Research article

Profitable Management Styles of Small-Scale Pig Farming in Rural Areas of Cambodia

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Abstract For years, farmers in rural Cambodia have practiced small-scale pig farming mainly with family-based production. However, in recent years, there has been an increasing inflow of imported pigs grown with a lower production cost in neighboring countries. In addition, the share of products from domestic large-scale pig farming using commercial production systems has been increasing. This situation has led to price fluctuations in Cambodia's highly competitive pig and pork meat market, which affect family-based small-scale pig farming in rural areas. This study aimed to identify various management styles of small-scale pig farming and analyze their business status to discuss the profitable management styles under low sale price conditions. To grasp the pig farming styles, key informant interviews were conducted with government officers, middlemen, and pig farmers in the Treang and Tramkak districts of Takeo Province and in urban markets of Phnom Penh. The economic statuses of pig farming were clarified by interviewing the pig farmers and observing their rearing practices in the same areas to compare the profitability of different management styles. As a result, three pig farming styles were identified: fattening, breeding, and both. On the other hand, some farmers fed their pigs mainly with rice liquor residues with compound feeds, while some did not use rice liquor residues at all but mainly compound feeds. The comparative analysis of their economic statuses clarified that combining the fattening and breeding operations and feeding the pigs with both compound feeds and rice liquor residues effectively decreased the production costs and yielded comparatively high profits.

Keywords small-scale pig farming, import, by-product, agro-processing, animal feed

INTRODUCTION

In Cambodia, which is positioned as one of the least developed countries in the world, about 80% of the population of about 15.57 million people (WB, 2015) lives in rural areas (MOP, 2013). Among the working population, 64.3% are engaged in the agriculture sector (ADB, 2015) and account for 28.2% of the gross domestic product of the country (WB, 2015). The Cambodian government has prioritized the sector for poverty alleviation through increased income from agriculture, including crop and livestock production (MOP, 2014). Due to recent economic and population growth, the demand for meat has increased and this can enhance livestock production (MAFF 2015). Since then, pork has been the most consumed meat in Cambodia, and small-scale farmers have supplied about 70% of the pigs consumed (Huynh, et al., 2006). However, the importation of pigs and pork meat from Vietnam and Thailand has been increasing (Tornimbene and Drew, 2012). Cambodian domestic

pig production peaked in 2006, before starting to decrease (FAO, 2020). Since mid-2015, the price of pigs has been decreasing due to increasing pig imports, and local farmers cannot meet their daily expenses (Phnom Penh Post, 2016). Tornimben and Drew (2012) argued that the increase of lower priced imported products has discouraged Cambodian farmers from raising pigs and in extreme cases, abandon their business. Vathana and Takeya (2006) clarified the advantageous conditions of that have resulted in lower production costs in those neighboring countries compared to small-scale Cambodian pig production. In addition, in 2012 the Association of South East Asian Nations signed a free trade agreement to lift the tariff barriers of all items within the region (FAO, 2012). This loss of protection could greatly impact small-scale pig farmers under more severe business environments in the near future. Moreover, as large-scale pig companies with commercialized production systems have increased their supply share in Cambodia, the family-based small-scale pig farming faces more challenges competing with cheaper and higher quality pigs from both imported and commercialized products (Thai, 2018). Strom et al (2017) clarified that small-scale pig farmers recognized the main constraints to pig-keeping were high feed costs and pig diseases as well as low pig sales prices. Recently, the high cost of compound feed and high labor requirement make it less attractive for farmers to continue this business (Ashley et al., 2018).

Previous studies on pig farming in Cambodia discussed the advantages of utilizing agricultural by-products as pig fattening feeds (Vathana and Takeya, 2004). Yagura et al (2010) suggests that the by-products of rice milling and rice liquor production can be used as pig fattening feeds when available in appreciable quantities. However, no research has been found that gives a detailed situation on how small-scale pig farmers in Cambodia are coping with the declining price of pigs due to the increasing pig importation.

This study aimed to identify various management styles for small-scale pig farming and analyze their business statuses to discuss the profitable management styles under low sales price conditions.

