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Assessing Economic Livelihood of Small-scale City Swine Farmers Using Structural Equation Model of PLS: Special Case of Manokwari, West New Guinea Papua

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Authors' contributions

This work was carried out in collaboration among all authors. Authors MB and DAI are the leader of the study. Authors MB, DAI and DW conducted field research. Authors TWW and SS compiled field the data in Excel. Authors TWW, SS and SP run and interpreted the results. Authors MB, DAI, TWW and HM wrote the manuscript. Authors Mulyadi, HM, SAB and DW searched references and corrected the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

City swine farmers have been raising the swine in economical ways for generations. The research objective was to depict a sustaining small-home business of the city swine production, and to assure existence, sustainability and the roles in economic and production purposes. The represented sixty city farmers selected using snowball method as respondents gained from several sub districts. Questionnaire made was used in interviewing respondents of swine farmers. The SemPLS employed by using economical model. The principal findings are significant parameters and hypothesis proven in model designs are population swine affected cost swine and price of swine (p=0,000), price of swine induce sold swine (p=0.000) and sold swine determined income generation (p=0.000). Dropped variables after re-analyzed are X4: Cost breed, X7: cost housing,

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X8: Cost tools (loading factor under 0.5). It has been concluded from our study that SemPLS has been proven to be a flexible and an analytical tool that is suitable to test more number of parameters simultaneously.

Keywords: City swine farming (csf); SemPLS; West New Guinea Papua (WNGP).

1. INTRODUCTION

City livestock production (CLP) has been a trending livestock issue in developing sustainable farmer' development programs [1]. This is fully taken into account when small-scale home livestock business operates in and around the crowded human population, such as in urban areas. This characteristic of livestock farming tends to play a vital role in supporting livelihood of the poorer households [2]. They are exist running their business production and tied with a number of constraints.

Pictures of home-livestock business in the third world are under developed performance. The production seen mostly in the way of extensification production systems. Lack of improvement, unrolled market systems, weak of policies supports, low market demands, and etc. are the shapes of under developed livestock performs [3-8].

Constraints faced by city swine farmers (CSF) are complex and multiplied effects. However, gaining knowledge to solve that constraints need passion and critical construct of thinking. Why complex is due to interrelated factors and actors involvement. Why multiply is due to multiplayer effects. Economic effect such as income losses will bring loses in swine production and productivity [9,10].

Parameters assessed mostly in swine production are herding size, body weight, average daily gain, pig production productivity, pig production efficiency, litter size, farrowing rates, etc. Parameters assessed mostly on swine economic performance are costs of production, sold swine, prices of the swine, income and efficiency [11-15]. The economical and production parameters can be combined to have synchronization on interacted effects simultaneously. This will be tested using assessing analysis tool such as SPPS, Stat, and R. Now a days, many experts and researchers are using SemPLS [16-20]. Application of SemPLS on particular topics such as swine production and its factors economical parameters is lagging behind. This preliminary study is urgently need of the hour to prove the applicability of SemPLS on this case study of city swine farmers.

The relationship of swine population (herd sizes), swine prices, swine production costs (including variable and fixed costs), sold swine and earned swine income may have meaningful benefit in understanding the swine production cycles [9,21,22]. By building the mental models in line with swine city production system (cps), particularly city swine farming (csf), the dynamic and flows will be monitored and evaluated in appropriate methods.

The objective of this research is to assess the effects of herd size, sold swine, and swine costs on prices of swine, and income generation of the swine farmers. By doing this, a picture of sustaining small-home business of the city swine production can exist, sustain and play vital role in economical and production purposes.

2. MATERIALS AND METHODS

2.1 Sites and Sampled Farmers

Selected sites of this field research are Padarni, Sanggeng, Amban, Wosi sub district, West Manokwari District, Regency of Manokwari-West Papua province Indonesia. A month of field research was done during April to May 2021.

Observation and interviews were applied to 60 respondents out of the 145 city smallholding swine farmers (41.37%). We chosen these swine farmers using snowball method by considering the existing places of farmers living around the city town center. Therefore, It is interesting to improve knowledge and keen on their swine production, economic development and income generation.

