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The Contribution of Labors to the Income of Pig Farming Business in the Tropical Coastal Papua Barat

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ABSTRACT

The purpose of this study was to determine the type of work and division of labor in the household-scale pig farm business and how much income was earned and generated by each male, adult female and child labor as a case study in the Manokwari coastal agroecological area Papua Barat. The method used is descriptive research method with survey techniques through interviews and field observations. The sample of farmers chosen *purposively* was 35 households out of 50 pig breeder. Farmers selected as samples are those who have been running pigs for more than 1 year. The parameters measured are labor involvement and contribution of economic beneficiaries. Data were analyzed using descriptive statistics and inferential statistics, namely analysis of variance with further testing Scheffe using SPSS v.16.0. The results showed that the types of work carried out by domestic workers included processing and providing [A4] food, medicine and sanitation, selling live cattle on the market and selling carcasses. Female breeders have almost the same level of participation as men. In terms of working hours, women give higher time (521 hours/month) in 6 pig raising activities. Female workers contribute higher incomes than male workers.

Keywords: Business income, Labors contribution, Pig farming business, Women labors

Introduction

Tropical livestock farming systems particularly subsistence production system have a severe relationship with household labors. Using men and women, even children as laborers, that is how livestock farming systems exist amongst tropical farming systems. Men, women and children play certain roles in keeping livestock. Farmers in Ethiopia and other tropical and less developed countries spend scarce resources, limited asset and knowledge (Tekle *et al.*, 2013), to maintain the production of animal agriculture in sustainable ways. Access to a bank loan, and community services by local related government felt and experienced by many pig farmers. This is in contrary with developed countries and first-leading agro-tech countries. They have shifted the traditional pattern in keeping livestock into technological and even entering the robotic era. It is in contrast with a situation faced by communities in Pacific, West Papua in particular.

Men and women work as household labors. Women have an important role in helping household incomes. One private enterprise that provides many women as workers is raising pigs (Warastuti, 2001; Iyai, 2008; Iyai *et al*., 2013). The choice of women to raise pigs because they are easy to observe and no need length of time to maintain, having litter size (Iyai, 2010), easy to access for feed (Iyai *et al*., 2015), and sold two to three times a year, so as to provide additional income for the family (Ayoade *et al*., 2009; Iyai *et al.*, 2015). According to Saragih and Iyai (2015), the female labor of Arfak tribe in Manokwari operates more role than Arfak man labor in farming works. Monim (2012) reported women contribute more to agricultural farm business than men do in the Baliem Valley Jayawijaya. Similarly Rahayu *et al*. (2012), mentioned as well as housewives, women are also able to play an active role as a labor in duck breeding business.

The economic decision was found playing a vital role as women do in Arfak ethnic (Iyai, 2010; Saragih and Iyai, 2015). At a glance, there is no visible gap between female and male workers in modern society, but there is still a difference in status in the workplace and in families where women as wives and homemakers are rated as individuals who are full of limitations. Distrust of women comes from their own families

(husbands, fathers) as well as outsiders such as donors (government and related institutions). The phenomenon that occurs is women also work to manage farms but the dominant participants of socialization of human resource development are men, while women are invited and present in the socialization activities if the status as a widow who owns pig farms. In Monim (2012), the amount of outpouring work greatly determines the amount of production. It affects the large income in the farm. The number of women who take care of pigs in Baliem Jayawijaya valley West Papua is higher than men, so that it becomes one of the factors causing the increase in income. Like in Wamena of Dani tribe, it is unknown what kinds of job and what shapes of works shares by household labors and lastly how much income generated by household labors, i.e. women, men and children from pig household business at tropical coastal region of Manokwari. Hence, the purpose of study was to determine the type of work and division of labor in the household-scale pig farm business and how much income was generated and generated by each male, adult female and child labor as a case study in the Manokwari coastal agroecological area- Papua Barat.