METHODOLOGY

This study consisted of three field studies, including key informant interviews, semi-structured interviews, and structured interviews with small-scale pig farmers on their management styles and business statuses to determine the more profitable management styles for pig farming in the rural areas of Cambodia. The key informant interviews aimed to determine the necessary information for further field studies, including the location and recent situation and issues of pig farmers in the survey area. In order to identify existing management styles of pig farming, semi-structured interviews were conducted with all the available pig farmers in the survey area according to the result of key informant interviews. Finally, semi-structured interviews were conducted with pig farmers who had different management styles to analyze their business status, including all the necessary costs and sales to calculate their profit. Then, a profitable management style and its characteristics were discussed through a comparative analysis among the business status of different management styles.

Target Area and Data Collection

The surveys for this study were conducted in Tramkak and Treang districts of Takeo Province (Fig. 1) which are in rural regions where the numbers of small-scale pig farming were confirmed with the rice liquor production (Hamano, et al., 2013). Takeo Province is located between Phnom Penh (capital city) and the Vietnam border, which are connected by the National Roads.

The key informant interviews were conducted to understand pig farming management styles and its distribution system in the survey areas in August 2016. The key informants selected for the study were government officers at animal husbandry offices, the district office under the provincial Department of Agriculture, the merchants at the local markets, slaughterers, middlemen, and several pig farmers.

Semi-structured interviews and observations to collect data on the economic status of pig farming were conducted in August and September 2016. First, the simple survey to understand the farmers' management styles, which could be breeding or/and fattening, as well as their feeding

operation and main material, was conducted with 21 farmers in the two districts. Five of these farmers with different management styles took part in the detailed survey through semi-structured interviews on their economic status and observation of their operations. The data on the production costs on revenue were collected, including the cost of piglet, feeding in several growth stages, facility and health care, growth periods and weight increases of pigs, the weight of sold a pig and its sales price, and profit from the various management styles.

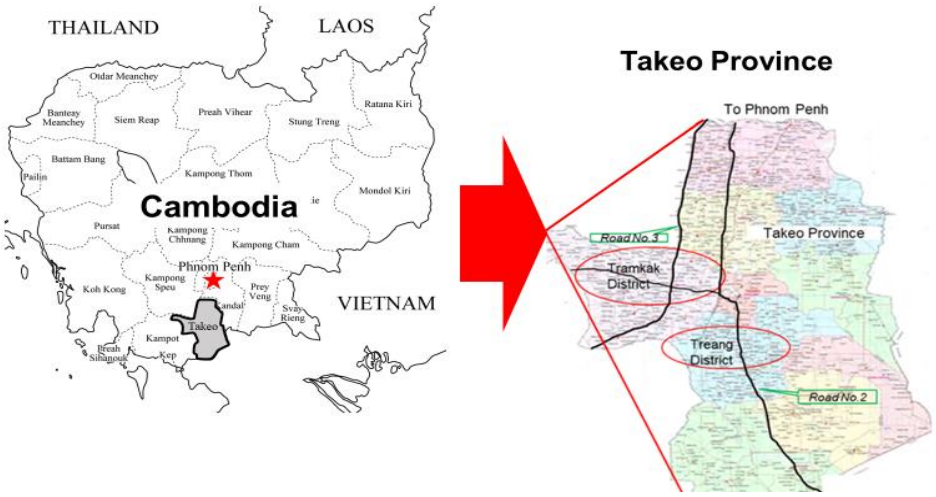

Fig. 1 Target areas for the survey

An analysis of the profitability was conducted by comparing the profit per pig (head) and the farmers' monthly income from pig farming. The monthly incomes were also simulated under the lower sales prices than those at surveyed time, -1,000 Riel (4,000 R = 1.00 USD), -2,000 Riel, and -3,000 Riel to examine which management styles can survive under a fluctuating pig market.

RESULTS AND DISCUSSION

Management Styles of Pig Farming

Pig farmers were targeted and interviewed to grasp their operation styles in the areas. As a result, 21 farmers were interviewed and three styles of operation were confirmed: only breeding (2 farmers), breeding and fattening (8 farmers), and only fattening (11 farmers). Their feeding operations were also confirmed. Fifteen farmers fed the pigs mainly with rice liquor residues and compound feeds, while 6 farmers mainly used compound feeds without rice liquor residues (Table 1).