2.2 Parameters

The outer model (formative) consisted of population of swine, cost of swine, sold swine, price of swine, and income of swine. We used SemPLS when simulating key target constructs or identifying key driver construct. Formative

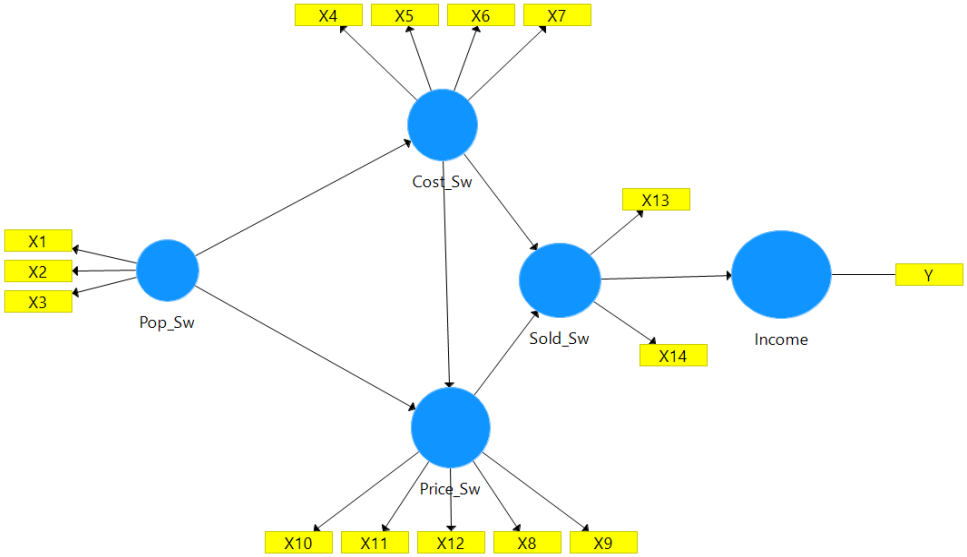

Fig. 1. Mental model drawn using SemPLS. X1: Population piglet, X2: Population weaners, X3: Population adults, X4: Cost breed, X5: Cost medicine, X6: Cost feed, X7: Cost housing, X8: Cost tools, X9: Price weaners, X10: Price adult, X11: Total price, X12: Cost total, X13: Sold piglet, X14: Sold weaners, Y: Income

constructs are easy to use in the structural model, the structural model is complex, small sample size and data not normally distributed, and the last one is to use latent variable scores in subsequent analyses. Ghozali (2008) provided protocol to analyze SemPLS using Outer model analysis using AVE indicator, Composite reliability (CR) and Goodness of Fit (GoF) [23,24].

Manifest variables (exogenous latent variables) consisted of population of piglet, population of weaners, population of adults, cost of breed, cost of medicine, cost of feed, cost of pens (house), cost of tools, sold of piglet, sold of weaners, sold of adults, price of piglet, price of weaners, price of adult, total prices, revenue, cost of total swine, and income. Latent variables are population of swine, cost of swine, sold swine, price of swine, revenues of swine, proportion of sharing, and income of swine. Structural model/inner model consisted of population of swine (pop-swine), sold-swine, cost-swine, price-swine, income swine. Structural equation model of Partial Least Squares, namely SmartPLS version 3.0 was employed (Ghozali and Latan, 2015).

2.3 Hypothesis

1. The prices of swine are being affected by swine population herd size
2. The population of swine influence cost swine
3. Sold swine are determined by the prices of swine and swine costs
4. Incomes of the farmers depends on sold swine

3. RESULTS AND DISCUSSION

Farmers characteristic consisted of ages ranged in the productive ages. Each households has 2-10 head/hh ($\bar{x}$ =5 head). Farmers are experienced in rearing swine from 1-37 years. They can keep maintain number of swines on the ranges of 1-89 AU/hh ($\bar{x}$=5.73 AU/hh).

Piglet size ranges between 0-50 (x:5.73 head/hh), weaner reached 20 head/hh), and adults reached 0-18 head/hh (2.00±3.014), while adult size was 2 head/hh in average. The breed cost spent by the CSF was IDR 283,333, medicine IDR 2166,67 (quite cheaper). The ranges of cost spent in ranges of IDR 2,166-1,077,333. Cost spent by CSF in proportion dominated by housing cost (33.76%), followed by breed cost (28.1%), feed (24,11%), tools (3,37) and medicine (0,22%). The proportion of prices dominated by adult prices (37.61%), followed by weaner price (4.82%) and piglet (4.05%). The proportion of sold piglet is 56.72% higher than sold weaner (28.73%) and sold adults (14.55%). Net income obtained from this small-home business is IDR 5,41,933 head/hh. From this figures, farmers have been earning small amount of income.

