Agricultural Technology, Jalan. Tentara Pelajar No.10, Bogor 16114,

E-mail: bng.utomo2004@gmail.com

Abstract. The sustainable cattle farming approach is integrated with plants and the most potential is the oil palm plantation industry, because the potential of feed resources is cheap and abundant available. The research activities carried out in the Farmer Group in Lamandau district after 3 years of introduction of oil palm-cattle integration (ISaPi) through the introduction of technology for making organic fertilizer and complete feed based on the oil palm plantation industry. The information was obtained from primary data through interviews with farmer groups and key informants from the Agriculture Service and PBS of Oil palm during the Focus Group Discussion (FGD) and secondary data was obtained from study desks. Field survey was also conducted. Data were analyzed descriptively and SWOT. Lamandau Regency is ideal for developing ISaPi activities, because of the potential feed resources from the oil palm plantation industry, in the form of oil palm fronds, solid palm oil and palm kernel meal (BIS). Oil palm plantations in Lamandau District with an area of 175,480.46 ha if only 25% of ISaPi activities have the potential to develop livestock around 73,977 animals throughout the year, due to the supply of solid palm oil from 1 PKS, forage in the oil palm area and oil palm fronds. There are 10 farmer of groups and One individual that consistently applies ISaPi activities with various models of application adjusted to the availability of human resources, access to palm oil mills (PKS) and capital from each farmer group. The difference in the application of ISaPi is in the formulation of animal feed (solid palm only or complete feed) and the allotment of organic fertilizer that was produces. Increased productivity and income from the farming is a major factor in ISaPi's activities keep it running. The strategy for developing of ISaPi activities in Lamandau District by taking into account existing of internal and external factors is to maximize the utilization of the potential of existing resources to increase farm productivity (palm, livestock and horticulture) and diversify farm income by applying technology that is already available and controlled by groups of farmer. With the application of technology, it will be able to increase the added value of products which it was produced. The limiting factors such as access to PKS, product marketing and capital were need support and commitment from related parties, especially the local government and this has been initiated by the local government.
1. Introduction
The efforts to develop ruminant livestock production require the availability of stable and quality feed, because feed is a determining factor for the success and continuity of production businesses. Feed costs are the highest component (60–75%) of all livestock production costs [1,2], so that the development of production technology is mostly directed at increasing feed efficiency. The importance of feed resources in increasing livestock productivity can be seen in the PSDK sensitivity analysis reported by [3,4]. The availability of feed plays an important role and is one of the factors that influence the rate of growth of livestock after weaning [4]. Thus animal husbandry must be brought close to animal feed sources whose availability is sufficient, continuous and does not compete with human needs.

Based on the results of research was conducted by Indonesian Agency for Agricultural Research and Development that the criteria for feed resources can be fulfilled from the oil palm plantation industry. Considering oil palm plantations are growing rapidly in most provinces in Indonesia with an area of ± 11 million Ha [5]. Some types of waste that have potential as animal feed are solid palm oil and palm kernel cake (BIS) [6,7]. The potential of such a large oil palm plantation opens opportunities for the development of livestock, especially beef cattle. To increase livestock productivity needs to be supported by technological innovations that are ready to be applied.

The integrated cattle farming with the palm oil plantation industry has led to four integrated activities at once, namely: (1) the by-product feed industry based on the oil palm plantation industry, 2) the cow calf operation industry, (3) the beef cattle fattening industry, and (4) organic fertilizer industry. The philosophy of integration applied is the utilization of by-products of the oil palm plantation industry as animal feed and the use of livestock manure for fertilizer. The oil palm-cattle integration the farmers' profits were 10.56% -16.49% higher compared to without the oil palm-cattle integration farming [8]. Profit indications were also reported by [9] with a reduction in fertilizer costs of around 30-50%.

The objective of this paper was to provide information on the implementation of oil palm-cattle integration activities at the farmer group level, the problems encountered and their development strategies in Lamandau District, Central Kalimantan.

2. Materials and methods

2.1. Materials
The research activities carried out in farmer groups in Lamandau District after 3 years of introduction of oil palm-cattle integration (ISaPi) through the introduction of technology for making organic fertilizer and complete feed based on the oil palm plantation industry. The object of observation was 11 farmer groups that have implemented ISaPi activities.