Table 1 Identified management styles of pig farming

Management style	No. of interviewed pig farmers		
	Main feed material		
	Rice liquor residue and compound feeds	Compound feeds	Total
Breeding	1	1	2
Breeding + fattening	3	2	5
Fattening	11	3	14
Total	15	6	21

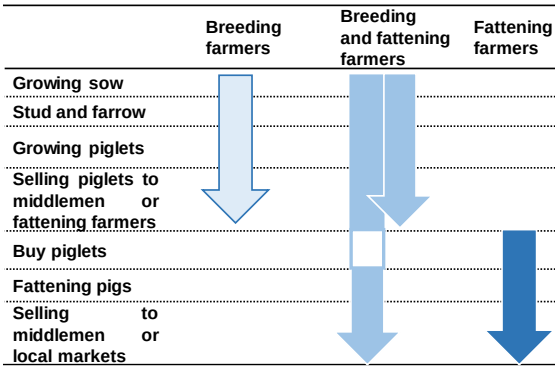

Fig. 2 Chain of pig production system

Fig. 2 shows the distribution flows of the piglets and fattened hogs according to the results of key informant interviews and semi-structured interviews with the 21 pig farmers. Three types of pig farmers, only breeding, breeding and fattening, and only fattening, were identified. The farmers who breed and fatten the pigs obtained all piglets from their own breeding. One breeding cycle is generally about 5 months. The farmers who only fattened the pigs purchased the piglets directly from breeders or from middlemen. The fattened pigs were sold through middlemen or transported by pig farmers themselves to the local markets in the surveyed areas, where they were marketed either by a slaughterer in the same district, by a middleman, or sometimes by the farmer himself.

Business Status in Different Management Styles

To conduct semi-structured interviews on production cost and sales revenue and observe the pig farming practices, five of the 21 interviewed farmers were selected for the survey. The farmers included: two farmers (A and B) who focused only on fattening using rice liquor residues and compound feed; one farmer (C) who focused only on fattening using compound feeds without rice liquor residues; and two farmers who managed both fattening and breeding, one (D) of which used liquor residues and compound feeds while the other (E) only used compound feeds. There was no chance to interview the farmers of animal breeding in detail.

The farmers were asked about their production costs and sales revenue for one fattening cycle for farmer A, B, and C, and one cycle of breeding and fattening for farmer D and E. Table 2 shows compares the profitability of different management styles based on the production costs including feeding and piglet costs, sales revenue, fattening periods, and increase in weight.

Farmer A focused on pig fattening by feeding them mainly with rice liquor residues and compound feeds. The rice bran from a neighboring miller and water convolvulus from her garden and pond were used as feeds. Farmer A bought 17 piglets, each of which weighed about 7 kg. Three piglets died from a disease in the very beginning, and the remaining 14 pigs were sold at a weight of 79 kg each after 5 months of fattening. Feeding costs were the highest proportion at 63.3% of the total costs at 5,268,000 R. The piglet cost was the second highest proportion at 32.3% of total expenses. Health and facility cost shared 4.4%. The sales of 14 pigs at a price of 8,000 R/kg earned a profit of 3,532,000 R.

Farmer B focused on pig fattening by feeding them mainly with rice liquor residues, compound feeds, and rice bran. Three pigs weighed about 35 kg each; they were fattened for 3 months after purchase, and all of them were sold at a weight of 105 kg each. Farmer B only purchased pigs that had been grown for 2–3 months since the risk of managing them is low compared to piglets with a higher risk of disease and death. The pigs can also be fed with rice liquor residues from the starting point, while piglets, after weaning, require a different compound feed for about a month. The pig cost was almost as high as the feeding cost, making up 48.0% and 49.5% of the total production cost (2,012,000 R), respectively. Farmer B sold the three pigs at a price of 8,500 R/kg and made a profit of 666,000 R.