Materials and Methods

Research on income contribution of women have been conducted for two months, from February 2nd to April 2nd 2017. The research conducted in West and East Manokwari Districts, which included Sanggeng, Padarni, Amban, and Wosi Sub-districts. The sites selected by reasons that these are the center of household coastal pig farm production. Sample intensity of the fourth sites was 10% due to similar farming system, i.e. semi-intensive to intensive systems. The method used was a descriptive method using survey, interview and observation techniques. Direct observation in the field was done to approach women, men and including children breeders as respondents. Sampling. Sampling was done purposively that is intensive and semi-intensive pig farmers. Total 35 households from 50 households raised pig farming were involved as respondents, consist of 9 households at Sanggeng, 13 households in Wosi, 10 households in Padarni, and 3 households from Amban.

The data derived from primary and secondary data. Primary data was obtained directly from female and male farmers as respondents and secondary data are data obtained from the Livestock Service Office, and related agencies and other parties. Data of interview result and observation were typed written and processed using working computation formula in Excel, income formula and calculation formula of income contribution based on working time. The main variables observed in this research were the role, time spent by women, men and children workers and income earned from raising pigs. Analyses of data were done by using working Computation formula based on ages and sex of labor (Suratiyah, 2008). It was done to find out the major working hours by applying formula of CK= (ΣHK × ΣTK × ΣJK) / (JK (7)) × AK, where CK stands for “Curahan Kerja” (allocated works), HK stands for “hari kerja” (working day), TK stands for “tenaga kerja” (labor), The JK stands for “jam kerja” (working hours), whereas the AK stands for “angka konversi” (conversion number). Conversion rate or work rate consisted on adult male, i.e. 1, conversion rate for mature women is 0.8 and conversion rate for children is 0.5. The formulae of income according to (Soekartawi, 2003) to calculate the income generated from the pig farm business is by using formula as follows: PD = TR-TC, where PD stands for “pendapatan”, i.e. net revenue. The TR stands for “total revenue” which is computed by total production × production price. The TC stands for “total cost”, calculated by fixed cost + variable cost. According to Soekartawi (2003) and Suratiyah (2008) that the fixed cost is derived from (Hr B-Hr S) / UP. The Hr B and Hr S subsequently stands for “harga baru” (new product cost) and “harga sisa” (rest product cost). While UP stands for “umur pakai” (usage time period). The formula for calculating contribution of labor income based on the working hours of the business is as follows SPTKU = JkTK / TJkU × PU. The SPTKU stands for “sumbangan pendapatan tenaga kerja dari usaha”, i.e. labor income shares of business is contribution of employing revenue from business. The JkTK stands for “jam kerja dari tenaga kerja’ (working time of labor), The TjkU stands for “total jam kerja usaha (total hours of working business) and the PU stands for “pendapatan usaha”, i.e. business income (Suratiyah, 2008).

All of the data then stored in SPSS 16.0. Analyses of data using SPSS 16.0 was done by applied Analyses of Variance. Multiple comparisons were applied when there were any effects using Scheffe test (Ott and Longnecker, 2001).

Results and discussions

The household member living on each household of pig farmers dominantly ranged from 4-6 heads/hh. The ages of pig farmers were dominantly filled by 20-50 years old (88.57%), followed by ages over 50 y (37.14%), and under 19 years old (17.14%).

In line with experiences in keeping pigs, the ranges of experiences in raising pigs were at 6 to 20 years (94.29%). The rest had experience less than 5 years (48.57%). We were interested in knowing the formal education. We found the dominant education level of pig farmers was on higher education (71.43%), followed by junior and senior high schools (37.14%). The rest were on elementary level (22.86%).

The works done by farmers in raising pigs were grouped into collecting feeds, feed processing, feed offering, medicine and sanitary, marketing life pigs and selling cuts (Table 2). In collecting feeds, men and women were sharing

similar working jobs, i.e. 0.68±0.47 and was greater than children 0.05±0.23. In working hours, women were spent a more hours 1.88±0.9 h than that of men and children, i.e. 0.63±1.48 h and 0.11±0.47 h ($p<0.001$). In considering days, men and women spend a similar number, i.e. 18.43±13.65 and lesser than children did, i.e. 0.66±2.83 ($p<0.001$). In general, work allocation of labors was dominated by men 6.24±6.02, followed by women 5.92±6.65 and children 0.09±0.41 ($p<001$). In processing feeds, men and women were sharing similar working jobs, i.e. 0.68±0.47 and was greater than children 0.05±0.24. In working hours, women were spent a more hours 2.20±1.68 h than that of men and children, i.e. 2.03±1.69 h and 0.00±0.00 h. In considering days, men and women spent a similar number, i.e. 17.57±13.36 and lesser than children did, i.e. 0.00±0.00 ($p<0.001$). In general, men were dominating work allocation of labors 7.47±6.96, followed by women 6.37±5.88 and children 0.00±0.00.

