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Pig Farming System in West Papua: A Case study of Three Districts

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Abstract

Pigs are livestock that has a significant meaning for the local Papuan community. Pig rearing is done traditionally from generation to generation without providing technical input to increase productivity. Therefore, this study aimed to examine the determining factors that influence the production of pigs. This research was conducted in three districts in West Papua, namely Manokwari, Bintuni, and Sorong. A semi-structured questionnaire was employed for data collection and supported by key informant group discussions. Respondents were sample dusing purposive random sampling under predetermined criteria and then randomized. Aregression equation was used to analyze the production system of raising pigs by evaluating the relationship between the production of breeding pigs and the influencing factors. The results of the analysis of the determinants showed that the amount of feed, working time, and experience in pig breeding had a positive effect on pig production. Therefore, to optimize pig production, it is necessary to increase feeding, working time, and experience in raising pigs.

Key words: pigs, feed, experience, working time.

I. INTRODUCTION

Pig production systems in tropical agro-ecosystems of each country vary. These pig production systems depend on resources, in particular feeds such as crops [1], residues, and other potential edible plants and climate elements [2].The structure and alternation of pig production systems tend to be determined by climates and other important relevant factors. Wet and dry seasons tend to influence live stock production systems. Many agro-ecological components have been identified to control the performance of livestock production systems in Asia [3]. Several classifications of animal agriculture and definitions can be referred to in the articles of [2] and [4].

Other typical agro-ecological elements can be classified into the island, coastal, and lowland zones. A region such as Indonesia has many agro-ecological zones. They are recognized as typical agro-ecological components. Many livestock and crop production systems are severely and evidently dependent on these components. However, the structure of many production systems israrely studied and lacks important information. The effects of the structure on livestock production systems were investigated quite often in studies involving ruminants, such as cattle, dairy cattle, and goats and sheep. However, a livestock commodity that has

prospects is the pig [5]. Pig farming in Indonesia is scarce and limited. The natives of North Sumatera, Borneo, Bali, North Sulawesi, Molucca, Flores and Papua depend on this animal agriculture [6].

Papua has several recognized agro-ecological zones. Similar to other Indonesian regions, her islands and mainland are separated.One of the main livelihoods of Papuan farmers is pigfarming [7]. Using different agro-ecological zones, the knowledge and experience of Papuan farmers are vital to understanding the success oflivestock production systems in Papua.[5]), [8] classified pig farming systems into four categories. Other important Papuan livelihoods are crop farming, fishing and hunting. However, a small proportion of Papua people are working as public state officers. Ethnics of Papua live in coastal areas, islands (including big and small islands), lowlands and highlands. Their pig farming tethered, and benefits the various agro-ecological zones that have shaped the production of pigs. The farmers adopt and adapt typical pig production based on their local wisdom. However, the typical features of these zones are lagging. Therefore, this research aimed to characterize the statistics that are vital for the success of pig farming including pig health status, and business achievement.

II. MATERIALS AND METHODS

The study was undertaken in West Papua Provincein 2020. The study site was chosen based on the pig population and production practices. A total of 150households were purposively selected and used in the study. A semi-structured questionnaire was employed for data collection and was supported by key informant group discussion. Different datawere collected from both primary and secondary sources. The primary data included household characteristics of producers, pig holding, types of feeds, and feeding management.

Explorative research was carried out in Teluk Bintuni, Sorong, and Manokwari districts. The residents of the three districts are different and are considered to have differences in terms of raising pigs.

Teluk Bintuni District

The location of Teluk Bintuni district is 9.12 m asl. The area of Teluk Bintuni districtis about 18,673 km² and covers 13.02% of West Papua Province. The population of pigs as of2021 was 5,503.The populationof pigs increasedby38.37% from the year 2020. Teluk Bintunidistrict has natural potential in the oil and gas sector. The exploration and exploitation ofoil and gas are carried out by Tangguh LNG.

