

# THE ADAPTABILITY OF SMALLHOLDERS TOWARD LIVESTOCK INTEGRATION WITH OIL PALM AND INCOME GENERATED

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**Abstract:** *The purpose of this study was to evaluate the level of adoption of oil palm independent smallholders toward livestock integration technology. One hundred nine participants were interviewed using a structured questionnaire as the main research instrument. The assessment showed that 52% of the respondents owned and maintained the breeder buck given to them but 48% of these participants changed the breeds. Most of them (95%) constructed a goat shed for their animals but approximately only 5% tethered their goats under the pen. The benefits of the smallholders engaging in goat production are to make it a source of food and an additional income for the family. By practising livestock integration, the respondents are able to improve their quality of life because of the additional income they derived from the operation and the maximum utilization of resources it has done to their farms. The result shows that the smallholders can get either positive or negative additional income depending on their livestock management). Under good management, they can get positive returns in the long term or vice versa. In general, the livestock integration program indirectly helps to reduce the cost of fresh fruit bunch (FFB) production due to the reduced application of weedicide and diversity their income.*

**Keywords:** *Oil Palm, Smallholder, Livestock Integration*

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## Introduction

The National Agro-Food Policy (2011- 2020) was an initiative specifically for the agro-food industry as an effort of the government to ensure adequate food supply and safety of the people as well as increase contributions to national income and agro-preneurs. In developing countries, population growth, urbanisation and income growth stimulate considerable global increases in animal food demand, and exacerbate competition between crops and livestock through growing crop areas and reducing. Omolehin (2007) stated that parameters like the size of the farmers household, traditional way of production, availability of more food from the crop-livestock

combination for the farm household, and availability of traction power from the animal component are factors that facilitate the adoption of the farming practice with livestock.

Malaysia's rapid economic and human population growth has increased the consumption of livestock products (Kaur, 2010). The livestock industry has the potential to grow in order to secure food supply in the country and reduce imported meat. The advancement of technology and the implementation of policies are inextricably linked to the development of the livestock industry (Gabdo and Ismail, 2013). Livestock production will become more reliant on agricultural systems because there is a great demand for agricultural land to produce food as the human population is rising. Due to its strategic nature, livestock becomes an important sector for ensuring domestic food safety. Malaysia's livestock industry contributes earnings to households through the sale of livestock and livestock products; and also provides raw materials for agro-industries. Meanwhile, demand for meat is expected to increase from 1.4 million metric tons in 2010 to 1.8 million metric tons in 2020 with a growth of 2.4% per annum (Zainalabidin et al., 2019).

### Literature Review

In order to sustain its competitiveness as well as facing the challenges of the global oils and fats market, the Malaysian palm oil industry must increase the productivity and the usage of land resources. The best way to maximize land use is to integrate cattle with palm oil (Zamri and Azhar, 2015). Livestock includes cattle, buffaloes, and goats are already common to be integrated with mature oil palm age more than 5 years (Md. Said and Man, 2014). Edwina et al. (2019) state that, in Indonesia, the concept of integration of livestock with palm oil began to be adopted in 2007 and some local governments make it as a flagship program. The overall trend is to increase the net income of farmers who have adopted the livestock integration approach (Devendra, 2011). Implementation of integrated systems can address the problem of limited conventional feed resources by utilising agriculturally based feed materials (Zainalabidin et al., 2019). Thus, livestock integration with oil palm is apparently eminent to cater for the rising demand for meat consumption in Malaysia (Gabdo and Ismail, 2013).