The main materials during the introduction of the ISaPi activity primarily for the production of complete feed were solid oil palm, palm kernel cake (BIS), palm fronds and a few other additives in small portions such as molasses and minerals. Feed materials, fertilizer materials, cattle, cages, fertilizer processing facilities, feed and organic fertilizer equipment were provided by the Pande Makmur Farmers Group. The location of the Pande Makmur Farmers Group was used as a place for participants' practice and at the same time as a center of excellent of ISaPi activities where other farmer groups can learn and practice in that location.

2.2. Methods
Activities were carried out through primary and secondary data collection. Primary data were obtained through direct interviews with farmer groups and information gathering during the process of implementing Focus Group Discussion (FGD). FGDs were held 3 times. Besides the group of farmer,
representatives of the Oil Palm Mill (PKS), related agencies in term of Agricultural Services and representatives of Bank were invited. Information during the FGD was one of the sources for formulating external and internal factors in the SWOT analysis. Secondary data were obtained through desk study and from the relevant Government Services in Lamandau District.

The introduction of complete feed technology was done through technical guidance (Bimtek) starting from the preparation of a complete feed formulation and its application directly to cattle until observing weight gain. This was to provide evidence to farmer groups as a result of the application of technology. Also given the practice of making solid organic fertilizer and liquid organic fertilizer (biourin). Monitoring and assistance were conducted every year for 3 years.

The data obtained were analyzed descriptively and in tabular form to facilitate evaluation. The strategy for developing ISaPi activities in Lamandau District was carried out using SWOT analysis (Strengths, Opportunities, Weakness, Threats). The SWOT assessment system is often considered to have a degree of subjectivity, but by using information in the field and the justification of related informants who understand the problems in the field, according to [10] the nature of the subjectivity can be reduced or in other words the results of the analysis can be scientifically justified. The SWOT analysis was carried out to formulate a strategy for developing ISaPi activities in Lamandau District. Analysis is based on logic that can maximize strengths and opportunities, but simultaneously minimize weaknesses (Weaknesses) and threats (Threats).

3. Results and discussion

3.1. Potential of oil palm plantations for the development of cattle in Lamandau District

Farm areas in Lamandau District are found in all subdistricts with an area of approximately 4,033 hectares spread over Bulik sub-district with an area of approximately 703.82 hectares, East Bulik sub-district with an area of approximately 555 hectares, Menthobi Raya sub-district with an area of approximately 466 hectares, sub-district Sematu Jaya with an area of approximately 386.14 hectares, Lamandau sub-district with an area of approximately 455 hectares, Belunggu Raya sub-district with an area of approximately 529 hectares, Delang sub-district with an area of approximately 516 hectares, Batang Kawa sub-district with an area of approximately 422 hectares [11]. Beef cattle population in Lamandau District was reported 3,956 with the most population in Bulik District 1,172 heads (29.63%), second in Sematu Jaya District 915 heads (23.13%) and the smallest population in Batangkawa District 155 heads (3.92%) [12].

At present the oil palm and rubber commodities are still the leading commodities in Lamandau District. Both of these commodities have the highest production value and the largest area compared to other plantation commodities. The oil palm plantation sector is excellent because the type of land in Lamandau District is very good for oil palm plantations [13]. Oil palm plantations in Lamandau District are spread across in 7 sub-districts with a total area of plantations (smallholders + PBS of Oil Palm) of 175,480.46 Ha and with a production of 288,856.76 tons (table 1).

Based on information from various sources and BPS reports (2017) there are 16 oil palm plantation companies operating in Lamandau District and the results of field monitoring at least 3 Palm Oil Mill (PKS) that produce solid of oil palm that have been utilized by farmer groups, namely PT. Gemaraksa Mekarsari (GM), PT. First Lamandau Timber International (FLTI) and PT. Sawit Mahardika Graha (SMG). Especially for PT. Gemaraksa Mekarsari produces 80-100 tons of solid of oil palm per day [14].
Table 1. The area distribution of oil palm plantations, fresh fruit bunches (TBS) production and estimated solid oil palm products in Lamandau District in 2018.

| Sub district         | Oil palm plantation (Ha) | TBS production (ton) | Estimated solid oil palm production (3%) (ton/day) |
|----------------------|--------------------------|----------------------|-----------------------------------------------|
| Bulik                | 12,560                   | 34,540.55            | 1,036,217                                     |
| Sematu Jaya          | 6,981                    | 18,400               | 552                                           |
| Mentobi Raya         | 1,863                    | 515                  | 15.45                                         |
| Bulik Timur          | 1,350                    | 2,391                | 71.73                                         |
| Lamandau             | 1,129                    | 443                  | 13.29                                         |
| Belantikan Raya      | 1,083                    | 545                  | 16.35                                         |
| Delang               | 28                       | 12.3                 | 0.369                                         |
| Batangkawa           | 30                       | 18                   | 0.54                                          |
| The total smallholder’s oil palm | 25,024                   | 56,864.85            | 1,705,946                                     |
| The total PBS’s oil palm | 150,456.46              | 175,127.06           | 5,253,812                                     |
| The total Lamandau District’s oil palm | 175,480.46              | 288,856.76           | 8,665,703                                     |

