

RELATIONSHIP BETWEEN FACTORS AND ADOPTION RATE OF CATTLE DEVELOPMENT INNOVATION IN KUANTAN SINGINGI DISTRICT

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ABSTRACT

Kuantan Singingi Regency is one of the districts with the potential for oil palm plantations to be integrated with livestock. Innovation in using by-products from plantations and palm oil processing as animal feed and animal manure as fertilizer can be maximally applied using cheap by-product management technology. It can improve the quality and quantity of these by-products. Through the utilization of plantation by-products and palm oil processing as feed, it is predicted to be able to provide support for increasing the cattle population. This study aims to see the relationship between the factors that influence the level of adoption of innovation integration between cattle and oil palm in Kuantan Singingi. The results of the study indicate that there is no significant relationship between the characteristics of innovation, breeder characteristics and the performance of the extension worker on the technological innovation of the livestock-palm integration system. With the integration of livestock and palm oil, cattle feed from processed palm oil is beneficial, and cow dung is used as fertilizer for the oil palm plant. With the palm oil program, it is hoped that it can help improve the welfare of oil palm planters and cattle breeders and improve the quality of products produced by palm oil livestock. Breeders still need regular assistance from agricultural extension workers and related agencies regarding applying components of livestock-palm integration technology.

Keywords: *by-products, feed, Kuantan Cattle, integration, palm oil*

BACKGROUND

A new idea, new technology or innovation will be helpful if the innovation has been used or utilized by the community. The community will utilize innovation if it is relevant to the community's needs and follows their environment. One of the goals of agricultural development, especially animal husbandry, is to preserve food self-sufficiency, especially animal protein. Through its Livestock Service, the government always pays excellent attention to efforts to increase livestock production. Various programs have been launched and implemented to spur production in the livestock sector, such as vaccine injection in cows, animal feed training and artificial insemination training programs. The system of providing livestock facilities and infrastructure continues to be improved so that farmers are more productive in the livestock business in the community through the procurement of nearby companions.

The livestock sector development aims to increase the income of rural communities, especially farmers. On average, the people of the Kuantan Singingi Regency make a living in the agricultural sector, which is 75%, especially in the rubber and oil palm plantations and food crops, especially rice (Yulida et al., 2021). However, apart from being farmers of plantation crops and food crops, there are also many farmers who make cultivating cows a side business and support their main income. The farmer chose the breed of cattle that was cultivated was a native cow of Kuantan Singingi (local cattle).

Based on the survey results, the production of local cattle farms managed by farmers in the study area is still low, so it is unable to meet the beef needs in Kuantan. This is certainly not as expected. Nevertheless, there is still an opportunity to increase and develop the number of livestock so that it is expected to increase the amount of production which in turn can increase the income and welfare of farmers. Based on this before and to achieve the goals and objectives of agricultural development, especially local cattle breeding. Then the extension activities carried out must apply appropriate technological systems and methods. This appropriate technology (innovation) will help increase the production of local cattle introduced to farmers are Kuantan native cattle.

Meanwhile, areas abundant in feed, such as oil palm plantations in Sumatra and Riau and Kuantan Singingi, are still relatively empty of livestock. Seeing this trend, the area of oil palm plantations in Kuantan Singingi will continue to grow by 5-7% every year. Along with this, it provides a massive opportunity for cattle development through the Palm-Cattle Integration System in an environmentally friendly bio-industrial farming system. This integration system will develop rapidly if oil palm planters or entrepreneurs can directly feel the benefits, among others in terms of : (i) reducing the use of chemical fertilizers, which are increasingly expensive, (ii) increasing land fertility due to the use of organic materials derived from processing livestock manure, (iii) increased crop productivity due to maintained land fertility, (iv) increased income of growers/entrepreneurs from livestock sales, and (v) opportunities for utilization to ease the burden on FFB collectors (Sahbuddin et al., 2021).

