

POULTRY SUPPLY CHAINS AND CHALLENGE FACING THE POULTRY SMALLHOLDERS IN HANOI SUBURBAN

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The Highly Pathogenic Avian Influenza (HPAI) caused by H5N1 virus occurred in Vietnam from early 2004 with millions of birds culled. A question was raised: how could Vietnam limit this epidemic? This research aimed at addressing this question and improving the income of small poultry producers by identifying the poultry production systems and the various restraints faced by the poultry supply chains, including the diseases. The research also attempted to analyze the explicative factors of the poultry development at local level. The research was conducted by interviewing and looking at the production record system at household-level farms that possessed a poultry production business at different scales in the suburban of Hanoi from December, 2008 to November, 2009.

There were four poultry production systems: (1) integrated the poultry production system with a good bio-security level; (2) layer/reproductive poultry production system at the semi-commercial scale with the low to average bio-security level; (3) broiler bird production system at the semi-commercial scale with the low to moderate bio-security level and; (4) backyard poultry production system with low bio-security level. Only the chicken flocks in the system 1 and the layer/reproductive hens in the system 2 were strictly vaccinated in accordance with a good vaccination calendar. This research found that the farmers' scientific knowledge was still limited which led to unstable economic outcomes. Therefore, poultry production in the studied region was facing grave difficulties. In order to have a sustainable development in the coming years, it is necessary to equip farmers with good scientific knowledge or to support them to build improved poultry production systems such as a practical system for disease prevention and food safety, the HACCP.

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1. OVERVIEW OF POULTRY PRODUCTION IN VIETNAM

The average growth rate of Vietnam's agricultural production was about 5% per year from 1990 to 2007. In which, the growth rate of animal products was about 9.5% in the period of 2000 - 2009. The value of animal production reached 16 thousand billion VND in 1995, contributing 19% to the agricultural production value and increased to 98 thousand billion VND in 2008, making up 27% of the structure GDP of the agricultural production value. This contributed to the increase of the average GDP per capita from 200 USD in 1986 to 1,000 USD in 2009 (MARD & GSO, 2009). However, rice production and animal production at small scale were mainly run by farm households in Vietnam. Poultry production remained at small scale with low investment, and was mostly for households' self-sufficiency. The bio-security level in the poultry production was very low when different animal species were raised in the same household in a densely population area. According to a research in Red River and Mekong Deltas, there were 80% of the total households raising chickens, 74% of the total households having ducks and 53% of farms that raised both chickens and ducks did this on a limited land surface (Vu Dinh Ton et al. 2008).

Vietnam had about 8.3 millions of small households (70% of the total households) that characteristically had a low poultry productivity for self-consumption. The average scale of the poultry production was only 32 birds per household (MARD/DLP, 2008). The animal production at the small and semi-commercial scale, along with farmers' limited knowledge, was considered infection vectors of animal diseases, particularly the poultry production at semi-commercial scale (Phan Dang Thang et al. 2009).

At the end of 1990s, some official models of poultry production at (semi-) commercial or industrial scale were established in the country. Although poultry production at commercial scale still made up a modest ratio, its output was accounted for approximately 35% (MARD, 2008). The poultry production at commercial scale is nowadays facing difficulties of finding available production land surface (should be far away from densely populated areas), production capital, and lack of knowledge and management capacity of farmers. In fact, with poultry production at small scale and semi-commercial scale, farmers could quickly restore their animal production because they were least influenced by each epidemic disease of HPAI. But the commercial farms were loss-marking and had to halt the production for several months (Phan Dang Thang et al. 2009).

The poultry production effectively contributed to the household income rate, 19% of total household income came from pig production, which helped decrease the rate of mal-nutritive children in the rural areas. The average growth rate of the poultry population continuously increased from 1990 – 2003 (around 7% per year), equally to the poultry population of 254 million of heads in 2003 - an increase of 28% compared to 2000. However, early 2004, the influence of HPAI, originated from H5N1 virus in early 2004 when millions of birds culled, caused a decrease in the poultry population (from 14% in 2004 to 16% in 2006) (GSO, 2007). Furthermore, the average growth rate of birds was only 1.5% in the period of 2000 – 2007. Whereas from 2000 – 2003, this average growth rate reached to 9% per year. This leads to large

socio-economic impacts. The loss caused by H5N1 virus was estimated to be about 3,000 billion VND (Vu Dinh Ton et al., 2008; M. Peyre et al., 2008). The risk of avian influenza on the poultry flock was huge, particularly on the backyard poultry production system (FAO, 2005).

The Red River Delta possessed the highest quantity of the poultry flock in the whole country, making up about 30% of the total flock (Vu Dinh Ton et al., 2008). From 2006, the poultry herd was restored. In 2008, the poultry herd had about 247 millions of heads, increasing to 9% compared to 2007. In 2009, the poultry flocks had 280 millions of heads, increasing 13% compared to 2008 (GSO, 2009). The poultry production represented about 19% of the total household income; and the poultry meat made up 15% of total meat consumption in families (VLSS, 2006; MARD, 2008).