Source: [15,16]

If the average of PT. Gemaraksa Mekarsari produces 90 tons/day, can fulfill the needs of feed 21,333 cattles /day (If solid is given 1.5% of cattle body weight with an average body weight of 250 kg/head). Especially if added by the production of solid oil palm from the other of two factories, the number of cattle will be more. Animal feed forage in the per hectare of oil palm plantation area can hold 1 head of cattle [9]. If 25% of the total area of oil palm plantations in Lamandau District is integrated with cattle can accommodate around 43,870 head of cattle. The oil palm fronds which are currently used as a complete mixed feed ingredient for cattle, adding to the available feed resources from the oil palm plantations themselves. Available oil palm fronds are 7.2 kg/day/ha [17]. If the cattle needs 10% of body weight (assuming 250 kg), then the availability of the oil palm fronds can fulfill 0.2 heads/day/ha, so that the potential of oil palm plantations can fulfill 1.2 heads/ha. With an area of 175,480.46 oil palm plantations, if only 25% can be integrated with cattle, it can accommodate the needs of cattle feed as many as 52,644 heads. Thus by utilizing the byproducts of PKS (1 PKS) namely solid and the byproducts of oil palm plantations (forage between plants and palm fronds), Lamandau District has the potential to develop as many as 73,977 head of cattle throughout the year. This extraordinary potential has not yet been exploited due to the lack of information to the farmers community, and the difficulty in getting access to solid collection for certainly PKS.

Solid oil palm is currently the main source of cattle feed in Lamandau District because it is cheap and has good nutritional content for cattle development [17]. Solid oil palm can replace rice bran in concentrate feed and positively influence in ransom consumption, efficient in using of energy and protein [18]. Several companies in Central Kalimantan have used solid oil palm as additional feed for cattle, such as PT Korin III, PT Sulung Ranch, PT. Medco, and PT. Astra. Whereas the people's farms that have developed using these material feed among others are KUD Tani Subur and P4S Karya Baru Mandiri. All of which are in Kotawaringin Barat District [17].

Another potential feed resource is palm kernel cake (BIS). The Palm Oil Mill (PKS) which produces BIS in Lamandau District is PT. FITL. BIS potential as a livestock feed resources besides solid oil palm because it contains nutrients (PK: 14-17%) is better than solid oil palm [6]. This feed material is suitable as ruminant animal feed concentrate, but its use must be given together with other feed material [19].
The results of research and during monitoring in the farmer groups show that feed formulations consisting of solid oil palm, BIS, oil palm fronds that have been extracted, molasses, urea and minerals into the complete feed as a source of fiber and protein have a price of Rp.950,-/kg, - Rp.1,000,-/kg. The feed was good quality but inexpensive, and producing better of cattle development. As a complete feed, there is no need grass anymore because the fiber needs have been fulfilled [17].

3.2. The development model of oil palm-cattle integration in farmer groups

Technology dissemination in the form of a complete formulation of feed based on the byproduct of the oil palm plantation industry, processing of solid organic fertilizer and liquid fertilizer (biourin) at ISaPi activities was introduced to farmer groups in the form of direct practice. The introduction of this technology to farmer groups and not individuals because according to [20], it is more efficient to do with groups. A number of 10 farmer groups and one individual who adopted ISaPi activities, each of them differed in its application (Table 1) and it was very dependent on existing human resources, access to PKS and capital. Adoption works when the farmer groups get the benefit because there is an increase in productivity of their farming activities. This is in line with what was conveyed by [21] that technology introduced to farmer groups is a lever and use of technology according to [22] and [23] did influence in increasing agricultural productivity.

Reportedly at the training site, the productivity of oil palm plantations increased by about 20% [24], average daily gain of BX Cattle was 0.99 kg /head/day [17], income from horticulture which was given solid and liquid organic fertilizer was 600 rb / day [25]. Lower feed prices and the provision of organic fertilizer cause the cattle farming more efficient and profitable. These things that enable ISaPi activities with various models can run.