This condition demands a work system that can guarantee the level of adoption of innovations in carrying out agricultural extension workers services. Through this work system, it is hoped that the learning process of the community, especially local cattle farmers and their substances, can interact with each other. So it is necessary to analyze the relationship of factors that affect the absorption rate of innovation in cattle breeders. Based on this description, the purpose of this study is to analyze; 1) the Characteristics of local cattle breeders and the institutional profile of agricultural and animal husbandry extension in Kuantan Singingi Regency, 2) the level of adoption of local cattle innovation in Kuantan Singingi Regency, 3) Factors related to the adoption of local cattle innovation in Kuantan Singingi Regency. It is hoped that the results of this research can provide input for making policies to accelerate the adoption of innovations, especially the development of Kuantan cattle.

RESEARCH METHODS

The method used in this study used a survey method conducted in Kuantan Singingi Regency. Kuantan Singingi Regency was chosen because it has a local cattle center and also has a high area of oil palm plantations. So that it has the potential to develop various innovations related to cattle farming and plantations. The objects observed in this study are local cattle farmers in Kuantan Singingi Regency, namely in Seberang Pulau Busuk Village, Inuman Island, Sipan Island, Inuman

District, and Banjar Lopak, Benai District. Samples of Kuantan cattle breeders were determined by purposive sampling. Determination of the sample is carried out deliberately. Each village was taken as many as 10 Kuantan cattle breeders, so the number of research samples was 30 breeders spread across the three villages.

The data types used are primary data and secondary data. Primary data were obtained from local cattle farmers who were sampled, which was carried out using a list of questions that had been prepared in advance with question types tailored to the data needed in this study. The primary data obtained will be related to the characteristics of cows, the application of innovations and the problems faced by farmers in absorbing innovations. Secondary data obtained from relevant government agencies, including the general condition of the research area, population, education and livelihood conditions.

The breeders' characteristics are age, level of formal education, livestock business experience, household income, family dependents, the scale of business and level of cosmopolitan breeders. The level of technology adoption for Kuantan cattle cultivation, the cattle-palm cattle integration system, from breeding to production-ready for sale, as measured by category. The level of innovation adoption is categorized as follows; 1) The total number of indicators studied, the lowest score is 14, and the highest score is 42. 2) The range is $42 - 14 = 28$, so the Innovation Adoption level category is obtained as follows: a). High = $34 - 42 =$ score 3, b). Medium = $24 - 33 =$ score 2, c). Low = $14 - 23 =$ score 1. To find out the relationship between the socio-economic factors of farmers and the level of adoption of technological innovations is to use the Spearman rank correlation test (Siegel, 2017)

$$\rho_{xy} = \frac{6 \times \sum D^2}{N(N^2 - 1)}$$

Information:

ρ_{xy}	: Rho correlation
N	: Number of cases or samples
D	: The difference in ranking between the variables X and Y for each subject
1 & 6	: Constant number

Criteria for close relationship (Siegel, 2017):

$0 - 0.025$ ($\alpha = 0.05$)	: Very weak correlation
$> 0.025 - 0.050$ ($\alpha = 0.05$)	: Sufficient correlation
$> 0.050 - 0.075$ ($\alpha = 0.05$)	: Strong correlation
$> 0.075 - 1.00$ ($\alpha = 0.05$)	: Very strong correlation

RESULT AND DISCUSSION

Characteristics of the Breeder

The characteristics of farmers can affect the level of use or adoption of new technologies, the production and income of the livestock business they manage. The characteristics of farmers referred to in this study are age, formal education, business experience, household income, number of dependents, number of livestock and cosmopolitan. The age of breeders ranged from 26-70 years, with an average of 47.13 years. The education of breeders ranges from 6-12 years, with an average length of education of 7.20 years, whereas farmers are generally still at the end of elementary school. The average farmer experience in Kuantan cattle farming is 8.37 years. The number of family

members of breeders is between 2-8 people, with an average number of dependents of 4.40 (rounded down to 4). The income of farmers from livestock and non-livestock businesses ranges from Rp. 875,000.00 to Rp. 14,250,000.00/month with an average income of Rp. 3,031,000.00/month. Ownership of domesticated cattle is heterogeneous, ranging from 1 to 6 heads with an average of 3.47 heads (rounded down to 3 heads). Farmers trying local cattle in the use of new sources of innovation such as electronic media and print media have never been done where all farmers (100%) do not use the media.

