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Factors Contributing to Animal Health Risks: Implication for Smallholder Pig Production in Vietnam

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Abstract

In Vietnam, there are about four million households producing pigs of which more than half are producing at small scale, i.e., about one to two pigs per production cycle. One of the most critical constraints to pig production, especially for small scale, is the presence of animal disease. Many types of diseases have been reported by smallholder pig producers in Hung Yen such as diarrhea, pneumonia, fever, blue ear, head edema and pasteurellosis. The percentage of sick pigs is highest among piglets (27 percent), as compared with growing pigs and fatteners (five percent each). Diseases could lead to death of pigs, resulting in economic losses to the pig producers. Estimates of the cost of mortality in pig production in Hung Yen were about 3.3 million VND per household, accounting for about 13.6 percent of total income from pig production. Results of this study suggest that there are some practices that contribute to mitigating disease risk and those practices can be easily applied at small scale of pig production. These practices are related to applying a suitable production scale, isolating different age classes of pigs, designing pig houses and using specialized livestock farming tools and sanitation. The value of losses avoided from the above practices is estimated at 320.3 USD per household per year.

Key words: Pig production, animal health risk, food safety

Rationale

Pig production plays an important role in Vietnam. In 2011, there are about four million households producing pigs. Pig production industry contributes about 74-80 percent to total quantity of meat production and generates around 14 percent of household income (Nga et al., 2013). Hung Yen is a province located in the Red River Delta. It is one of the leading provinces in pig production. In practice, pig production in Hung Yen contributes more than 65 percent to household income of pig producers and in total pig production accounts for 40 percent to gross output of agricultural production of the province.

Pig production in Vietnam is typical of agricultural production characteristics in developing countries in that the number of producers is very large but the scale of production is quite small. As the pig industry has developed, the scale of pig production of households has increased since the mid-1990s. However, the majority of producers are still smallholders (Costales et al. 2006). According to Tung (2009), in 2006 about 92% of pig production households have a scale of one to ten head. The proportion of households producing more than

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ten pigs per year was very small (only eight percent). At present, small scale production remains predominant in the country. According to Nga et al. (2013), there are more than four million pig raising smallholders in the country, of which 52% are raising from one to two pigs. Household pig production supplies at least 80% of Vietnam's pork (Lapar et al., 2011).

One of the most critical constraints to pig production, especially for small scale, is the presence of animal disease. Pig disease outbreaks are a regular occurrence in various parts of the country, with the industry affected by diseases such as foot and mouth disease, porcine reproductive and respiratory syndrome, classical swine fever, porcine high fever disease, and swine influenza (MARD, 2013; Nga et al, 2013). Moreover, food safety issues related to pig diseases and pork-borne illnesses have also increasingly become more important concerns for the majority of consumers. For instance, at least half of urban consumers stop consuming pork in times of pig disease epidemics and/or shift consumption to other meat substitutes such as poultry or fish (Lapar et al. 2011). The presence of antimicrobial residues from treatment of pig diseases is cited as one of the concerns by consumers when they consume pork (Nguyen Thi Thu Huyen and Pham Van Hung, 2016).

Objective

The broad objectives of the paper are to understand the risk factors for pig diseases and to identify practices that can help mitigate the risks and their negative consequences.

Literature Review on Factors Contributing to Pig Disease

In practice, there are a number of factors contributing to pig diseases. The following section presents a synthesis of factors that are associated with e pig diseases based on existing literature.

- Production system: According to Faustin (2003) and Nansen (1999), production system such as extensive or intensive production affects possibility of disease occurrence, especially for diseases related to helminths. Extensive production system often has lower economic efficiency and a higher proportion of dead pigs. However, it still has been accepted in practice because it has low fixed costs and takes advantage of the household-products. Free-ranging pig production still exists in Vietnam, especially in mountainous and remote areas. However, pig farmers in Hung Yen no longer raise pigs in free-ranging production system.