Crops and livestock integration is one of the recommended activities to stabilize and diversify sources of income especially among oil palm independent smallholders (Slingerland et al. 2019). Although oil palm is a crop that fits well with smallholders due to its ability to provide consistent income throughout the year, the commodity price of fresh fruit bunch (FFB) in the market is very volatile (Zakaria et al., 2020). In order to be relevant and profitable, oil palm independent smallholders need a strategy to maximize their income and this could be achieved through sustaining the high productivity of fresh fruit bunch (FFB) and maximizing utilization of land area through crop integration in immature oil palm areas as well as livestock integration in mature oil palm areas (Asai et al., 2020). Smallholders will increasingly look for options to improve their farm productivity and efficiency of external input use through resource transfer between crop and livestock integration as the farm size expansion begin to decline and land availability is reduced (Bell et al., 2014). Bell et al. (2014) also revealed that this situation also faced by farmers in Australia who were exposed to the volatile commodity price due to the low government subsidy support of agriculture, thus, most of them opt to practice mixed farming.

The goal of integration, whether crop or livestock integration, is to recycle resources as efficiently as possible. Integration of crop and livestock involves more than both crop and livestock production on the same farm. The integration of animals with permanent crops is not a simple system (Gabdo and Ismail, 2013). Nur, Satriawan and Fadli (2020) found that an oil palm-cattle integration can improve the efficiency of oil palm plantation management while

also hastening population growth and livestock production. In Australia, farmers are highly motivated to practise mixed farming because of the variability in climate and price favours of diversified businesses (Bell et al., 2014). Through crop and livestock integration, smallholders can increase their income and ensure their income stability (Iyiola-Tunji et al., 2015). Integration of various system parts minimises agrochemicals use (Purwantari et al., 2015), reduces the opening up of new areas to crops and prevents environmental liabilities (Amejo et al., 2018). An empirical study on the comparative cost and benefit analysis revealed that the integrated livestock system is more profitable as compared to the sole livestock system on account of lower input costs (Khan and Iqbal, 2010). Apart from that, by practising the integration technology, it will improve the workforce, the stability of production, and increase food security to meet consumers' needs in terms of diversity and quality of products available at any given time (Nijbroek and Andelman, 2016).

A previous study by Tohiran et al. (2017) stated that most oil palm plantation companies refuse to practice livestock integration because lack of relevant technical expertise in the field and other issues such as theft and property intrusion by livestock. The problem is that livestock integration remains limited to small-scale farming among smallholders (Nur, Satriawan & Fadli, 2020). Ismail and Wahab (2013) found that integrating livestock with perennial crops can damage the young trees or the bark of adult trees. However, a study by Latif and Mamat (2002) found that livestock integration did not affect the palm oil yield.

An empirical study by Gabdo et al. (2014) found that the Malaysian beef industry was inefficient and lack comparative advantage. This is due to the high cost of animal production which involved animals' feeds, land scarcity and capital constraints. The involvement of experts in livestock integration is urgently needed in order to overcome the issues of lacking technical expertise in animal husbandry (Koura et al., 2015). To date, there is even less scientific research that gives emphasis to the impact and effectiveness of practising livestock integration with oil palm especially on a large scale (Tohiran et al., 2019; Khan and Iqbal, 2010). As a result, this study was conducted to determine the extent to which oil palm independent smallholders have successfully applied livestock integration technology and whether the programme has aided in increasing the economic aspect of smallholders. The scope of this study is going to cover the characteristic of independent smallholders, the outcome from the livestock integration technology programme and income generated by the smallholders.

### **Methodology**

This research is a quantitative study using a questionnaire as the research instrument. The survey was conducted by enumerators who are proficient in local dialect assisted by the researcher. The population of this study was determined by the selected sample through purposive sampling. Total number of all goat integration projects is 647 (3,429.19ha) that have received the assistance scheme where the total goats delivered is 4,460 head. The number of samples was 200 respondents. The sampling criteria were oil palm independent smallholders who participated in the livestock integration with the oil palm scheme. The scheme was implemented by the Malaysian Palm Oil Board (MPOB) and all the respondents' rear goats integrated with oil palm. 159 respondents completed the questionnaire which indicates a response rate of 79%. This response rate is acceptable and consistent with other studies (Zahariah et al., 2010).