In offering a feed, men and women have shown significant different in working jobs, i.e. 0.71±0.52 and was greater than children 0.03±0.17 ($p<0.001$). In working hours, men were spent more hours 20.57±14.13 h than that of women and children, i.e. 3.54±2.99 h and 0.08±0.51 h. In considering days, women spent a greater number, i.e. 24.00±12.17 than men, i.e. 20.57±14.13 h and lesser than children did, i.e. 0.22±1.35 h. In general, women were dominating work allocation of labors, i.e. 16.94±19.67, followed by men 12.85±14.07 and children 0.05±0.29. This experience reported in Uganda's household labors that women dominated works in offering feed to pig herds (Ayoade *et al.*, 2009). In medicine and sanitary activities, women had greater working jobs, i.e. 1.00±0.59 than men, i.e. 0.71±0.52 and was followed by children 0.05±0.23.

In working hours, women were spent a more hours 2.03±1.65 h than that of men and children, i. 1.62±1.73 h and 0.02±0.16 h. In considering days, women spent more days, i.e. 22.28±11.72 compared to men 18.85±13.77 and children was lesser than women and men, i.e. 0.22±1.35. In short, women were dominating work allocation of labors 8.32±9.91, followed by men 6.85±8.69 and children 0.01±0.09.In marketing life pigs, men shared higher working jobs, i.e. 1.51±0.92 than women 0.94±0.48 did and lesser than children 0.05±0.23. In working hours, women spent more hours 1.97±1.91 h than that of men and children, i.e. 1.77±0.88 h and 0.06±0.34 h.

In considering days, women spent a greater number, i.e. 1.86±1.97 than men and children did, i.e. 1.86±0.73 and 0.14±0.85. In general, work allocation of labors was similar among men and women, i.e. 1.71±4.45 and 0.71±1.13, followed children 0.01±0.05. In selling cuts, men shared greater working jobs, i.e. 2.03±1.15 than women did, i.e. 1.17±0.56 and was lesser than children 0.57±0.23 were. In working hours, men spent more hours 3.02±1.81 h than that of women and children, i.e. 2.94±2.35 h and 0.03±0.17 h. In considering days, women spent a greater number, i.e. 1.83±0.75 and lesser than men and children did, i.e. 0.86±0.73 and 0.14±0.85.

In general, work allocation of labors was dominated by men 1.31±1.30, followed by women 0.60±0.62 and children 0.64±0.98. Working hours in pig raising activities run by small-scale pig farmers in Manokwari presented in Table 3. The figure shows that working hours spent by the three typical labors were dominated by feed offering done by women (593.14 h/mt), followed by men 355.71 h/month and children 1.71 h/month.

In general, women working on all activities in pig husbandry activities was higher than men. This was in line with Ayoade *et al*. (2009) in Nigeria. Women spent hours of time on several activities such as collecting feed (207.42 h/month), feed offering (593.14) and medicine and sanitary (291.43 h/month). It meant that women shared its knowledge and skills in collecting feeds, closed attention to feed the pigs and doing several

Table 1. Typical socio-household of pig farmers

Parameter		Sum*	Proportion (%)
Household member (head/hh)			
	<4	4	12
	5	16	46
	>6	15	42
Ages (y)			
	10-19 (y)	6	17.14
	20-50 (y)	31	88.57
	>51 (y)	13	37.14
Experience (y)			
	3-5	17	48.57
	6-20	33	94.29
Education			
	Experience	25	71.43
	Courses	23	65.71
	Training	2	5.71
Formal Education			
	Elementary	8	22.86
	Junior high school	13	37.14
	Senior high school	13	37.14
	Higher education	25	71.43

* The number counted based on labor specialist (children, mother and father).