- Production scale: Production scale is indicated as a factor in many studies that influences occurrence of diseases in the swine industry. For example, according to Pinto (2003), the herd size has been demonstrated as one of the main risk factors for pig diseases. Farms with many animals tend to have an increased amount of animal movement, an important factor for diseases such as classical swine flu. Hurnik et al (1994) and Broens (2005) also agree with Pinto (2003) that the likelihood of disease especially of infectious diseases, increases with scale of production. These authors analyze the factors affecting diseases from biology perspective. However, from economic point of view, according to Nga et al. (2013), disease

occurs more often in small scale production settings due to constraints faced by farmers to access input markets especially veterinary services. Beside production scale, density and the number of pigs and pig farmers in surrounding area also increases the likelihood of disease (Simon-Grife and Lambert 2012).

- Feeding practice: Feeding method is considered as one of the factors affecting the likelihood of disease in the swine industry. For example, scavenging will increase the ability of the pig disease (Hurnik et al 1994).

- Vaccination: According to Monger (2014), using a vaccine is one of the measures to reduce disease in pig farming. Another research conducted by James about the economic of foot and mouth disease has been confirmed that applying a vaccine program to reduce disease is very costly. However, he has also confirmed that using vaccines as a preventive measure is more cost-effective than treatment of the disease if it happens. Durr (2013) has suggested that using the vaccine will reduce the size of an outbreak of disease and the length of the period of the disease existing.

- Bio-security: (1) Visitors: Visitors such as veterinary staff, pig traders, feed suppliers and the movement of labor in the farm are also seen as one factor affecting the disease in pig production. According to Garforth (2011), one of the ways to prevent diseases is to limit the spread of disease from the visitors and the surrounding pig farms. Pinto (2003) and FAO (2010) also made similar conclusions. Simon-Grife (2013) also pointed out that the majority of livestock producers and animal health officials in his studies agree that restricting visitors and the means of transport are important measures to prevent the spread of disease from other areas to pig farms. Lambert (2012), Kabuuka (2014). (2) Entry into/out of the pig pens: The next factor affecting pig diseases is from new introduced herd. In order to prevent diseases from new introduced herd, farmers should have preventive measures such as isolation activity, application of disinfection measures for new purchased pigs and only buy new pigs from trusted sources (Garforth, 2013, Pinto, FAO, 2010, Simon-Grife, 2013, Lambert, 2012). Mixing different age classes and the contact between those pigs is another risk factor for diseases in pig production (Hurnik, 1994). Finally, cleaning pig houses and production tools affects the likelihood of disease risk. Garforth (2013) has pointed out that the management and disposal of waste, designing a separate feeding area, providing drinking water by taps and labor using protective clothes reduced the spread of disease in pig farming. In addition, Hurnik (1994) argues that manure management, use padding and floor hygienic treatment are considered risk factors of the disease. Lambert (2012) in a study of risk factors in pig production in Canada also showed that the proportion of pigs that have been cured has positive relationship with the state of hygiene of employees and pig barns. Nguyen Thi Sam et al (2012) in a study of the risk factors of the disease in pig production in Central Vietnam also showed that cleaning pig cages make a positive impact in reducing diseases.

Research Methods

The paper uses data from a survey of 200 pig producers in 3 districts in Hung Yen Province, namely Tien Ly, Khoai Chau and Van Giang, selected based on a criteria of different pig value chain gradients which are rural-rural, rural-peri-urban and peri-urban-urban value chains. Thereafter, communes are chosen according to pig density defined as follows: (1) Less or equal 33% of households producing pigs is low density; (2) Between 33% and 66% of households producing pigs is medium density; and (3) above 66% of households producing pigs is high density. Finally, households surveyed are selected randomly from the list of pig producers in each commune (see Table 1).

The content of the farmer survey includes (a) general information about the household, (b) production resources, (c) pig production and situation of diseases, (d) production costs and selling details for the latest cycle, (e) farmer's behavior in responding to changes from the production environment, and (g) other issues related to policies supporting the development of pig production.