## Result and Discussion

### Demographic Profile of the Respondents

The demographic profile of the respondents is shown in Table 1. From the valid total number of this study, the majority of the farmers were male (95%) as compared to females which are only 5%. The average age of the respondents is within the age range of 41 to 60 years old (43%). This observation could be attributed to the rural-urban migration of young men for white-collar jobs (Koura et al., 2015). The majority of the respondents were Malay (82%). Most of the respondents (94%) were married which indicates that they opt to practice livestock integration in the oil palm to acquire additional income for the family (Gabdo et al., 2014). In terms of educational status, the majority of the respondents (53%) had formal education in secondary school, 21% had undergone primary school only and 18% had higher education level which is from university/college. Meanwhile, there were 6% of the respondents had no proper education. The majority of the respondents were full-time farmers (78%), 18% of them work as government servants and only 4% of the respondents work in the private sector.

**Table 1: Demographic Profile of the Respondents**

Characteristics	Frequency	%
<i>Age</i>		
20-40	36	23
41-60	69	43
60 and above	54	34
<i>Sex</i>		
Male	152	95
Female	7	5
<i>Marital Status</i>		
Married	151	94
Single	8	6
<i>Educational Status</i>		
University/ College	28	18
Primary School	33	21
Secondary School	84	53
No formal Education	14	8
<i>Occupation</i>		
Full time farmers	124	78
Govt. Servant	28	18
Private sector	7	4
<i>Ethnicity</i>		
Malay	131	82
Chinese	11	8
Indian	9	5
Others	8	5

### Goat inventory

Of the total farm area, 67% of the respondents had a pasture area of only less than 1 hectare. The most abundant grasses grown on the farm were *Napier* and *Guinea* grasses. Inventory of the animals shown in Table 2 indicated that 78% of the goat raisers used bucks as breeders which is 1 to 2 heads per participant, 37% have 1 to 2 pregnant bucks in the herd, 30% had neither lactating does, and the majority 100% of the respondents had produced kids. Some of the farmers (48%) had changed to other breeds, while others (52%) maintained the breeds given to them. 92% of the participants had pen-shed type goat houses with elevated floorings.

The respondents also were asked to list all the strengths that inspired them to practice livestock integration. The strengths were listed according to rank and the highest rank is goats are the source of food, able provide additional income for the family, waste from the animals can substitute fertilizer, high demand for goats especially on special occasions (festive season), and they have the passion as well as interest in goat raising.

**Table 2: Goat Inventory Goat Category/No. of Heads**

Item	Number of respondents	%
<i>Buck</i>		
1-2 heads	124	78
3-4 heads	35	22
<i>Pregnant Does</i>		
1-2 heads	59	37
3-4 heads	49	31
9-10 heads	51	32
<i>Lactating Does</i>		
1-2 heads	46	29
3-4 heads	66	41
5-6 heads	47	30
<i>Kids</i>		
1-2 heads	32	20
3-4 heads	54	34
5-6 heads	25	16
more than 10 heads	48	30
<i>Breed of goats</i>		
Maintained	83	52
Changed	76	48
<i>Housing facilities</i>		
Pen with elevated floor	146	92
Housing with partition	13	8

### Performance of Goat Integration by Participants

The respondents also were interviewed on the performance of the goat as shown in Table 3. Standard practices of livestock for goat are kidding rate at 145% and mortality rate for an adult is 2% meanwhile mortality rate for a kid is at 5% (Khan and Iqbal, 2010).

Based on the record, the kidding rate among the respondents is quite low compared to the mortality rate. Only 43% of the respondents acquire a kidding rate of more than 100% and the majority of the respondents (56%) had a high mortality rate for adults which is more than 10%. Meanwhile, 56% of the respondents had more than 10% of the kid's mortality. Only very few

farmers (19%) do not practice animal culling. The majority of the respondents (81%) had to cull their animals and instead continue to raise them on the farm. Culling refers to the process of converting the unproductive animals from the group to sustain farm production efficiency (Sempore et al., 2015). The purpose of culling as stated by the respondents are sick animals, defective or abnormal animals, and animals showing low performance.