Farmer C managed pig fattening operation by feeding the pigs with only compound feed and rice bran without rice liquor residues. The feeding cost shared the highest ratio at 68.6% of total costs at 1,921,000 R. Subsequently, piglet cost for 5 piglets which weigh around 5 kg each shared 26.0% of the total cost. All 5 piglets were fattened to 65 kg/head on average and sold at a price of 8,000 R/kg gaining the profit of 679,000 R.

Farmer D managed both the breeding and fattening operations. The farmer fed pigs with rice liquor residues, rice bran, and compound feed. Table 3 shows the production costs and sales in the breeding stage. Farmer D grew a total of 28 piglets from 3 mother pigs (sows). Nine of them were sold as piglets; 11 were fattened as hog for sales; 2 females were grown to be sows, while 6 died before weaning. For the breeding stage, the feeding cost for sows and piglets shared 77% of the total breeding cost at 744,000 R. The sales of 9 piglets gained a profit of 801,000 R in breeding stage. In the fattening stage (Table 2), the total cost of farmer D was 2,783,000 R for 11 fattened pigs. In addition, for the feeding cost and piglet cost were 85.9% and 13.4% respectively of the total cost. No medicines and vaccines were used during the fattening stage. All 11 fattened pigs were sold at 7,800 R/kg with 63 kg of each body weight and generated a profit of 2,638,000 R.

Farmer E also managed both the breeding and fattening operations. The pigs were not fed with rice liquor residues. As shown in Table 2, 20 piglets were grown by farmer E from two sows. Thirteen of them were sold as piglets, while the remaining seven were fattened. The feeding cost at the breeding stage was 83.1% of the total breeding cost of 1,423,000 R. The profit from the 13 piglets sold was 1,677,000 R. The breeding cost per head could be considered as the piglet cost per head at the fattening stage in Table 2. The total cost of Farmer E was 3,104,000 R for 7 fattened pigs for 4 months fattening period. The feeding cost and the piglet cost were 83.6% and 16.0% respectively of the total cost. The 7 pigs were sold at 8,500 R/head with 5 kg body weight and gained a profit of 393,000 R.

Profitability among Different Management Styles

Farmer A and farmer C were compared based on their differing feed management systems, as far as using rice liquor residues, on the similar conditions of the piglets, at 5 to 7 kg/head and around 1 month old, for fattening initiation. The feeding cost per pig for farmer A was 9.8% lower than that for farmer C. The feeding cost to increase 1 kg weight in famer A's pigs was 24.2% lower than that of farmer C. The fattened pigs were sold at the same price, therefore farmer A's sales revenue per pig was 21.0% higher than farmer C, based on the weight of pig sold. Therefore, the profit per pig of Farmer A was 85.3% higher than that of farmer C. The monthly income per pig of farmer A was 47.1% higher than that of farmer C. Using rice liquor residues in the feed resulted in improving the cost effectiveness per 1 kg of weight gain, contributing to lowering the feeding cost per pig and achieving a lower total cost and higher profit per head. As a result, the monthly income per pig was also higher even though farmer A's system took 1 month longer than farmer C's. Although farmer B fed the pigs with rice liquor residues and compound feeds, the initial cost for purchasing bigger pigs, feeding cost per pig, and feeding cost to gain 1 kg weight were 39.5% and 42.5% higher, respectively, than those of farmer A. As a result, production cost per pig for farmer B was 78.5% higher than for farmer A. Profit per pig for farmer B was 11.9% lower than for farmer A. However, farmer B took only 3 months to build 70 kg weight in the pigs while famer A took 5 months to build 72 kg, and contributed to farmer B's attainment of a higher monthly income per pig that was 48.0% higher than that of farmer A.

The main difference between farmer D and E was the feeding operation of either using rice liquor residues or not using them for both breeding and fattening management. The feeding cost per sow and per piglet of farmer D were 51.7% and 49.1% lower, respectively, than the feeding cost for farmer E. As a result, the production cost per piglet of farmer D was 52.1% lower than that of farmer E. Additionally, the feeding cost per pig and feeding cost to gain 1 kg of body weight for farmer D's pigs were 41.5% and 45.5% lower, respectively, than those of farmer E. As a result, the production cost per pig was 43.0% lower than that of farmer E. Profit per pig for farmer D amounted to about 4.3 times that of farmer E's pigs. Monthly income per pig for farmer D was 3.4 times of that for farmer E.