Descriptive statistics such as mean and frequency were used for hypothesis testing to describe situation of pig diseases and explore factors contributing to pig diseases.

Key Findings

Disease Profile

Many types of diseases have been reported by smallholder pig producers in Hung Yen such as diarrhea, pneumonia, fever, blue ear, head edema and pasteurellosis. The percentage of sick pigs is highest among piglets (27 percent), as compared with growing pigs and fatteners (five percent each). Among diseases, the most widely and frequently observed pig disease is diarrhea; it is also the disease most often affecting piglets.

In general, in comparison to a group of households without dead pigs, the percentage of sick pigs is higher among households with dead pigs. This trend can be seen clearly for several diseases such as foot and mouth disease, blue ear, pasteurellosis, and diarrhea.

Mortality Cost

Diseases could lead to death of pigs, resulting in economic losses to the pig producers. Estimates of the cost of mortality in pig production in Hung Yen were about 3.3 million VND per household per year. It accounts for about 13.6 percent of total income from pig production.

Factors and Practices Contributing to Pig Disease Risk

* Production Scale and Pig Density

As mentioned in the section of literature review that production scale and pig density is a factors influencing on pig diseases. The results from above table also informs that disease incidence appears to be correlated with scale, with higher numbers of sick pigs in large-scale production units; also higher mortality of piglets in these farms. For instance, in comparison to small and medium scale production (the number of pigs per a production cycle is less than 35 head), the number of sick piglets, sick growers and sick fatteners of the large production scale households is about 33, 8.9 and 9.6 heads higher, respectively. Pig density is also associated with sick piglets and sick growers. If pig density is observed to be crowded, the number of sick piglets and the number of sick growers will be 7.7 head and 3.2 head higher in comparison to households that pig density is observed to be not crowded.

* Contact between Different Age Classes

Contacting between different age classes do not appear to have an effect on disease situation of fatteners and dead pigs. However, it effects significantly the disease situation of piglets and growers. In more detail, if there is no contact between different age classes, the number of sick piglets is lower by 10 heads in a year, and about four heads of growers in a year.

* Designing and Investing in Infrastructure for Pig Production

Technically, the way the barn is designed and the use of various equipment in pig farming will affect the possibility of disease outbreak in pig production. For example, the test results shown in the table below confirm that if the barn is designed with separated feeding area, with water supply for pig through the spray-nozzles, with installed cooling system such as using the cooling fans, and the use heating lamps would mitigate the diseases outbreaks in the pig farm and hence reduce the number of pig deaths. Therefore, pig farmers should consider these factors when investing in infrastructure and designing barn to minimise pig diseases. However, there is also a need for more in-depth analysis on costs and economic benefits of these measures. Specifically, in pig pens with a separate area for feeding, relatively lower number of pigs are reported sick, e.g., sick piglets by 11, growing pigs by three, and fatteners by three per household. Providing drinking water through taps could potentially reduce the incidence of sick pigs by about 12 among piglets, three among growing pigs, and three among fatteners per household. Providing water by taps also can reduce the number of dead pigs significantly, e.g., dead piglets by one, dead growing pigs by 0.5 and dead fatteners by 0.3 per households. Installing a cooling system such as fans in summer and heating lamps in winter also helps to reduce disease incidence by about six in piglets, three in growing pigs and two in fatteners per household.

*** Cleaning Pig Houses and Production Tools**

Cleaning barn and livestock farming equipment is also one of the technical measures to prevent pig diseases. Unlike designing barn and infrastructure investment measures, cleaning barn and equipment has little impact on the production cost beyond requiring labour for this activity. In addition, the test results show that cleaning barn and farming equipment would have positive effects in diseases mitigation and hence reducing the number of dead pigs due to diseases. For instance, by keeping their pig houses clean, pig producers can reduce occurrence of pig diseases, e.g., by eight among piglets and more than four among growing pigs per household in a year. In addition, cleaning production tools can potentially reduce the number of sick piglets by seven and sick growing pigs by three per household. The value of losses avoided from the above results is estimated at 4.3 million VND per household per year. In addition, cleaning barns and farming equipment also have positive effects in diseases mitigation and subsequently reduce the number of dead pigs due to diseases. Thus, pig farmers should apply such measures to minimize the diseases outbreaks and hence reducing the chemical usage in pig production