**Table 3. Average Performance of Goat Integration by Participants**

Item	Number of Respondents	Percentage (%)
Kidding rate		
>100%	68	43
50-99%	51	32
0-49%	40	25
Mortality rate - adult		
0-5%	17	11
6-10%	53	33
>10%	89	56
Mortality rate – kid		
0-5%	7	4
6-10%	62	40
>10%	90	56
Practice culling of goats		
Yes	128	81
No	31	19

(Standard Practices: Kidding rate 145%, Mortality rate – adult 2%, Mortality rate – kid 5%)

### Farm Management

The survey showed that 82% of the respondents kept a proper record of their farm activities while 18% did not keep any records at all as shown in Table 4. For those who had kept records, only a few had some recordings on the different farm activities. Out of the many different records to keep on the farm, only 130 out of 159 farmers (82%) recorded the animal inventory, feeding activities and income of the farm. There were few also who kept records on mortality, health and production.

As to the primary feed expenses, 78% of the participants indicated that they spent some amount on buying concentrate feeds (pellet etc.), molasses and minerals (salt). When further asked how could they reduce their feed expenses, the following were suggested: by using alternative feeds like farm by-products (23%), by planting more diverse grasses species (61%), and by following better grazing management for the animals. Based on the survey, the respondents practiced continuous grazing in which the animals were allowed to graze on the oil palm area for more than 6 hours (95%). As for storage facilities, 62% of respondents had separate storage for chemicals; meanwhile about 54% of the respondents had a storage area for their feeds. Pests and diseases treatment activities in goat farming should be included in the program and 77% of them practiced this every month while 23% did not.

The livestock integration program indirectly helps to increase the respondents FFB yield which is 56 out of 159 respondents (35%) acquire 26-30/t/ha/y of FFB yield after carrying out the project. Meanwhile, the majority of the respondents (73%) agreed that the application of weedicide was reduced after practicing livestock integration because the goats are grazing freely in the oil palm area.

**Table 4: Farm Management Practices**

Activities	Number of Respondents	Percentage (%)
Records keeping		
Have records	130	82
No Records	29	18
Money expenses		
Feeds, molasses, minerals	124	78
Alternative feeds		
Farm by-products	36	23
Planting grasses	96	61
Grazing in oil palm area	151	95
Storage facilities		
Chemical's storage	98	62
Feeds storage	89	54
Treatment- goat pest and disease		
Practice	122	77
Not practice	37	23
Average FFB yield before goat project		
15-20 t/ha/ha	72	45
21-25 t/ha/ha	65	41
26-30 t/ha/ha	22	14
Average FFB yield after goat project		
15-20 t/ha/ha	28	18
21-25 t/ha/ha	75	47
26-30 t/ha/ha	56	35
Weedicide before goat project		
1 round /month	127	80
1 round /2 month	32	20
Weedicide after goat project		
1 round / month	43	27
1 round /2 month	116	73