Table 1. Characteristic of city swine farmers performance

Variable	Observations	Minimum	Maximum	Mean	Std. deviation
Ages (y)	60	15.000	60.000	33.150	10.789
Member (head)	60	2.000	10.000	5.133	2.236
Experience (y)	60	1.000	37.000	8.300	6.468
Herd size (head)	60	1.000	89.000	11.583	17.384
X1:Pop_piglet (head)	60	0.000	50.000	5.733	9.053
X2:Pop_Wean (head)	60	0.000	20.000	3.100	4.375
X3:Pop_Adult (head)	60	0.000	18.000	2.033	3.014
X4:Cost_Breed (IDR)	60	0.000	800000	283333.333	241931.96
X5:Cost_Medicine (IDR)	60	0.000	50000	2166.667	7611.692
X6:Cost_Feed (IDR)	60	0.000	900000	243000.000	215149.140
X7:Cost_House (IDR)	60	0.000	2000000	340233.333	506471.22
X8:Cost_Tools (IDR)	60	0.000	300000	34000.000	73696.584
Cost_Total (IDR)	60	0.000	7000000	1007733.333	1012847.201
X9:Price_piglets (IDR)	60	0.000	700000	260000.000	224891.688
X10:Price_Weaners (ID)	60	0.000	1000000	310000.000	366245.264
X11: Price_Adults (IDR)	60	0.000	9000000	2416666.667	3076932.584
Price_Total (IDR)	60	0.000	32000000	6425000.000	7594302.615
Sold_piglet (IDR)	60	0.000	10.000	2.533	2.646
X13: Sold_Weaners (IDR)	60	0.000	7.000	1.283	1.823
X14: Sold_Adults (IDR)	60	0.000	4.000	0.650	0.971
Y: Income (IDR)	60	1800000	32000000	5418933.333	7333724.038

The AVE value was employed to analyze discriminant validity value with correlation between construct and other constructs in the mental model. The AVE values has to have value above 0.5. We got cost swine 0.479 and price swine under 0.5. Other parameters are above 0.5. The significant of the AVE is for assuring further feasibility assessing convergent reliability. The requisite values of composite reliability shall above 0.6 and the outputs in the Table 2 reached by these indicators setup.

In the Table 3, the manifest variables that reached above 0.5 are X1 to X14 including Y. Since the loading factors have not achieved standards of 0.5, these parameters were culled, namely X4, X7, and X8 (Fig. 2).

Table 2. Average extracted value and composite reliability

Latent variables	AVE	Composite reliability
Cost swine	0,479	0,620
Income	1,000	1,000
Population of swine	0,766	0,908
Price_Swine	0,496	0,793
Sold_Swine	0,553	0,710

Table 3. Values of loading factors in the measurement model

Indicator	Loading Factor Value
X1=Population piglet	0.925
X2=Population weaners	0.857
X3=Population adults	0.842
X5=Cost medicine	0.420
X6=Cost feed	0.884
X9=Price weaners	0.770
X10=Price adult	0.821
X11=Total price	0.666
X12=Cost total	0.524
X13=Sold piglet	0.661
X14=Sold weaners	0.818
Y=Income	1.000