Table 2. Performances of pig husbandry activities performed by labors in Manokwari

Parameters	Men	Women	Children	p
	ẋ±SD	ẋ±SD	ẋ±SD	
Collecting feed				
TK	0.68±0.47[a]	0.68±0.47[a]	0.05±0.23[b]	0.000
JK	0.63±1.48[a]	1.88±0.97[a]	0.11±0.47[b]	0.000
HK	18.43±13.65[a]	18.42±13.65[a]	0.66±2.83[b]	0.000
CK	6.24±6.02[a]	5.92±6.65[a]	0.09±0.41[b]	0.000
Feed processing				
TK	0.68±0.47[a]	0.68±0.47[a]	0.05±0.24[b]	0.000
JK	2.03±1.69[a]	2.20±1.68[a]	0.00±0.00[b]	0.000
HK	17.57±13.36[a]	17.57±13.56[a]	0.00±0.00[b]	0.000
CK	7.47±6.96[a]	6.37±5.88[a]	0.00±0.00[b]	0.000
Feed offering				
TK	0.71±0.52[a]	0.97±0.62[a]	0.03±0.17[b]	0.000
JK	20.57±14.13[a]	3.54±2.99[b]	0.08±0.51[b]	0.000
HK	20.57±14.13[a]	24.00±12.17[a]	0.22±1.35[b]	0.000
CK	12.85±14.07[a]	16.94±19.67[a]	0.05±0.29[b]	0.000
Medicine and sanitary				
TK	0.71±0.52[a]	1.00±0.59[a]	0.05±0.23[b]	0.000
JK	1.62±1.73[a]	2.03±1.65[b]	0.02±0.16[b]	0.000
HK	18.85±13.77[a]	22.28±11.72[a]	0.22±1.35[b]	0.000
CK	6.85±8.69[a]	8.32±9.91[a]	0.01±0.09[b]	0.000
Market life pigs				
TK	1.51±0.92[a]	0.94±0.48[a]	0.05±0.23[b]	0.000
JK	1.77±0.88[a]	1.97±1.91[b]	0.06±0.34[b]	0.000
HK	1.80±1.95[a]	1.86±1.97[a]	0.05±0.33[b]	0.000
CK	1.71±4.45[a]	0.71±1.13[a]	0.01±0.05[b]	0.031
Selling cuts				
TK	2.03±1.15[a]	1.17±0.56[b]	0.57±0.23[c]	0.000
JK	3.02±1.81[a]	2.94±2.35[a]	0.03±0.17[b]	0.000
HK	0.86±0.73[a]	1.83±0.75[a]	0.14±0.85[b]	0.000
CK	1.31±1.30[a]	0.60±0.62[b]	0.64±0.98[c]	0.000

**=highly significant (p<0.01),*=significant (p<0.05). Means in the same row with the same superscripts are not different at p<0.05. TK stands for "Tenaga Kerja" (Labors), JK stand for "Jam Kerja" (Working hours), HK stand for Hari Kerja (working days), CK stand for Curahan kerja (allocating works).

Table 3. Working hours allocation of the whole pig raising activities

Working activities	Working allocation/month		
	Men	Women	Children
Collecting feed	192,85	207,42	3,29
Feed processing	246,43	222,86	0
Feed offering	355,71	593,14	1,71
Medicine and sanitary	188,57	291,43	0,57
Marketing life pigs	590	0,342	0,285
Selling cuts	42,28	21,14	0,36
Total	1615,84	1336,332	6,215
Mean	53,86	44,54	0,21

activities for caring and carrying pigs. Activities such as caring and carrying shown the emotional relationship with the animals compared to men. Frequently, women pursue the caring activities by doing activities such as preventing the pigs from wound and injury. Therefore, medicine and sanitary works frequently practice. In selling the pig product such as life pigs and its cuts, man dominated the works more than that of women (21.14 h/ month) and children (0.36 h/month).