The profitability between only fattening management and both breeding and fattening management can be compared between farmer A and farmer D under the same feeding operation of using rice liquor residues, compound feeds, and rice bran (Table 2). The feeding cost per pig and the feeding cost to increase 1 kg weight on the pigs of farmer A at 238,000 R and 3,328 R, respectively, are similar to those of farmer D at 217,000 R and 3,439 R, respectively. However, the piglet cost per head for farmer D is 34,000 R, which is 66.0% lower than that for farmer A.

As a result, the production cost per pig for farmer D is 32.7% lower than that for farmer A. Since the body weight of farmer A's sold pig was 79 kg, which is 16 kg heavier than that of Farmer D's sold pig, the sales revenue per pig for farmer A is 27.6% higher than that for farmer D. Profit per pig and monthly income per pig for farmer A were 252,000 R and 50,000 R, respectively. This was similar to price per pig and monthly income per pig for farmer D at 240,000 R and 48,000 R, respectively, and were higher than those for farmer C and farmer E.

Table 2 Comparisons of profitability in different management styles

Farmers	A	B	C	D	E
Management styles	Fatten -	Fatten -	Fatten -	Fatten Breed	Fatten Breed
Compound feeds	Use	Use	Use	Use	Use
Rice liquor residue	Use	Use	Not use	Use	Not use
Pigs for starting	17	3	5	11	7
Pigs marketed	14	3	5	11	7
Death loss	3	0	0	0	0
Growing period (month)	5	3	4	5	4
Feed cost (‘000 R)	3,335	996	1,318	2,390	2,595
Piglet cost (‘000 R)	1,700	966	500	372	498
Facility cost (‘000 R)	83	50	3	21	11
Health cost (‘000 R)	150	0	100	0	0
Total cost (‘000 R)	5,268	2,012	1,921	2,783	3,104
Total weight of sold pigs (kg)	1,100	315	325	695	412
Average starting weight (kg)	7	35	5	-	-
Average sold weight (kg)	79	105	65	63	59
Unit price of sold pig (R/kg)	8,000	8,500	8,000	7,800	8,500
Revenue (‘000 R)	8,800	2,678	2,600	5,421	3,498
Profit (‘000 R)	3,532	666	679	2,638	393
Profitability (fattening) (%)	40.1	24.9	26.1	48.7	11.2
Feed cost/pig (‘000 R)	238	332	264	217	371
Feed cost to gain 1 kg weight (R)	3,328	4,743	4,393	3,439	6,306
Piglet cost/pig (‘000 R)	100	322	100	34	71
Production cost/pig (‘000 R)	376	671	384	253	444
Sales revenue/pig (‘000 R)	629	893	520	493	500
Profit/pig (‘000 R)	252	222	136	240	56
Monthly income/pig (‘000 R)	50	74	34	48	14
Monthly fattening income (‘000 R)	706	222	170	528	98
Monthly income from piglet sales (‘000R)	-	-	-	160	335

Note:

- *The feeding cost included feed material and purchased feed price and amount during the several stages of fattening period. Feeding cost using the rice liquor residues were accounted at zero cost since rice liquor earned incomes.*
- *Piglets cost consisted of the unit price per head and the numbers purchased for fattening operators. Piglet cost for both the fattening and breeding operators consisted of numbers of sows and piglets with breeding costs included the feeding cost of sow and piglets, as well as the facility and health management costs.*
- *The facility cost accounted with 10 years of pig house depreciation and health management cost.*
- *The labor cost was not included in the calculation since all the respondents operated with only family members.*

Profitable Management Style under the Low Sales Price

Fig. 3 simulates the change in the monthly income per fattened pig under declining sales prices. Farmers reported that lower pig sales price per kg of weight in the past were in the range of 5,000 R-7,000 R which were 1,000 R-3,000 R lower than the current sales prices at around 8,000 R-8,500 R. Farmers C and E who fed the pigs with compound feed without rice liquor residues faced a deficit when sale prices decreased 2,000 R and 1,000 R respectively.