Innovation Characteristics

The characteristics of the local cattle business innovation of the cattle-palm cattle integration system include (1) complexity, (2) experiment ability, (3) observability, (4) relative advantage and (5) compatibility/harmony.

Complexity

Innovations will be straightforward to understand and convey when they are simple enough, both in the sense that it is easy for communicators and the communication to understand and use. According to (Harta et al., 2021), complexity is the degree to which an innovation is considered relatively difficult to understand and use. Specific innovations are easily understood by specific recipients, while others are not. The complexity of innovation, according to the observations of members of the social system, is negatively related to the speed with which it is adopted. This means that the more complex an innovation is for a person, the slower it will be adopted.

The results showed that as many as 21 people (70.00%) stated that the innovation of livestock-palm integration was in accordance with those recommended by local extension workers. Farmers who want to implement the innovation of livestock and palm oil integration as recommended by the farmer extension workers, because farmers do not find it complicated to implement the innovations that are continued. Meanwhile, those who stated a moderate level of complexity were only 9 people or 30%.

Can be tried

Innovations that are not easy to try because of complex equipment and require high costs or capital is more challenging to adopt. According to (Budiman et al., 2020), traceability is the degree to which an innovation can be tried on a small scale. New ideas that can be tried out are usually adopted more quickly than innovations that cannot be tried first. The study showed that as many as 8 people (26.67%) who wanted to implement a livestock-palm integration system were not in line with those recommended by local agricultural extension workers. Meanwhile, other breeders who apply the innovations recommended by agricultural extension workers because farmers state that these innovations are considered easy to try in implementing these innovations. Meanwhile, 22 people (73.33%) stated that it was not easy to try.

Observable

Innovations will be adopted more quickly when their effects or results can be easily and or quickly seen or observed by the communicant. According to Purnomo et al. (2019), observability is the degree to which the results of innovation can be seen by others. The study showed that as many as 17 people (56.67%) wanted to implement the innovation of livestock-palm integration as recommended by local agricultural extension workers. Because breeders in applying these

innovations state that they are easy to observe and in accordance with those recommended by agricultural extension workers. Meanwhile, those who stated that it was less easy to observe were 13 people or 43.33%.

Relative Advantage

Each new idea (innovation) will be considered how far the relative advantage can be provided, as measured by the degree of economic benefit, how significant or security, or its influence on the social position that the communication will accept as an adopter. According to Vecchio et al. (2020), the relative advantage is the degree to which a new idea is considered better than the previous ideas. Relative advantage is expressed by or in the form of economic profit. The study showed that as many as 20 people (66.67%) accepted implementing the innovation of the integration of animal husbandry by what was determined by the local agricultural extension. Farmers understand implementing innovations as recommended by agricultural extension workers because they feel that they will benefit from implementing them compared to profits before implementing them. Meanwhile, those who stated that the profit and production levels were the same as before were only ten people or 33.33%. This shows that innovation in livestock-palm integration is expected to provide better profits for farmers.

Compatibility

Every innovation will be quickly adopted when it fits or relates to local conditions that already exist in the community. According to (Vecchio et al., 2020), compatibility is the extent to which an innovation is perceived as consistent with existing values, past experiences and the recipient's needs. A total of 23 people (76.67%) who wanted to implement the innovation of livestock-palm integration said they were ready to comply with those recommended by the local agricultural extension. Farmers implementing innovations are those recommended by agricultural extension workers because they state that they are in line with past experiences in implementing innovations, such as cattle breeders and oil palm farmers. Meanwhile, those who stated that they had a level of alignment with the value obtained were 16 people or 53.33%. Thus, applying livestock-palm integration innovations can provide harmony between past experiences and the application of these innovations. Besides that, it also has alignment with values. This shows that the innovation of livestock-palm integration is consistent with existing values and with the past experience of farmers.