Losses Avoided from above Practices

Above avoided losses are estimated from the number of dead pigs including piglets, growers and fatteners that can be reduced by applying above practices and avoiding risk factors. Thereafter, the number of dead pigs is timed with production cost avoided. On average, if a producer apply all mentioned practices and avoiding risk factors to reduce dead pigs, he/she can reduce mortality cost of more than seven million in a year. This avoided loss is about 30 percent of household income from pig production.

Conclusion and Recommendations

The findings from the study highlight the potential economic benefits from small changes in pig production practices that smallholder pig producers could adopt to mitigate the impacts of animal diseases. Increasing awareness about these practices and their potential impacts could contribute to improving uptake, Extension programs that could demonstrate the benefits of these practices, coupled with activities to improve the capacity of pig producers to adapt these practices in their own context would also be useful to implement.

Tables and Figures

Table 1 Allocation of producer sample across communes

District	Commune	Producer as % of total population	Sample size
Tien Lu	Minh Phuong	43.6	34
	Duc Thang	24.4	19
	Thu Sy	32.1	25
Subtotal		***100***	***78***
Khoai Chau	Nhue Duong	28.4	21
	Dai Hung	31.1	23
	Binh Kieu	40.5	30
Subtotal		***100***	***74***
Van Giang	Tan Tien	40.0	24
	Nghia Tru	30.0	18
	Thang Loi	30.0	18
Subtotal		***100***	***60***
Total		**100**	**212**

Source: survey of pig producers, ILRI-VNUA 2013

Table 2 Disease profile in pig production by growth stage

Unit: %

Item	By growth stage			By with/without dead pigs	
	Piglets	Growing pigs	Finisher pigs	HHs with dead pigs	HHs without dead pigs
Total	28.6	5.1	5.5		
FMD	0.3	5.9	3.1	3.1	1.7
Fever	1.9	12.5	9.5	7.7	13.5
Pneumonia	3.0	6.2	33.4	10.8	12.6
Blue ear	1.6	15.9	14.8	18.5	1.7
Pasteurellosis	0.5	5.9	6.2	12.3	0.8
Diarrhea	91.1	27.0	24.5	69.2	59.7
Polio	0.0	21.8	0.3	1.5	1.7
Salmonellosis	0.4	3.0	2.9	4.6	2.5
Head edema	1.2	1.7	5.4	4.6	4.2

Source: survey of pig producers, ILRI-VNUA 2013

Table 3 Estimation of mortality cost

Item	Unit	Amount
1. Total surveyed household	hhs	184
- No. of hhs having dead pigs	hhs	81
- Percentage of hhs having dead pigs	%	44.0
+ No. of dead sows	head	20
+ No. of dead piglets	head	244
+ No. of dead growing piglets	head	87
+ No. of dead fatteners	head	86
2. Total estimated mortality cost	Mil.	610.8
- Mortality cost/hhs	Mil.	3.3
- Pig mortality cost as % of income from pig production in a year	1000đ	13.6

Source: survey of pig producers, ILRI-VNUA 2013

Table 4 Incidence of disease and mortality between diferent production scales and levels of pig density

Item	Production scale 1= Small scale (< 10 head) 2= Medium scale 3= Large scale (> 35 head)		Pig density 4= Not crowded 5= Crowded
	(1)-(2)	**(2)-(3)**	
No. of sick piglets/hh	-7.6^{ns}	-33.0***	-7.7**
No. of sick growers/hh	-1.3^{ns}	-8.9***	-3.2*
No. of sick fatteners/hh	-0.5^{ns}	-9.6***	0.9^{ns}
No. of dead piglets/hh	-0.4^{ns}	-1.8**	0.5^{ns}
No. of dead growers/hh	-0.1^{ns}	-0.4^{ns}	0.5^{ns}
No. of dead fatteners/hh	-0.4^{ns}	0.2^{ns}	-0.3*