Sorong district

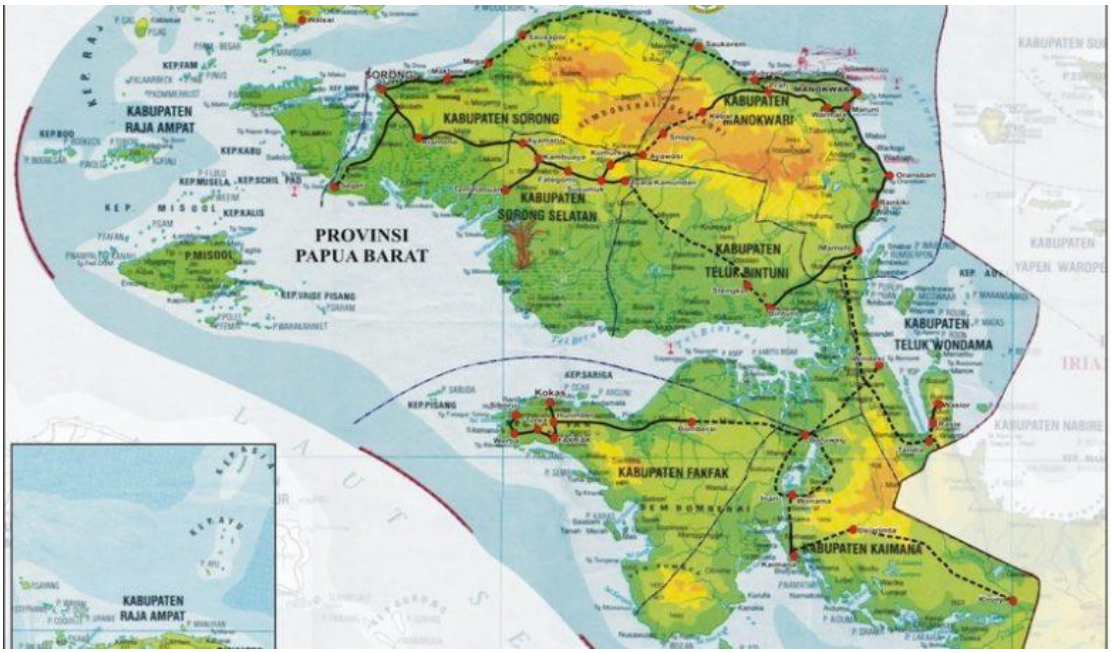
The location of Sorong district is 5-9 mabove sea level with an area of 56,840 km^2, which consists of 28,867 km^2 of land and 27,973 km^2 of sea (Bappeda Sorong district).

Administratively, Sorong district is bordered by Raja Ampat district in the north and west, while in the south it is borderedby South Sorong district. In the east, it is bordered by the Manokwari district.

The number of pig populations as of2021 was 2,875.The population of pigs increasedby6.08% from the year 2020.

Manokwari District

Manokwari District is located in the bird's head of Papua Island at a position of 0015'-3025' south latitude and 132035'-134045' east longitude. Manokwari has a lowland topography, hills, and mountains that are rich in natural resource potential. The area of Manokwari District is around 14,268 km^2. The total population of pigs as of2021 was 37,989, with an increase of 2.46% from the previous year.



Source: https://www.tataruang.id/2022/04/11/gambar-peta-papua-barat-lengkap/

Teluk Bintuni, Sorong, and Manokwari were chosen as sample locations for the study because the pig population of these districts is more than the pig population of other districts in West Papua Province. There is a total of 13 districts in West Papua. Field data were collected from50 pig farmers in each of the three districtsusing a survey method based on a structured questionnaire. The farmers selected as respondents are as follow. Firstly, pig farmers who already have at least two years of livestock experience. Secondly, breeders who maintain sows that have progeny. The sampling of respondents was done by adopting the method of purposive random sampling under predetermined criteria and then randomized so that each sample had the same opportunity to be selected. Data collection includes primary and secondary data, primary data was obtained through direct observation and interviews with farmers using a list of questions that have been prepared, while secondary data was obtained from relevant agencies. The data was tabulated and the mean and standard deviation were calculated. To evaluate the level of production and reproduction efficiency, a descriptive study was conducted.