Factors Associated with the Level of Adoption of Cattle-Palm Integration Innovation

Factors related to the level of innovation adoption of the cattle-palm integrated system were analyzed using Spearman's rank correlation. The following is Table 1, which shows the factors related to innovation adoption in the Kuantan Singingi Regency.

Relationship between Farmer Characteristics and Innovation Adoption Rate

The relationship between the characteristics of farmers and the level of adoption of innovations in the livestock-oil integration system can be seen from the components of the characteristics of farmers, namely: (1) age, (2) education level, (3) business experience (4) household income, (5) number of family dependents, (6) the number of livestock (local cattle) and (7) the cosmopolitan level. More details can be seen in Table 1. Based on Table 1, it can be seen that age has a negative but not significant relationship where the P value is $0.596 > 0.05\%$, and education level has a negative and insignificant relationship where the P value is $0.222 = 0.05\%$. Business

experience has a positive relationship. a positive and insignificant relationship where the P value is $0.353 > 0.05\%$, the number of family dependents has a negative and insignificant relationship where the P value is $0.696 > 0.05\%$, household income has a negative and insignificant relationship where the P value of $0.065 > 0.05\%$, the number of cattle has a negative and insignificant relationship where the P value is $0.136 > 0.05\%$. The cosmopolitan level has a positive relationship. This shows that of the seven variables, no farmer characteristic variable has a significant relationship with the level of adoption (application) of the livestock-palm integration system innovation technology component. This shows that the characteristics of farmers regarding age, education, number of family dependents, income, number of livestock and cosmopolitan level are optional for influencing farmers to implement the livestock business management component of the livestock-palm integration system.

Table 1. Farmer Characteristics Factors Associated with the Level of Adoption of the Cattle-palm Integration System Innovation in Kuantan Singingi Regency, 2021

No	Breeder Characteristics	Adoption Rate (Y)			
		Correlati on	P-Value	A	Description (Correlation)
1	Age (X11)	-0.101	0.596	0.05	Not significant
2	Education Level (X12)	-0.230	0.222	0.05	Not significant
3	Business Experience (X13)	0.176	0.353	0.05	Not significant
4	Number of Family Dependents (X14)	-0.074	0.696	0.05	Not significant
5	Household income (X15)	-0.342	0.065	0.05	Not significant
6	Number of local Cattle (X16)	-0.278	0.136	0.05	Not significant
7	Cosmopolitan Level (X17)	-	-	0.05	Not significant

Relationship between Innovation Traits and Adoption Rate

The relationship between the characteristics of innovation with the level of innovation adoption of the livestock-oil integration system was measured based on the variable ; (1) complexity, (2) testability, (3) observability, and (4) relative advantage, (5) compatibility. For more details, the relationship between these variables and the level of innovation adoption can be seen in Table 2

Table 2. Factors of Innovation Characteristics Associated with the Level of Adoption of the Cattle-Oil Integration System Innovation in Kuantan Singingi Regency, 2021

No	Innovation Characteristics	Adoption Rate of Application of Animal-Palm Integration (Y)			
		Correlatio n	P- Value	α	Description (Correlation)
1	Complexity (X21)	0.130	0.492	0.05	Not significant
2	Can be tried (X22)	-0.018	0.925	0.05	Not significant
3	Observable (X23)	0.362	0.049	0.05	Close enough and significant
4	Relative advantage (X24)	0.211	0.262	0.05	Not significant
5	Compatibility (X25)	0.267	0.154	0.05	Not significant