The fixed-, variable- and total costs, as well as revenue and net income generated from smallholder pig husbandry from household labors shown in Table 5. Fixed costs allocated during keeping pigs were costs of cage, tools, the sum of left value, the sum of new value, usage ages, and fixed cost values. Variable cost consisted of breeding cost, feed, medicine and light and hiring outsider labors. The average variable costs allocated by farmers IDR 474,285±155,474 (ranged between IDR 250,000-800,000) for buying new breed stocks. In addition to that, farmers also spent cash to provide feed, i.e. IDR 29, 142.86 (range between 0-100,000). To prevent sickness, farmers provide medicine, i.e. around IDR 31,428.86±32,280.57 (ranged between IDR 0-100,000). Energy of light needed by farmers, i.e. 18,571.4±32,280 (ranged between IDR 0-100,000).Outsider or hired labor have contributed for IDR 129,411±266,889 (ranged between IDR 0 – 800,000).

Total cost resulted from the sum of fixed cost and variable cost. The total cost allocated to purchase business of pig farms was IDR 2,047,714.29±499,194 (ranged between IDR 1,160,000 – 3,100,000).Revenue is grouped into labor specialists, i.e. adults and young (head/production). It seems that the average revenue earned by an adult was higher (7,442,857.14±1,842,199) from young ages (IDR 714,285.7±1,270.74). Total revenue of this smallholding pig farming systems potentially can achieve 14 million rupiahs. At the end, net income achievement can reach 2,650,000 million to 12,300,000 rupiahs (IDR 6,109,429,428.57 ± 2,226,665 million rupiahs).

Income

Revenue gained from total revenue minus total cost. Pig Farming in Manokwari Barat district is a family business with little capital. Metubun (2012) states that the pig farm business in Manokwari city is limited capital livestock business with small business scales. From the results of interviews, activities of pig raising as a work carried out to fill the spare time. A sideline business does not absorb the attention of many farmers. Less attention to pig farming at the research site shown in the physical condition of the damaged cage but it is still functioned and does not have cost breakdown in the form of notes.The data obtained from the respondents that the acceptance of pig farming is only sourced from the sale of pigs.

Other sources of income from pigs such as from pig manure do not exist (Iyai *et al*., 2015). This is because in general, the community has not realized the value of pig manure as compost and as a source of biofuel for electric power (Iyai, 2008). Means only one source of income from raising pigs in West Manokwari district is from the sale of pigs both in living conditions and already in the form of meat. Farmers usually sell pigs at grower and finish ages (life or cut) and weaners due to sudden economic needs. Beside pigs also sold at piglets. Mature finish pigs sell for IDR 5 million to IDR 12 million/head in one production process. The selling price of piglets is IDR 1 million- IDR 2 million/head.

The cash earned from pig production in Manokwari Barat district can reach IDR 6,109,500 million/hh. Meaning that income from sold pigs in two times production can reach IDR 12,220,000 in one year and contribute to the family's income of IDR 1,018,000 in each month.Based on the minimum needs/person of West Papua Province that the basic needs hh/month is IDR 475,559 revenue/cap/month increased from IDR 454,578, - in 2012 to IDR. 475,559 in 2013. There was an increase of IDR 20,981. Based on are five people. Then the income from raising pigs can subsidize the basic needs/month in the family of IDR 203,000. This means that the income from pig raising is one of the income sources of the farmer communities that help to improve the fulfillment of family basic needs.

Table 5, Illustrates the contribution of women, male and female labor earnings where each one can contribute income from pig breeding. Male labor donates income from the total income of IDR 95.208.978 or 45% with an average of IDR 2,508,064 or 4%. Female labor contributes income from the total income of IDR 116,168,331 or 54% with an average of IDR 3,048,387, while children labor can share IDR 2,452,690 or 1% with an average of IDR 443,548 or 1%.