Note: (1) Pig density is defined by veterinarian (Checklist data) (2) Statistical significance at the 10%, 5%, 1% and no significant levels are indicated by *, **, *** and ns respectively

Source: survey of pig producers, ILRI-VNUA 2013

Table 5 Incidence of disease and mortality, with and without contact between different age classes of pigs

Item	**(Contacting – Not contacting)**
No. of sick piglets/hh	9.8***
No. of sick growers/hh	3.8*
No. of sick fatteners/hh	-0.7^{ns}
No. of dead piglets/hh	0.9*
No. of dead growers/hh	0.5^{ns}
No. of dead fatteners/hh	-0.3^{ns}

Note: (1) Contacting means that different age classes of pigs can contact to each other and not contacting means that different age classes of pigs cannot contact to each other. This is observed by veterinarian.(2) Statistical significance at the 10%, 5%, 1% and no significant levels are indicated by *, **, *** and ns respectively

Source: survey of pig producers, ILRI-VNUA 2013

Table 6 Effects of using specialized livestock farming tools to diseases and mortality in pig production

Items	**Having a private place for feeding (Yes-No)**	**Providing drinking water by taps (Yes-No)**	**Using other tools (fans, cooling systems, heater…) (Yes-No)**
No. of sick piglets/hh	-10.8***	-11.7***	-6.1*
No. of sick growers/hh	-3.1*	-3.4**	-2.6*
No. of sick fatteners/hh	-2.6**	-3.0***	-2.2*
No. of dead piglets/hh	-0.5^{ns}	-1.0***	0.8^{ns}
No. of dead growers/hh	0.5^{ns}	-0.5***	0.4^{ns}
No. of dead fatteners/hh	-0.3**	-0.3**	-0.2**

Note: Statistical significance at the 10%, 5%, 1% and no significant levels are indicated by *, **, *** and ns respectively

Source: survey of pig producers, ILRI-VNUA 2013

Table 7 Effects of cleaning pig houses and production tools to diseases and mortality in pig production

Items	Pigs houses are clean (Yes-No)	Production tools are clean (Yes-No)
No. of sick piglets/hh	-7.7**	-7.3**
No. of sick growers/hh	-4.4***	-3.2^{ns}
No. of sick fatteners/hh	-0.3^{ns}	-2.9**
No. of dead piglets/hh	-0.7*	-1.0***
No. of dead growers/hh	-0.4**	-0.5*
No. of dead fatteners/hh	0.2^{ns}	-0.3**

Note: Statistical significance at the 10%, 5%, 1% and no significant levels are indicated by *, **, *** and ns respectively

Source: survey of pig producers, ILRI-VNUA 2013

Table 8 Losses avoided from applying practices to reduce dead pigs

Unit: USD

Practices	Reducing mortality cost for piglet	Reducing mortality cost for piglet	Reducing mortality cost for piglet	Total
Suitable production scale	-46.3			-46.3
Appropriate pig density			-31.6	-31.6
No contacting between different age classes	23.1			23.1
Having a private place for feeding			-31.6	-31.6
Providing drinking water by taps	-25.7	-28.6	-31.6	-86.0
Using other tools (fans, cooling systems…)			-21.1	-21.1
Cleaning pig house	-18.0	-22.9		-40.9
Cleaning production tools	-25.7	-28.6	-31.6	-86.0
Total	-92.6	-80.1	-147.6	-320.3

Source: survey of pig producers, ILRI-VNUA 2013

References

Costales A., C. Delgad, (2006) Scale and Acess Issues Affecting Smallholder Hog Producers in an Expanding Peri-Urban Market. International Food Policy Research Institute.