Based on Table 2, it can be seen that the complexity variable has a positive and insignificant effect where the P value is $0.492 > 0.05\%$, and the variable can be tried to have a negative and insignificant effect where the P value is $0.925 > 0.05\%$. The variable can be observed to have a positive effect. And significant where the P value is $0.049 < 0.05\%$, relative advantage has a positive and insignificant effect where the P value is $0.262 > 0.05\%$, and compatibility has a positive and insignificant effect where the P value is $0.154 > 0.05\%$. This shows that there is no significant relationship between the characteristics of innovation and the level of adoption (application) of components of the livestock-palm integration system, where only observable variables have a significant effect. This insignificant result indicates that innovation characteristics are not important in influencing farmers to implement the livestock business management component of the livestock-palm integration system. The higher the innovation characteristics, which include relative advantage, compatibility (level of suitability), complexity (level of complexity), triability (can be tried), and observability (observable), the higher the level of farmer adoption towards the application of integrated livestock management components.

Relationship Between Extension Performance and Adoption Rate

The relationship between the performance of the instructor and the level of adoption of innovation in livestock-oil integration includes; (1) increasing knowledge of breeders, (2) improving the skills of breeders, and (3) fostering positive attitudes in breeders. For more details, the relationship between the performance of the instructor and the level of adoption of innovation in livestock business management with the livestock-palm integration system can be seen in Table 3.

Table 3. Extension Performance Factors Related to the Level of Adoption of Palm Oil Integration Innovations in Kuantan Singingi Regency, 2021

No	Extension Performance	Adoption Rate of Application of Animal-Palm Integration (Y)			
		Correlation	P-Value	α	Description (Correlation)
1	Increase farmer knowledge (X31)	0.089	0.639	0.05	Not significant
2	Improve farmer skills (X32)	0.355	0.054	0.05	Significantly close enough
3	Cultivating a positive attitude towards farmers (X33)	-0.002	0.993	0.05	Not significant

Based on Table 3, it can be seen that the X31 variable has a positive and insignificant relationship with the level of adoption of the innovation adoption of the livestock-oil palm integration system, where the P value is $0.639 > 0.05\%$, the X32 variable has a positive and significant relationship where the P value is $0.054 = 0.05\%$, and X33 has a negative and insignificant relationship where the P value is $0.993 > 0.05\%$. This shows that there is no significant relationship between the instructor's performance regarding the technological innovation of the cattle-palm integration system and the level of adoption (application) of the integrated cattle technology component, except for the significant X32 variable. This insignificant result is because the activities of the extension workers on the technology of the livestock-palm integration system are essential to provide information to the respondent farmers about the technology components. The more often extension activities are carried

out by extension workers or other field guides, the higher the level of farmers' adoption towards the application of technology components.

The Problem of Adopting Innovations in Animal-Palm Integration Technology

If analyzed in general, it can be seen that the integration of cattle with oil palm farmers can generally fill the niches of integrated or semi-commercial agricultural systems. This is because integration efforts can only be carried out by farmers who own oil palm land and cattle. In terms of control of production capital, farmers implementing the integration of cattle and oil palm have a relatively better standard of living than subsistence farmers. Farmers who own/maintain plantations may integrate their gardens as the primary source of income, with cattle assisted through soft credit by plantation companies (for plasma farmers) or government programs (smallholder farmers). The support of private plantation companies and the government through the core-plasma system can help support efforts to integrate cattle and plantation crops if this is one of the company's concerns. Cattle can be used for transportation and become a source of organic fertilizer for plants. Much plantation crop processing waste can be used as feed for cattle and vice versa.

In addition, that the integrated agricultural system of crops-livestock on dryland agroecosystems, cattle, especially kuantan cattle or local cattle is still a part-time business for most farmers so that the maintenance is still traditional. Even though in the structure of household income, such farmers in the research area are the most significant contributor to household income (Santoso et al., 2022). This is following the statement of Sibhatu et al. (2015) although the contribution of income from livestock is significant, it is not necessarily an efficient effort to increase farmers' income and increase the quantity and quality of national beef. According to Nur et al. (2021), feeding solid feed (dried palm mud) at 1.3 kg/head/day and oil palm leaf midrib at 1.5 kg/head/day showed that the productivity of fattened Bali cattle was almost two times better than Bali Cattle which were only fed forage, which each showed a daily weight gain (PBBH) of 0.267 kg/head/day compared to 0.139 kg/head/day. This is reinforced by Tahuk et al. (2018), that PO cattle fed solid feed as much as 5 kg/head/day and forage had a weight gain of 0.378 kg/head/day higher than cattle that consumed forage alone (0.199 kg) /head/day), in addition to the efficiency of labour foraging forage to reach 50%.