To evaluate how the farmers in these three districts handle the pig production system, we analyzed by studying the relationship between the production of breeding pigs and the influencing factors using the following regression equation:

Ln Pig Production = $\ln a_o + a_1 \ln A + a_2 \ln L + a_3 \ln Ex + a_4 \ln Ed + a_5 \ln BW + a_6 \ln TL + a_7 \ln FT + a_8 \ln PS + \varepsilon$

Description :

Pig Production : the number of weaned piglets with the weight of the free weaning piglets produced from the pig breeding business (kg)

a_o : Intercept

a_i : Regression coefficient (estimated parameter) (i= 1 to 8)

A : age of farmers (years)

L : number of workers used in the business (person)

Ex : farmer's experience of raising the pigs(years)

Ed : farmer's education (year) where elementary school= 6, junior high school = 9, high school = 12, college = 17

BW : sow body weight (kg)

TL : working time (hours/day)

FT : total feed given during the production process (kg)

PS : protein source of feed given during the production process (kg)

ε : error term

III. RESULTS AND DISCUSSION

In the life of Papuans, pigs are very important domesticated livestock. Apart from considering the benefits obtained from raising pigs(proliferative benefits),asa culture of the local community, pig farming has a close relationship to social and cultural values because it is in line with the practice of customs and cultural rituals. Several things are connected to the social value of pigs, for example: as a dowry, a determinant of social status (a measure of wealth), sacred animals, and as a medium of exchange. In Papua, pigs are traditionally farmed on a small scale and according to the socio-economic conditions of the local community.

Age structure

The age of breeders varies greatly between districts as presented in Table 1.

Table 1. Age structure of pig farmers(N= 150).

District	<20 years (%)	20-29 yrs (%)	30-39 yrs(%)	40-49 yrs (%)	>50 yrs (%)	Total (%)
Bintuni	0.00	6.00	48.00	38.00	8.00	100
Sorong	0.00	6.00	40.00	30.00	24.00	100
Manokwari	0.00	2.00	12.00	30.00	56.00	100
West Papua	0.00	4.67	33.33	32.67	29.33	100

The results of the interviews with farmers showed that the age of farmers was between 20-49 years (70.67%) and over 50 years (29.33%). It means that most of the respondents are of productive age. According to [9], the productive age is the age in the range of 15-64 years, while the non-productive age is the age of 65 years and above. Productive age is very important because mature age has a very good impact on the development of capture power and mindset so that the knowledge obtained by farmers is improved[10, 11, 12].This condition allows them to easily accept technological innovations related to their work towards a change, both individually and in groups. [13] stated that education affects the learning process, the higher a person's education, the easier it is for that person to receive information. Higher education makes a farmer to easily find information and even manage the information in order to meet his/her needs, for example, extension workers or inseminators.

Educational Status of Farmers

The level of education is expected to help the community in the efforts to increase the production of pigs. Ithasan impact on the management of the livestock business. The status of farmers based on education level is presented in Table 2.

Table 2 shows that the education level of farmers is very diverse and the majority (42%) of them are those who have attained a high school education level.

Tabel 2. Educational status of farmers (N=150)

District	Read and Write	ES I	ES II	High School	Diploma and above	Total (%)
Bintuni	10.00	6.00	22.00	44.00	18.00	100.00
Sorong	4.00	12.00	34.00	38.00	12.00	100.00
Manokwari	8.00	12.00	8.00	44.00	28.00	100.00
West Papua	7.33	10.00	21.33	42.00	19.33	100.00

Note: ES I= elementary school I; ES II= elementary school II

[14] stated that the level of education reflects a person'sability toaccept and cope with new innovations. The higher the education level, the easier it will be for a personto receive new information related to the livestock business.