On the other hand, farmer A and D, who feed the pigs with both rice liquor residues and compound feed, can remain profitable with sales price decreasing 3,000 R. The amount farmer B generated on a monthly basis as income per pig was around 1.5 times that of farmer A and D at the sales price during the survey. However, if the sales price went down by 2,000 R, farmer B would run into a deficit due to the higher production cost per pig compared to Farmer A and D. The comparison between farmer A and D also shows that farmer D can keep advantageous income during the sales price declines due to a lower production cost than farmer A.

Table 3 Comparisons of economic statuses of breeding managements

Farmers	D	E
Mother pigs	3	2
Born piglets	28	20
Sold piglets	9	13
Fattened piglets	11	7
Grown as sow	2	0
Dead piglets	6	0
Production cost ('000 R)		
Feed: sows	518	1,073
Feed: grown piglets	56	110
Facility	42	15
Health	128	226
Total cost	744	1,423
Cost/ piglet	34	71
Sales, cost, profit: Sold piglets ('000 R)		
Unit price for sales	123	200
Sales revenue	1,107	2,600
Production cost	306	923
Profit	801	1,677
Monthly income	160	335

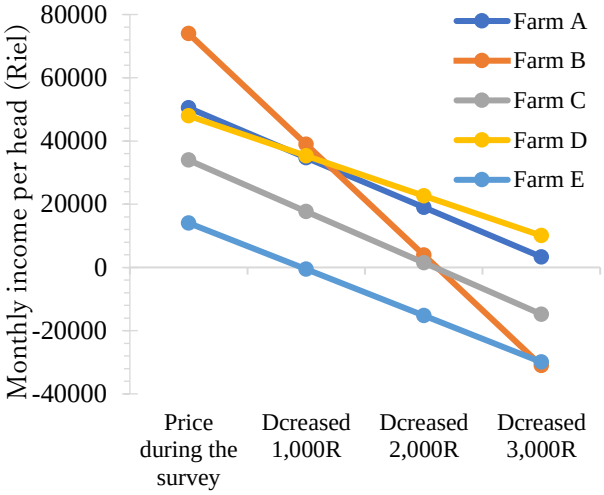

Fig. 3 Monthly incomes per fattened pig

The comparison of the feeding operations between rice liquor residues and/or compound feeds shows that rice liquor residues contributed in lowering the feeding cost. The feed management of farmers A and D with rice liquor residues, compound feeds, and rice bran showed a higher feed cost efficiency to increased body weight relationship than those of farmers C and E who used only compound feeds and rice bran. Comparing farmers who deal with breeding and/or fattening operations revealed that an integrated management of both can contribute to a decrease in piglet costs for fattening. The total cost of breeding sows by feeding them with rice liquor residues can produce piglets at a lower cost than the purchasing price in the market, which includes the margin of breeders and middlemen. As a result, the initial fattening cost can decrease, and it can contribute to the decrease in the total cost. Additionally, breeding can generate income from piglet sales.

CONCLUSION

This study aimed to identify the management styles of small-scale pig farmers in Cambodia and to discuss the profitability of each style by comparing their economic statuses. The results of the interviews and observations to farmers indicated the effectiveness of integrated pig farming operations with breeding and fattening stages and feeding management with rice liquor residues and compound feeds to decrease the production costs. The results showed possible challenges for small-scale farmers to sustain a profitable status despite the lower sales prices of pig markets in Cambodia.

The integrated management requires more skills and knowledge on both fattening and breeding management, including mating and taking care of small piglets that could easily die from diseases. Wider spaces to take care of sows and piglets are also necessary. To feed pigs with rice liquor residues, a farmer needs to manage rice liquor production and sales activities, which require equipment and stable operations and sales. Thus, further studies are necessary to understand how the farmers obtain and accumulate the information and experiences of the production techniques and business managements, how they cope and optimize their businesses within the limited resources in labor, finance, land, equipment, and materials in family-based small-scale productions, and what kind of external interventions are necessary and effective.

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