All activities undertaken to produce yields took hours. Total income generated from raising a interviews and observations, inside a family, there pig in Manokwari Barat district is IDR 213,830,000 for total 35 households with an average gross margin of IDR 6,109,500/hh. This income is derived from the sale of pig production both life and its cuts. Selling pigs done by male,

Table 4. Fixed and variable costs, revenue and income in raising pigs

Income	Mean	SD	Min	Max
Fixed cost (IDR)	1.251.428.57	360.336	800.000	2.100.000
Cage (C) (unit)	612.857,1	293.142,9	300.000	1.500.000
Tools (T) (unit)	272.857,1	196.417,5	100.000	8.00.000
Sum of C+T (IDR)	885.714	460.908,9	500.000	2.000.000
New cost C+T (IDR)	1.428.571	439.633,2	1.000.000	2.500.000
Usage year (Yr)	5	0	5	5
Nilai BT (IDR)	1.251.429	360.335	800.000	2.100.000
Variable cost (IDR)	796.285,7	308.726.9	300.000	1.500.000
Breed cost (IDR/head)	474.285,7	155.474.3	250.000	800.000
Sum (head)	1.342.857	481.594	1	2
Breed (IDR)	591.428,6	163.367.9	300.000	1.000.000
Feed (IDR)	29.142,86	33.813.63	0	100.000
Medicine (unit)	31.428,57	32.280.29	0	100.000
Light (month)	18.571,43	32.280.29	0	100.000
TK (month/day)	129.411,8	266.889.4	0	800.000
Total cost (IDR)	2.047.714,29	499.194	1.160.000	3.100.000
Revenue (IDR)				
Adult/head/prod	7.442.857,14	1.842.199	5.000.000	12.000.000
Young/head/prod	714.285,7	1.270.744	0	7.000.000
Total revenue (IDR)	8.157.142,86	2.328.504	5.000.000	14.000.000
Income (IDR)	6.109.428,57	2.226.665	2.650.000	12.300.000

Table 5. Income shares contributed by man, women and children in raising pigs

Labor Type	∑ JK(Hour)*	JK(%)	PDT(IDR)	SPTKU(IDR)
Men	427	45	213,830,000	95,208,978.1
Women	521	54	213,830,000	116,168,331.6
Children	11	1	213,830,000	2,452.690,302
Sum	959	100		213,830,000

*JK stand for "jam kerja" (working hours), PDT stand for "pendapatan" (income), SPTKU stands for "sumbangan pendapatan tenaga kerja dari usaha", i.e. labor income shares of business.

female and child labors. A similar experience was found in Uganda (Ouma *et al*., 2013; Nabikyu and Kugonza, 2016), Malawi (Mbaso and Kamwana, 2013; Phiri, 2012a), Vietnam (Chau *et al*., 2017). Orthner *et al.* (2004) concludes that each worker can contribute his earnings to the family from business based on work time. Further explained that the large contribution of income from labor can be calculated according to work time. Table 4. and Table 5. describes the major contributions of male, female and child labor based on working hours.

Conclusions

There are tight distinguished working job done by specialist household pig farmers, i.e. among women, man and children on labors, working hours, working days, and allocating works. Women show dominance in pig farming activities, i.e. processing and offering feed, medicine and sanitary, life market and selling cuts. Therefore women sharing household income higher than other household labors specialist. In general, this smallholding pig farming system will sustain due to allocated low input, cost, and good market prices of the pigs.

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References

Ayoade, J. A., H. I. Ibrahim, and H. Y. Ibrahim. 2009. Analysis of women involvement in livestock production in Lafia Area of Nasarawa state, Nigeria. Livestock Research for Rural Development. http://www.lrrd.org/lrrd21/12/ayoa21220.htm. Accessed 24 June 2019.

Chau, L. T. M., P. Lebailly, and T. Q. Trung. 2017. Enhancing farmers' market power and income in the pig value chain; a case study in Bac Giang province Vietnam. Livestock Research for Rural Development. http://www.lrrd.org/lrrd29/12/ltmc29221.html. Accessed 24 June 2019.

Iyai, D. A. 2008. Innovationof pig keeping system in pig farmers at Manokwari, West Papua Province, Indonesia. Tesis, Wageningen University The Netherlands.

Iyai, D. A., B. Gobay, and A. Yaku. 2015. Understanding the objectives of pigs farming development in Arfak Tribe Farmers, West Papua-Indonesia. Agricultural systems. 3: 179-191.

Iyai, D. A., O. Marani, T. Marjen, and L. Usior. 2013. Pig farming performances of three Papuan tribes: the case study of Byak, Onate and Arfak Tribes in Papua Barat. Journal of The Indonesian Tropical Animal Agriculture 38: 55-64.