Off-farm Income

The characteristics of farmers based on their main off-farm income arepresented in Table 3.
Tabel 3. Main off-farm income characteristics of respondents(N=150).

No	Income Sources	Bintuni	Sorong	Manokwari	Total	Total (%)
1	Farmers	29	20	12	61	40.66
2	Fisher	0	5	5	10	6.67
3	Trader	1	0	0	1	0.67
4	Government employees	10	6	9	25	16.67
5	Private sector	10	19	20	49	32.68
6	Retired man	0	0	4	4	2.67
	Total	50	50	50	150	100.00

Table 3 shows that the main off-farm income of the farmers is around 40.66%. According to [15] the people living in rural areas mostly rely on off-farm income from agriculture which is supported by the livestock sub-sector. It is evident that raising pigs is only used as a side business for savings and sudden needs, such as to finance schools, health costs, building houses and others. The results of this study are in accordance with [16]who stated that the livestock business is not a major business but a side business or a family savings which can be cashed at any time. However, the role of livestock farming makes a large contribution to the income of farmers in rural areas.

Pig ownership

The pig ownership of the three districts in West Papua is presented in Table 4.
Tabel 4. Pig ownership (N=150).

District	Starter (0-3 mo.)		Grower (3 - 8 mo.)		Finisher (sow)	
	Male	Female	Male	Female	Male	Female
Bintuni	1.83	2.67	2.00	2.78	1.12	2.00
Sorong	6.11	7.73	4.61	5.80	2.71	4.32
Manokwari	3.08	3.82	2.86	3.74	2.46	3.7
Wes Papua	3.63	4.56	4.56	4.71	2.29	3.83

From Table 4, it can be seen that the highest average number of pig ownership is in Sorong Regency. Although the total population of pigs in Manokwari is much higher.The results of this study indicate that the ownership of pigs at the farmer level in Sorong Regency is more than that of Manokwari Regency. In total, the large number of pigs in Manokwari is the contribution of entrepreneurs who raise large numbers of pigs and were not sampled in this study. Ownership of pigs in West Papua shows that basically, pig farming is one of business which if managed seriously can provide financial benefits as well as other positive impacts. Local pigs are the breed that is mostly kept by the farmers characterized by black skin. Contrary to the results of the study by [1] in the coastal areas, lowlands and highlands of West Papua, the average population of pig farmers wasthe same, which is relatively diverse. In coastal areas, the average number of pigs that can be kept is 4 to 5 animals, in the lowlands 6 animals and in the highlands 10 animals.

Feed for Pigs

The cost of feed is the highest production cost in a livestock business therefore farmers try to find raw materials (used for making feed)that are affordable and available at any given time. Table 5 shows that the use of market waste, household waste and restaurant waste arethe wayslocal farmers provide feed for their animals.

The type of feed varies from restaurant waste, vegetable waste, banana peels, cassava, tofu dregs, fish market waste and kitchen waste which is cooked and then given to livestock. Indirectly, the use of these wastes helps to maintain environmental cleanliness because it reduces the volume of waste that continues to grow due to urban development. In addition, from an efficiency perspective, the farmers get benefits because the need for animal feed can be supplied from this waste at a very low cost. Waste can be taken at any time in large quantities without incurring high costs.

Table 5. Use of feed raw materials for pigs in West Papua (N=150).

Feed raw material	Manokwari	Sorong	Bintuni
Concentrate	2	2	0
Fruit	0	0	1
Rice	0	0	4
Vegetables	42	42	37
Tofu dregs	39	38	30
Restaurant waste	21	21	31
Sweet potatoes	23	23	30
Mixture	11	11	8
Agriculture waste	16	16	0

The level of waste utilization by traditionally managed pig farms, especially by farmers in the coastal area of Manokwari, ranges from 25–75 kg depending on the number of livestock raised (based on direct observations and interviews with 150 sampled farmers who use food waste as feed or raw materials for their animals' feed production). That range is the quantity of waste that is taken each time by the farmers. Usually, the above-stated quantity can be exhausted by pigs within 2 to 3 days. The quantity of waste collected by the farmers is based on the number and age phase (starter, grower, male or female) of the pigs that are reared.