### Marketing

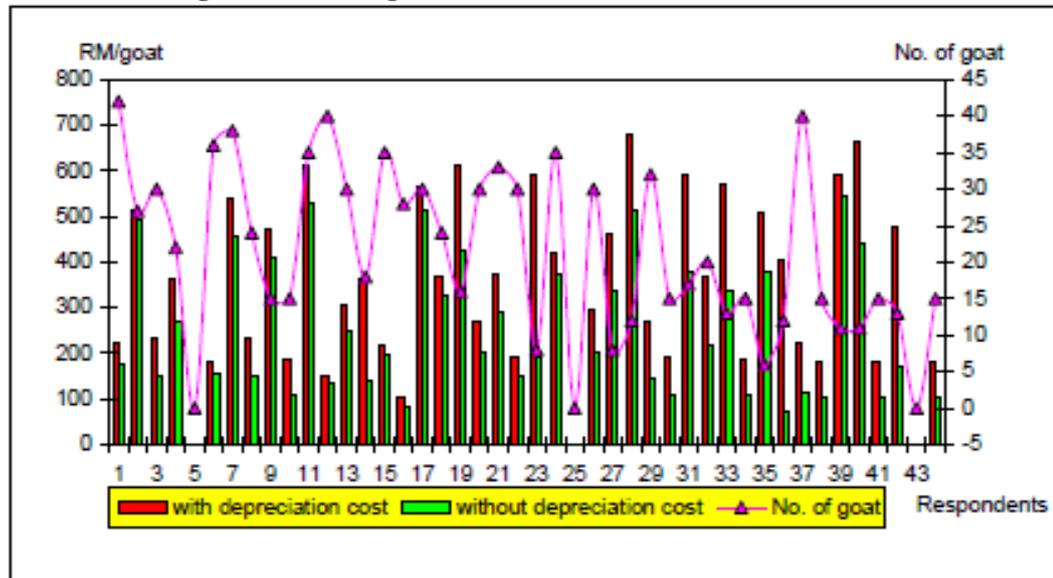
For the marketing aspects, 47% of the respondents encounter major problems in marketing their goats. These problems were ranked in the order of most to the least problematic: 1) cannot meet the standard of the buyer, 2) low price, 3) far from the market, 4) no buyers, 5) road accessibility and 6) no demand.

To improve goat production, the respondents suggested enhancement training in production and management, pasture improvement by planting grasses and legumes, exposure to good goat growers or cross visits to successful goat farms, availability of financing institutions or credit facilities, provision of proper goat housing facilities and use of improved breeds of goats.

### Additional Income Generated Through the Goat Integration Program

Figure 1 shows various costs of goats at 2 years old from the 43 out of 159 respondents of the study with depreciation cost. It shows that the average cost of a goat at 2 years old with depreciation cost ranged from RM 105.60 to RM 678.70 per goat and the costs without depreciation cost ranged from RM 70.80 to RM 545.50 per goat. The mean and median for the cost of a goat at 2 years old with depreciation cost are RM 369.60 and RM 362.20 respectively.

Figure 1: Average Cost of Goats at 2 Years Old



Based on the survey, the majority of the respondents manage to sell their doe (female goat) and buck (male goat). The average selling price of doe by the 10 respondents out of 159 ranged from RM 280 to RM 550 per goat as shown in Table 5 below. The mean and median for the price of the doe are RM357 and RM300 respectively. Based on the average price of the goat and the cost of the goat integration program, additional income received by each respondent can be estimated. However, the average selling price of doe goat from the 10 respondents was RM357 per doe. Therefore, in general, the average additional incomes received by the respondents with and without depreciation cost are RM12.30 and RM85.20 per doe respectively.

Table 5: Additional Income Received by 10 Respondents Sold Their Doe

Respondents	Price (RM/doe)	Cost of goat (RM/doe)		Net profit (RM/doe)	
		With depreciation cost	Without depreciation cost	With depreciation cost	Without depreciation cost
1	350	223.8	176.2	126.2	173.8
2	350	235.3	148.7	114.7	201.3
3	280	361.1	270.2	-81.1	9.8
4	300	541.5	457.3	-241.5	-157.3
5	300	474.7	408.0	-174.7	-108.0
6	300	217.5	197.5	82.5	102.5
7	550	105.6	80.6	444.4	469.4
8	300	567.5	514.1	-267.5	-214.1
9	500	422.3	370.9	77.7	129.1
10	300	272.0	147.0	28.0	153.0
<b>Average</b>	<b>357</b>	<b>344.7</b>	<b>271.8</b>	<b>10.8</b>	<b>85.2</b>

Meanwhile, 16 of the respondents able to sell their buck (male goat) only. The average selling price of buck ranged from RM400 to RM700 per goat. The mean and median for the selling price of buck is RM597 and RM650 respectively. Table 6 shows additional income from the goat integration program (selling of buck) with depreciation cost that ranged from negative RM65.60 to positive RM498.90 per buck and without depreciation cost ranging from negative RM43.30 to positive RM586.00 per buck.