Related to other farmer groups that are still unable to implement due to limited human resources, access to PKS and Capital, the solution offered by the established farmer groups (Pande Makmur and Mitra Tani Sejahtera), is to help provide complete feed. The payment is according to the agreement that has been arranged before, it can even be bartered with cattle manure. In Pande Makmur of Farmer Group, fertilizer processing machines require large amounts of cattle manure and its ready to barter complete feed with its manure.

The problem that pay attention is the difficulty in getting feed materials from the by-products of oil palm mill (PKS). Because the demand for feed materials even though it is only in the form of waste (byproduct) must be done procedurally, namely through a written request. This is usually always avoided by farmers because it is troublesome and they are not accustomed to come the factory. For this reason, it is necessary supporting of the local government in this case it is the relevant agencies to be able to bridge between the farmers and the PBS of oil palm.

3.3. The strategy for developing of oil palm-cattle integration (ISaPi) in Lamandau District

The ISaPi activities in Lamandau District have great potential to advance agricultural development, especially cattle development, so that they also have the potential to drive the economy in the region. Some problems are still encountered, the indication is that not all farmer groups can carry out ISaPi activities. Based on internal factors consisting of strengths and weaknesses as well as external factors which include opportunities and threats, the formulation of strategies for developing ISaPi activities in Lamandau District is presented in table 3.
### Table 2. Farmer groups who adopt the integration of palm oil and cattle (ISaPi) in Lamandau District.

| The name of Farmers Group (Head of Group) | Number of Cattle (head) | Oil palm area (Ha) | Organic fertilizer production | Source of feed materials | The Application of ISaPi |
|------------------------------------------|-------------------------|-------------------|------------------------------|-------------------------|--------------------------|
| Pande Makmur (Marukan)                   | 150                     | 250               | Solid + Liquid -             | PT. GM FITL             | Complete feed for cattle, organic fertilizer was applied in oil palm and grass gardens |
| Mitra Tani Sejahtera (Sofyan Adriansyah) | 60                      | 25                | Solid + Liquid +            | PT. GM FITL             | Complete feed for cattle, organic fertilizer was applied in oil palm and grass gardens and it was sale |
| Agro Sejahtera (Sudamin)                 | 12                      | 30                | Solid + Liquid +            | -                       | Complete feed for cattle, organic fertilizer was applied in horticultural plants |
| Brahma Jaya (Suharto)                    | 67                      | 20                | Solid + Liquid -            | PT. GM FITL             | Complete feed for cattle from the partnership program with PT. CBI. |
| Maju Bersama (Gst. Budiansyah)           | 50                      | 25                | Solid + Liquid -            | PT. GM                  | Solid feed supplement for cattle belonging to farmers group |
| Maju Bersama (Sugito)                    | 10                      | 4                 | Solid + Liquid -            | PT. GM                  | Organic fertilizer was applied in grass gardens |
| Karya Bersama (Gst. Zulkifli Iskandar)   | 10                      | 4                 | Solid + Liquid -            | PT. GM                  | Solid feed supplement for cattle, organic fertilizer was applied in grass gardens |
| Pesta Karya (Rustamaji)                  | 10                      | 10                | Solid + Liquid -            | PT. GM                  | Solid feed supplement for cattle, organic fertilizer was applied in grass gardens |
| Lembu Jaya (Yayan)                       | 25                      | 30                | Solid + Liquid -            | PT. GM                  | Solid feed supplement for cattle, organic fertilizer was applied in grass gardens |
| Putra Mangkaba (Asmadi)                  | 8                       | 4                 | Solid + Liquid -            | PT. GM                  | Solid feed supplement for cattle, organic fertilizer was applied in grass gardens |
| Wajib (Individual)                       | 15                      | 10                | Solid + Liquid -            | PT. GM                  | Solid feed supplement for cattle, organic fertilizer was applied in grass gardens |

Note: Complete feed: Solid of oil palm+BIS+Mineral+Molase
Table 3. The formulation of strategy for development of oil palm-cattle integration (ISaPi) in Lamandau District.