Production Component of Pig Business

Tabel 6. Production component of pig business.

No	Items	District		
		Manokwari	Sorong	Bintuni
1	Body Weight of Sow	74.09±8.92	72.7±19.7	68.24±22.07
2	Littersize (head/birth)	7.55±2.92	8.3±2.5	5.88±3.03
3	Body Weight of pig after weaning (kg)	7.42±4.46	11.5±2.42	4.38±1.03
4	Feed Source of Energy (kg/day)	10.61±4.44	13.72±3.35	10.51±3.04
5	Feed Source of Protein (kg/day)	4.08±6.65	8.26±6.02	5.99±8.64
6	Land (acre)	1.88±1.57	1.4±1.26	2.56±1.23
7	Family Labour (head)	3.3±1.15	4.1±1.37	3±1.41
8	Times Labour (hours/day)	2.45±1.52	3.7±1.06	3.32±1.73

Table 6 shows that the average body weight of sows of Manokwari is higher than that of sows of Sorong and Bintuni. The high weight of the sow is not matched by the high number of litter sizes as well. The litter size of Sorong is higher than the litter size of Manokwari and Bintuni. [1] stated that in local Papuans, the number of sows kept was different for different agro-ecological conditions. On average, one sow is kept in coastal areas, two sows in the highlands and three sows in the lowlands. Furthermore, [1] explained that the number of births per year (farrowing rate) in coastal, lowland and highland areas are one, three and two times, respectively. It is important to notethat pigs are able togive birth three times per year. Naturally, each sow can have a 4-11 litter size. However, results obtained from previous research showed that the litter size of sows in Papua is still low. According to [17],the litter size of the first birth of pigs in Wamena Indonesia is 9offspring on average and it increases to an average of 11 offspring at the 6th birth. Also, they reported that litter size was 65%

affected by parental factors and 35% affected by other factors. The low birth rate is caused by the low quality of feed, especially the balance between energy and protein needed during the early pregnancy period of a sow[18].

Table 6 shows that the source of feed for pigs comes from energy sources more than protein sources. Both sources of feed are obtained from gardens, used land and kitchen waste. The results of this study are in accordance with the results obtained by [19, 20 and 5] in their studies. In this system of rearing, the pigs scavenge to feed in the morning in gardens or in areas where it is possible to get food, then in the afternoon, the pigs return to the owner's pens. Some farmers feed their pigs, while others do not. In addition, there are also farmers who provide feed in the morning before the pigs scavenge for food far from the vicinity of the farmers. This is in accordance with the research of [5 and 21] who reported that the feed obtained for pigs is mainly from gardens.

Some breeders provide protein source feed that comes from industrial waste (tofu dregs)because they are easily obtained in the villages where the farmers keep the pigs.[22] stated that protein source feeds are the feeds that have above 20% available protein. Food materials that are generally sourced to supply the needed protein for pigs are fish meal and soybean meal. According to [23], pigs really need protein because protein forms cells or body tissues (e. g. in the growth of young pigs), replacing damaged cells (e. g. producing milk). There are lots of fish wastes found in the three districts, but farmers mostly use tofu dregs as a protein source for their pigs. The study is in accordance with the study of [24]who stated that tofu dregs can be used as pig feed. In addition, [25]stated that tofu dregs have a crude protein of 22.1% and it is good for feed as a protein source for pigs.

In some areas in West Papua {33. 34], pigs act as a bulldozer (pig-dozer) that dismantles and then fertilizes the soil. When the rest period of the land is over, after a certain period of time, based on experience, and the land is ready to be planted again, the farmers return to cultivate crops on the land that has been loosened by the pigs. This kind of local knowledge practiced by the farmers has some advantages: 1) Utilization of "pig-dozer" livestock to assist in the tillage process. 2) Maintenance of soil fertility by using natural fertilizers (livestock compost). Such a maintenance system reduces labor time, family labor stress and land ownership. For example, in Manokwari Regency, the labor time is only 2.45 hours/day, family labor is 3.3 (4)people and land ownership is 1.8 acres.