Dinh Xuan Tung (2009). "Final report of survey on proportion, productivity, efficiency and organization of livestock sector in Vietnam." Ministry of Agriculture and Rural Development.

Dürr, S.; zu Dohna, H.; Di Labio, E.; Carpenter, T.E.; Doherr, M.G. (2013). "Evaluation of control and surveillance strategies for classical swine fever using a simulation model." Preventive Veterinary Medicine **108 (1)**: 10.

FAO (2010). "Good Practices for Biosecurity in the Pig Sector: Issues and options in developing and transition countries." FAO animal production and health: 169.

Faustin P. Lekule and Niels C. Kyvsgaard (2003). "Improving pig husbandry in tropical resource-poor communities and its potential to reduce risk of porcine cysticercosis." Acta Tropica **87**: 88.

Garforth C. J., A.P. Bailey, R.B. Tranter (2013), "Farmers' attitudes to disease risk management in England: A comparative analysis of sheep and pig farmers", Preventive Veterinary Medicine 110: 456-467.

Hurnik D, I.R. Dohoo, & L.A. Bate. (1994). "Types of farm management as risk factors for swine respiratory disease." Preventive Veterinary Medicine **20**: 11.

Hurnik D., I.R.Dohoo, A.Donald, N.P. Robinson (1994), "Factor analysis of swine farm management practices on Prince Edward Island", Elsevier Science B.V 20: 135-146.

Kabuuka, T.; Kasaija, P.D.; Mulindwa, H.; Shittu, A.; Bastos, A.D.S. et al. (2014) "Drivers and risk factors for circulating African swine fever virus in Uganda, 2012–2013." Research in Veterinary Science **92 (2)**: 8.

Lambert, Marie-Ève; Arsenault, Julie; Poljak, Zvonimir; D'Allaire, Sylvie (2012). "Epidemiological investigations in regard to porcine reproductive and respiratory syndrome (PRRS) in Quebec, Canada. Part 2: Prevalence and risk factors in breeding sites." Preventive Veterinary Medicine **104 (1)**: 10.

Lapar, M., Toan, N., Staal, S., Que, N., & and Toan, N. (2011). "The pork value chain in Vietnam: Emerging trends and implications for smallholder competitiveness and chain efficiency." Contributed paper presented at the 55th Annual AARES National Conference.

MARD (2013). "Report on the results of agricultural extension activities for the period 1993-2013 and the development strategy of the Vietnam agricultural extension system towards 2020." This report prepared for the conference about the review of 20-year Vietnam agricultural extension performance.

Monger, V. R., Stegeman, J. A., Koop, G., Dukpa, K., & Tenzin, T. (2014). "Seroprevalence and associated risk factors of important pig viral diseases in Bhutan." Preventive Veterinary Medicine **117 (1)**(11): 222.

Nguyen Thi Duong Nga, Ho Ngoc Ninh, Pham Van Hung, & Lucila Lapar. (2013). "The pig value chain in Vietnam: A situational analysis report.": 169.

Nguyen Thi Sam, Honma Hajime, Geurden Thomas, Ikarash Makoto, & Fukuda Yasuhiro. (2012). "Prevalence and risk factors associated with Cryptosporidium oocysts shedding in pigs in Central Vietnam." Research in Veterinary Science **93 (2)**(5): 848.

Nguyen Thi Thu Huyen and Pham Van Hung (2016). "Pig production and risk exposure: a case study in Hung Yen, Vietnam." Can Tho University Journal or science.

Pinto C. Julio and V. Santiago Urcelay (2003). "Biosecurity practices on intensive pig production system in Chile." Preventive Veterinary Medicine **59**: 8.

Simon-Grifé M., Martín-Valls G.E., Vilar M.J., García-Bocanegra I., & Martín M. (2013). "Biosecurity practices in Spanish pig herds: Perceptions of farmers and veterinarians of the most important biosecurity measure." Preventive Veterinary Medicine **110 (2)**: 9.