**Table 6: Additional Income Received By 16 Respondents Who Sold Buck Only**

Respondents	Price (RM/buck)	Cost of goat (RM/buck)		Net profit (RM/buck)	
		With depreciation cost	Without depreciation cost	With depreciation cost	Without depreciation cost
1	650	223.8	176.2	426.2	473.8
2	450	515.6	493.3	-65.6	-43.3
3	650	235.3	148.7	414.7	501.3
4	650	361.1	270.2	288.9	379.8
5	400	182.8	155.0	217.2	245.0
6	700	541.5	457.3	158.5	242.7
7	550	613.7	528.0	-63.7	22.0
8	650	151.1	136.1	598.9	513.9
9	650	217.5	197.5	432.5	452.5
10	600	105.6	80.6	494.4	519.4
11	650	567.5	514.1	82.5	135.9
12	600	192.0	152.0	408.0	448.0
13	650	422.3	370.9	227.7	279.1
14	400	272.0	147.0	128.0	253.0
15	600	370.0	220.0	230.0	380.0
16	700	224.0	114.0	476.0	586.0
<b>Average</b>	<b>597</b>	<b>324.7</b>	<b>260.0</b>	<b>278.3</b>	<b>337.0</b>

#### **Problems faced by respondents from the livestock integration programs**

From the interview, there are six problems faced by the smallholders for the goat integration program, as shown in Table 7. The major problem is they have not enough capital to start this project by 23% of the respondents. The second major problem is the high rate of mortality for birth/baby/breed which was reported by 31 out of 159 respondents (or 19%). The third major problem is pests and diseases reported by 17% of the respondents. In this case, the worst scenario reported was bloated and worm infected. The fourth major problem is the high price of pallets which contributed mainly to the high cost of the goat integration program. Those who had adopted less open grazing techniques realized that the high price of pallets is the major problem faced by them.

Based on the interview, it was found that 23 respondents (14%) raised this problem. Besides that, there were also cases where they had difficulty in selling their goats especially the doe (female goat) which was reported by 13% of the respondents. Lastly, the major problem they face is fewer skilled workers in this livestock industry. There were 19 or 12% of the respondents who reported having this problem.

**Table 7: Problems Faced by the Respondents in Practising Livestock Integration**

No.	Problems faced by the respondents	No. of respondents	% of respondents	Ranking
1.	Capital	37	23	1
2.	High rate of mortality for birth/ baby/ breeds	31	19	2
3.	Pest and diseases	28	17	3
4.	High price of pallet	23	14	4
5.	Goat marketing especially for doe	21	13	5
6.	Worker's shortage	19	12	6

### Conclusion

This study reveals the potential additional income that could be generated through livestock integration programs by oil palm smallholders. The major cost to conduct a livestock integration program is the cost of purchasing a replacement parent breed of goat. Through the allocated fund for the livestock integration program, each participant will receive 11 goats with an estimated value of RM10, 000 to RM15, 000.

Meanwhile, through this integration program, smallholders can earn additional income or vice versa. Livestock integration needs to be managed very well to ensure they can get a positive return in the long term. Respondents who fail to manage their livestock will face problems of high mortality rate and high operation costs. However, with good management practice, it will lower the cost incurred in livestock integration. Coupled with selling their goat at market price, they get positive net income. These findings can be used to guide relevant agencies in strengthening the extension and consultation activity in livestock integration.

The concept of livestock integration with oil palm is a feasible and practical proposition as demonstrated by many studies conducted in Malaysia (Gabdo et al., 2014). The only impediment towards implementing the concept is the attitude of the smallholder which lacks the expertise in animal husbandry and is unable to see the benefits derived from such a farming system. As the demand for animal products has exceeded supply because of improved standards of living and affluence, a paradigm shift is needed in the oil palm sector. This is only possible through new policy direction and availability of training packages to advance the concept of livestock or crop integration system. Therefore, it can be concluded that the livestock integration practices benefited smallholders and should be continued in the future.

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