Analysis of Pig Production

Pig production analysis was carried out by analyzing the following factors. Table 7. Regression of determinants of pig production in West Papua.

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Significant
Age	-0.02133	0.12557	-0.16988	0.86530	NS
Labor	0.04359	0.04479	0.97309	0.33220	NS
Experience	0.07978	0.04183	1.90729	0.05850	*
Education	0.02520	0.03654	0.68977	0.49150	NS
Body Weight	0.20068	0.20333	0.98698	0.32530	NS
Time labor	-0.21098	0.10609	-1.98873	0.04870	**
Feed total	0.85567	0.02641	32.40572	0.00000	***
Protein source	0.00337	0.04838	0.06958	0.94460	NS
C	0.78330	1.00381	0.78032	0.43650	NS
R-squared	0.9198		Mean dependent var		6.0534
Adjusted R-squared	0.9153		S.D. dependent var		0.940806
F-statistic	202.1417		Durbin-Watson stat		1.002962
Prob(F-statistic)	0.0000				

NS; Non significant

*: Significant Confident Interval 90%

**: Significant Confident Interval 95%
***: Significant Confident Interval 99%

The determinants of pig production in West Papua consist of the experience of raising pigs, the labor time and the total feed provided. The total feed provided had a very positive effect on pig production with an elasticity of 0.856 (α = 1%). Feed is an important factor that must be considered in pig production activities. Adequacy of feed, both in quality and quantity will determine the success of the production and reproduction of pigs. According to [26], pigs need feed for maintenance and production functions for example basal metabolism, digestive muscle activity, blood circulation and tissue replacement. In general, farmers provide feed as an energy source. According to [23], feed as an energy source include esgrains (corn, wheat, sorghum), cereals by-products (milling waste) and tubers (cassava, taro, sweet potatoes).

As presented in Table 5, the feeding of pigs in the three districts varies widely. Most of the farmers feed them with vegetables, sweet potatoes, restaurant waste, tofu dregs and agriculture waste. Concentrates, fruits and rice are very rarely given to pigs as feeds. The results of the study by [27]revealed that in Doreri Bay some farmers have their own gardens so it is easy to get energy source feed for their pigs. Asimilarscenario was also found in the three districts of Manokwari, Sorong and Bintuni.

Time labour significantly reduces the production of pigs with an elasticity of -0.211 (α = 5%). The research of [28] showed that time labour increased the pig farming business. In addition,[29] stated that working hours had a significant effect on the income level of dairy farmers' families. The difference between the results of this study and other previous studies is that the labour time of this study is very small, about 2-4 hours per day (Table 6). The farmers manage the animal particularly by providing feed for pigs in the morning and evening and releasing the pigs in the morning and putting them in their pensin the afternoon.

Another determining factor that has a significant positive effect on pig production is the experience of raising livestock with an elasticity of 0.080 (α = 10%). The results of the study by [30] stated that in general, respondents had a long experience in raising pigs. Breeders who already have experience will certainly increase their knowledge and skills in livestock rearing management and have a better ability to manage problems related to their livestock business. The results of the research by [27] in the Doreri Bay area of West Papua showed that the experience of raising livestock does not have any effect on production. This difference is very possible because of the difference in the length of experience raising. [31] and [32] reported that 92% of respondents have experience raising livestock for more than 5 years.

CONCLUSION

As animals play a key rolein the culture of the Papuan people, pigs are important animalsin their everyday life. The results of the analysis of the determinants showed that the amount of feed, working time and experience in pig breeding had a positive effect on pig production. Therefore, to optimize pig production, it is necessary to increase feeding, working time and experience in raising pigs.

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