Iyai, D. A. 2010. Valuing and defining socio-economical factors of pig farming systems at Manokwari, West Papua. Jurnal Ilmu Peternakan 5: 35-45.

Mbaso, M. and B. Kamwana. 2013. Comparative analysis of profitability among feeder-pig-finishing and farrow-to-finish production systems under the smallholder improvement management system in Nteheu district of central Malawi. Livestock Research for Rural Development.http://www.lrrd.org/lrrd25/10/mbas25175.htm. Accessed 24 June 2019.

Metubun, J. 2012. Potensi dan pemanfaatan limbah pasar dalam menunjang pengembangan usaha peternakan rakyat di kabupaten Manokwari. Prosidings. Seminar Nasional Peternakan. Revitalisasi sistim peternakan berkelanjutan berbasis integrase dengan perkebunan untuk mewujudkan ketahanan pangan. 19 Mei 2012. Ristika Handarini dan Ma'ruf Tafsin (Ed.) pp.286.

Monim, H. 2012. Bio-economic model of native pig (*Sus Scrofa Papuensis* (Lesonand Garnot) production in integrated organised sweet potato (*Ipomoea batatas*) L.,Lam]-native pig system in Baliem Valley Jayawijaya Regency, Papua Indonesia. Doctor of Philosophy In Animal Science. University of The Philippines, Los Banos.

Nabikyu, J. and D. R. Kugonza. 2016. Profitability analysis of selected piggery business in peri-urban community of Kempala Uganda. Livestock Research for Rural Development. http://www.lrrd.org/lrrd28/5/nabi28095.html. Accessed 24 June 2019.

Ott, R. L. and M. Longnecker. 2001. An Introduction to Statistical Methods And Data Analysis. 5th edn.Texas A & M University. Wadsworht Group USA.

Orthner, K. Dennis H. Jones-sanpei, and S. Williamson. 2004. The Resilience and Strengths of Low-Income Families. Family Relation 53: 159–67.

Ouma, E. A., M. M. Dione, P. Lule, K. Roesel, L. Mayega, D. Kiryabwire, G. Nadiope, and D. Pezo. 2013. Characterization of Smallholder Pig Production Systems in Uganda. Livestock Research for Rural Development 26: 150. http://hdl.handle.net/10568/29094.

Phiri, R. E. 2012a. Determination of piggery business mortality in Balaka district, Malawi. Livestock Research for Rural Development. http://www.lrrd.org/lrrd24/8/phir24147.htm. Accessed 24 June 2019.

Phiri, R. E. 2012b. Determination of socio-economic factors affecting piggery business in Balaka district, Malawi. Livestock Research for Rural Development.http://www.lrrd.org/lrrd24/8/phir24146.htm. Accessed 24 June 2019.

Rahayu, D. P., W. N. Umi and D. U. Hari. 2012. Analisis Curahan Jam Kerja dan Sumbangan Pendapatan Tenaga Kerja Wanita Pada Usaha Penetasan Telur Itik. Fakultas Peternakan Universitas Brawijaya, Malang.

Saragih, D. T. R. and D. A. Iyai. 2015. Performances comparison between Urban and Rural Pig Farming Systems in Manokwari, West Papua Province Indonesia. Buletin Peternakan 29: 212-218.

Soekartawi. 2003. Teori Ekonomi Produksi. PT. Raja Grafindo Persada, Jakarta.

Suratiyah, K. 2008. Ilmu Usahatani. 2nd edn. Penebar Swadaya, Jakarta.

Tekle, T., A. Tesfy, and T. Kifleyohannes. 2013. Smallholder pig production and its constraints in Mekelle and southern zone of Tigray region, North Ethiopia. Livestock Research for Rural Development.http://www.lrrd.org/lrrd25/10/tekl25184.htm. Accessed 24 June 2019.

Warastuti, D. F. 2001. Analisis pendapatan usaha ternak babi di Pesisir Pantai Kota Manokwari. BSc thesis. Universitas Negeri Papua, Manokwari-Papua.