Above have described several research results on the integration of cattle with oil palm, which broadly benefits farmers/breeders and owners of oil palm plantations. Why this integration is necessary and urgent to be carried out in oil palm plantations, Kusumo et al. (2017) outlines several reasons for this as follows:

1. The main obstacle to the development of the cattle population is sufficient and quality feed, while oil palm agribusiness can provide more than sufficient feed for cattle. The integration of cattle in oil palm plantations will be able to encourage the achievement of meat self-sufficiency in a relatively short time.
2. The more limited integration of agricultural land use, the more efficient it will be. One location of land can be used for several agricultural commodities.
3. Agricultural land is drained (fatigue soil) and poor in organic matter, making it difficult to maintain productivity. With the presence of cows in oil palm plantations, cow faeces along with empty palm fruit bunches, other organic waste, and palm oil mill effluent can be processed into organic fertilizer to fertilize oil palm so land fertility can be maintained and even increased to increase FFB production.

4. To increase business flexibility and efficiency in the event of fluctuations in FFB prices, as has happened several times, the last was at the end of 2008 and early 2009. The results of the cattle business, whose prices are continuously increasing, can increase the business balance. In the increasingly fierce competition in palm oil agribusiness, integration efforts can help the sustainability of oil palm agribusiness.
5. There has been a strong trend of increasing demand for organic food, so the demand and use of organic fertilizers will increase. The organic fertilizer produced can be used alone, and the excess can be sold to meet market demand, providing additional income. With the full use of organic fertilizers, the production of CPO becomes an organic food ingredient that is in demand by consumers.
6. The price of inorganic fertilizers continues to increase, its availability is increasingly limited, and there is much counterfeiting of fertilizers, so, with organic fertilizers, the availability of fertilizers will be guaranteed both in quality and supply, which are relatively cheaper than inorganic fertilizers.

Based on these conditions and conditions, the development of business management with the innovation of livestock-palm integration is excellent if developed in Kuantan Singingi Regency. This can be seen from the existing conditions, which include: 1). The potential for cattle integration with oil palm development is still huge in terms of the area of oil palm plantations in the Kuantan Singingi Regency, both mature and new plants. 2). Integrating cattle with oil palm can encourage an increase in cattle population and productivity and the efficiency of oil palm plantations. 3). Economically, increasing the cattle population can reduce imports, save foreign exchange, and increase the flexibility of palm oil agribusiness in global competition. 4). The cattle integration system with oil palm provides additional income for farmers and planters from the by-products obtained (feed, labour efficiency, use of organic fertilizers). 5). The integration of cattle farming with palm oil is environmentally friendly and sustainable.

CONCLUSION AND SUGGESTION

Based on the results of the study, several conclusions can be drawn as follows: the age of breeders ranged from 26-70 years with an average of 47.13 years, length of formal education ranged from 6-12 years with an average length of education of 7.20 years, experience in cattle farming the average local age is 8.37 years, the number of family members is between 2-8 people with an average of 4 people, the income of farmers obtained from livestock and non-livestock businesses ranges from Rp. 875,000.00 to Rp. 14,250,000.00 /month with an average income of Rp. 3,031,000.00 / month with cattle ownership ranging from 1 to 6 heads with an average of 3. At a cosmopolitan level, the use of new sources of innovation such as electronic media and print media has never been done. In the future, it is hoped that farmers will organize farmer groups in each village, making it easier to implement integrated cattle management in carrying out the livestock-palm integration program. Breeders need regular assistance from agricultural extension workers and related agencies regarding the application of components of livestock-palm integration technology.

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