| INTERNAL FACTORS | STRENGTHS (S) | WEAKNESSES (W) |
|------------------|---------------|----------------|
|                   | 1. Availability of own oil palm plantations | 1. Difficulties in getting cattle breeds |
|                   | 2. Evidence of the success of the ISaPi activities, especially at the farmer group level | 2. Limited capital and access to credit schemes |
|                   | 3. The availability of productive human resources and high interest | 3. There is no access or guarantee for marketing their products |
|                   | 4. Availability of technology and machinery | 4. Limited land for animal husbandry development due to the expansion of oil palm plantations |
|                   | 5. Main income of Farmer groups is farming activities | |

| EXTERNAL FACTORS |
|------------------|-------------------------------------------------|
| OPPORTUNITIES (O) | The strategy of SO (Strategy to use power to take advantage of opportunities): |
|                   | 1. Optimizing the use of available resources (livestock, land, byproducts of oil palm industry, human resources) to increase productivity (cattle and oil palm) and income diversification |
|                   | 2. Increasing economic added value of oil palm by product and cattle through technological and institutional innovations |
|                   | 3. Accelerating ISaPi replication to other farmer groups by providing easier access or partnership patterns |

| THREATS (T) | The strategy of ST (Strategy to use power to overcome threats): |
|-------------|-------------------------------------------------|
| 1. The company policy makes it difficult for farmer groups to have access to feed (solid oil palm and BIS) | 1. Government policies / regulations that support ISaPi activities |
| 2. Not all related parties have committed | 2. Instructed by the Regional Government (Bupati) so that PKS makes it easy for farmer groups to obtain by-products of palm oil mills (PKS), mainly BIS and solid |
| 3. Ganoderma can be transmitted by cattle when kept in an infected area | 3. Management of livestock farming is not carried out in areas suspected of endemic Ganoderma |

| The strategy of WO (Strategy to overcome weaknesses by taking advantage of opportunities): |
|-------------------------------------------------|
| 1. Establish a partnership with PBS of oil palm which was raised of cattle |
| 2. Increasing the access of ISaPi players to capital (credit schemes) |
| 3. ISaPi products (mainly fertilizers) are utilized through the regional government of agricultural program |
| 4. Application of ISaPi in beef cattle development programs |

| The strategy of WT (Strategies to minimize weaknesses and overcome threats): |
|-------------------------------------------------|
| 1. Coaching of existing ISaPi and socialization to stimulate the emergence of new ISaPi |
| 2. Increasing the partnership program with PBS of oil palm which was raised of cattle |
| 3. Institutional strengthening of farmer groups |
The strategy of developing ISaPi activities in Lamandau District by taking into account internal and external factors and the strategy entering into an aggressive quadrant, is to maximize the utilization of the potential of existing resources to increase farm productivity (oil palm and cattle) and diversify farm income by applying technology already available and controlled by farmer groups. With the application of the technology, it will be able to increase the added value of the products. The limiting factors such as access to PKS, marketing of products and capital needed supported and commitment from related parties, especially the local government. This has actually been tried to overcome in Lamandau District where the Agriculture Services and even the Head of Lamandau District at that time gave access to get solid oil palm and palm kernel cake (BIS), so that the ISaPi activities could run. Even he was issued regulations to purchase of organic fertilizer from farmer groups to support agricultural development program including horticulture in Lamandau District. The local government's policy to utilize fertilizer products from farmer groups stimulates the organic fertilizer industry in farmer groups, but this policy does not persist. The ISaPi activities will run continuously if there is commitment from various related parties.

4. Conclusions and suggestions

4.1. Conclusions
1. Lamandau District is ideal for the development of the activities of oil palm-cattle integration (ISaPi), due to the availability of potential feed resources completely based on oil palm plantation industry, in the form of oil palm fronds, solid oil palm and palm kernel meal. The Potential for livestock development is around 73,977 heads throughout the year if 25% of the area of oil palm plantations are used for livestock plus potential feed support in the form of solid oil palm meal (calculation of 1 PKS) and forage in the area of oil palm plantations.
2. The sustainability of the ISaPi activities in the Farmers Group is due to the benefits in terms of increased income and business diversification.
3. The Implementation model of ISaPi is different in some farmer groups because of human resources (quality and quantity), access to PKS and capital owned.
4. The strategy of the ISaPi development in Lamandau District by considering internal and external factors has good prospects and their application needs to be maximized. Supporting policies or regulations that enable all actors in the activities of oil palm-cattle integration to run well is urgently needed.

4.2. Suggestions
1. For the smooth implementation of the oil palm-cattle integration, it is necessary to establish a partnership between farmer groups and PBS of oil palm, this is related to the easier in obtaining animal feed materials and the possibility in supply of cattle and product marketing, especially fertilizer.
2. The product of organic fertilizer was produced by farmer groups should be utilized by the local government related to food crop or horticultural development programs which in their implementation require organic fertilizer, so that this will be increase the enthusiasm of the organic fertilizer business in farmer groups.

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