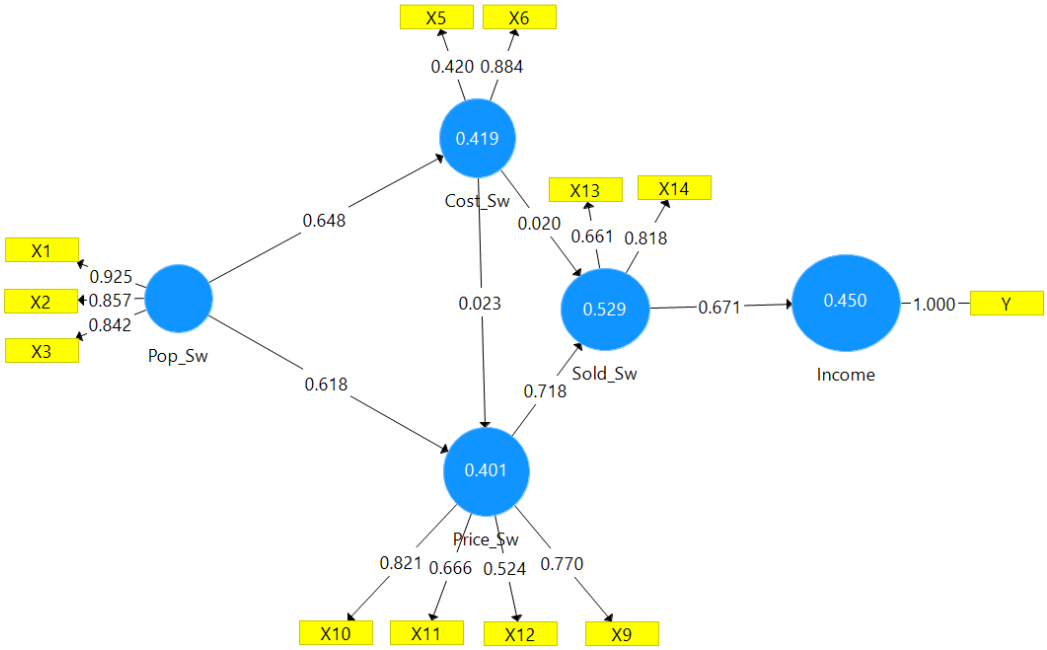

Fig. 2. Results of the first analysis for checking loading factor values. X1: Population piglet, X2: Population weaners, X3: Population adults, X5: Cost medicine, X6: Cost feed, X9: Price weaners, X10: Price adult, X11: Total price, X12: Cost total, X13: Sold piglet, X14: Sold weaners, Y: Income

Table 4. Result test of hypothesis

Result of hypothesis test	T-value	P values
Cost-Swine -->Price_Swine	0.747	0.455
Cost-Swine-->Sold_Swine	0.478	0.633
Pop-Swine -->Cost_Swine	5.053	0,000
Pop-Swine --> Price_Swine	2.855	0.004
Price_Swine -->Sold_Swine	10.181	0.000
Sold_Swine --> Income	6.344	0.000

Table 4 represents the output of refinement model to test the hypothesis, which is a result of significant value, where swine population determine the cost swine (p=0.000), including population of swine will significantly affect prices of the swine. On one hand, prices of the swine will also in turn determine sold swine. We also found that sold swine will induce raising income of the swine farmers (p=0.000). Cost of swine do not have significantly influence the swine prices of swine (p=0.455) and sold swine (p=0.633).

3.1 Discussion

Swine costs consisted of variable and fix costs [25,6,26] Table 1 represents the variable costs which consisted of breed cost (X4), medicines (X5) including treatment and veterinary cost, feed cost (X6), while fix cost consisted of housing (X7) and tools costs (X8). From these figures, the breed cost (X4) and housing cost (X7) and tools (X8) are dropped out due to under loading values 0.5. The breeding, housing and tool cost do not determine relationship of the total costs on swine income simultaneously. The outcome of this phenomenon revealed that this phenomenon, it reveals that consumers and farmers do not have preference in determining chosen breed to buy and breed to sold [27]. The breeds of swine in WNGP are not varied a such breed in outside WNGP and Indonesia [28,29,30]. In Europe, ASIA, America, breeds can determine the costs, sold, prices and gained income generation [31-35,21]. Preferred breeds can improve efficiency in raising swine, consumers demand and/or preferences. The city swine producers do not see these phenomenon of market demands on breed preferences [3,5,36,37,7]. Studies and

information on breed preferences have not been considering the issue of breed preferences which become the priority to improve certain and typical breeds.

Variable costs on housing and tools used in the CSF do not have appropriate facilities. Swine housing and its inside compartment do not provide in fulfilling standard and quality [38,-42,21]. The housing and rooms inside do not meet the animal welfare and animal rights. This slows the production and demand of the consumers to purchase. This in turn will determine the prices and sold swine. Appropriate housing with the size including length, height, and width will affect the number of head animal will be raised inside the housing. The herd size will determine pig production productivity and pig production efficiency [43,25,44,29,45].

Under slums, small-home business (SHB) will become the first choice and priority [46,35]. Several researchers in WNGP have proven it. Coastal livestock farmers particularly the swine farmers have been dependent on this kind of city swine production [47,10,37]. The CSF is the one that realistic being practiced and applied until sold their swine outside Manokwari.

4. CONCLUSIONS

City swine farming productivity will reach its potential income generation applied by city livestock farmers particularly city swine production via using indicators of economic cycle on swine production, swine cost, swine prices and sold swine. City swine farmers have considered breeds, housing and tools improvement. Calculation proved that cost spent by CSF in proportion dominated by housing cost, followed by breed cost, feed, tools and medicine. The proportion of prices dominated by adult prices, followed by weaner price and piglet. The proportion of sold piglet is 56.72% higher than sold weaner and sold adults. Net income obtained from this small-home business is IDR 541,933 head/hh. The CSFs have been earning small amount of income.

In achieving city livestock production and city swine production, better swine practices needed to be applied. Small-home business will optimize income generation by considering relationships of the parameters which in turn enhance city swine farmers to earn higher economic efficiency. It has been concluded from our study that SemPLS has been proven to be a flexible and an analytical tool that is suitable to test more number of parameters simultaneously.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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