The quick growth of poultry production stimulated other industrial development such as food processing industry. In 2006, the output of food reached 6.2 million tons, which was equal to an increase of 16% compared to 2005 and accounted for 43% of the total animal food demand. Therefore, the animal production played a more and more important role in the GDP structure of the agricultural production. However, the animal production was facing several difficulties such as epidemic diseases of HPAI on poultry, porcine reproductive and respiratory syndrome or food and mouth disease on pigs and cattle, etc. In addition, the animal production in the country had to face competition of imported meat products while consumers boycotted the domestic animal products because of epidemic diseases.

Hanoi's suburban area played an important role in supplying meat for Hanoi capital and providing chicks and ducks for other provinces in the whole country. From early 2004, the producers had to adapt to the context of epidemic of the avian influenza for a better responding to the demand on the market. In fact, not many research on the poultry production with the system approach and commodity chains approach, particularly research on the relation between the poultry production systems with the epidemic diseases, were done. Thus, this research aimed at analyzing the explicative factors of poultry development at local level in Hanoi Suburban area through an identification of poultry farming systems with their various constraints, including the diseases in this area. In addition, this research aimed at identifying the major risks of epidemic disease caused by H5N1 virus and how the breeders responded to the epidemic disease.

2. METHODOLOGY

Phu Xuyen and Chuong My districts were chosen to represent the main poultry production region in Hanoi suburban areas in this research. Households who ran poultry production at different scales in these two districts were included in the research. In each district, 2 - 3 communes were selected based on the agro-ecological patterns of the region and the diversification of the poultry farming systems. The research was conducted from December, 2008 to November, 2009.

The research began with the collection of poultry production data through official reports of the Department of Livestock Production (DLP), the FAO, the GSO, the Services of Veterinary, the Stations of Veterinary and from the discussions with the key persons and local authorities at the province, districts and the leaders of communes or villages in these research zones for a comprehensive understanding of the poultry production in this province.

The various poultry production systems and sub-systems were then identified; the research used a random stratification method to select households who ran poultry production. Over 270 poultry farms and veterinary agents were eventually interviewed, using a closed-structure questionnaire. Information collection allowed the classification of the poultry production (sub-) systems according to the scale of breeding. About 160 of poultry farms at different scales were chosen for production record keeping system according to a production cycle in the same farm conditions. In addition, the other economic activities of the farm-households such as cropping, animal production and off-farm activities... were also collected in this research for more understanding the household scales and their economic levels.

The price of some products concerning the poultry production such as industrial feed, maize, paddy, local broiler chicken, industrial broiler chicken, broiler duck, broiler Muscovy duck, chicks/ducklings, etc. in these zones were also collected every two days per week during the period of research. Then, monthly average prices of these products were calculated.

The principal income of the farms were calculated such as cropping, poultry production, other animal production at different scales and the income of off-farm activities such as hired labor, handcraft, transformation of agricultural products, commerce and monthly salary, etc. The survey data of 160 poultry farms from production record keeping system was analyzed by using MS Excel 2003. A financial analysis method was based on the concept of value-added, the whole production processes involved the flow of inputs and outputs. The income of off-farm activities was the net income by Vietnam dong coming from hired labor, handcraft, transformation of agricultural products, monthly salary, etc. per farm household a year.

3. RESULTS AND DISCUSSION

3.1. Highly Pathogenic Avian Influenza (HPAI) caused by H5N1 virus on birds

Highly Pathogenic Avian Influenza (HPAI) caused by the H5N1 virus in poultry was the first great challenge for poultry production in Vietnam with millions of animals destroyed. This greatly influenced the country's socio-economic condition, particularly in the period of 2003 – 2005. At the end of 2003, the HPAI was officially announced. Up till this time, there were seven outbreaks of HPAI in Vietnam causing more than 54 million of poultry heads dead and culled in almost all of the North and South provinces, which occupied about 20% of total poultry population. In which, the first outbreak happened from December, 2003 to March, 2004 in 57/64 provinces and cities, leading to roughly 44 million of bird heads dead and culled (FAO, 2009; DLP, 2007; DAH, 2010). This epidemic disease caused enormous loss-marking for this poultry production and other economic activities.

Now days, some small HPAI outbreaks were still announced in some provinces, particularly in the Northern provinces. To deal with HPAI, the Vietnamese Government and other international organizations proposed several measures to reduce the losses caused by H5N1 virus and to prevent multiplying of this epidemic disease. However, HPAI on birds still occurred in most provinces because of the small production scale with low bio-security level situated in densely populated areas. The farmers still have not used any preventative measures of vaccination for the poultry. The poultry were not normally vaccinated for the next flock if the disease did not occur in the previous flocks. In addition, legal procedures related to animal production, veterinary hygiene, transportation and slaughter-houses were still very limited. The legislation

for disease prevention was passively applied in animal epidemic disease; and authorities usually paid attention to problems only when epidemic disease happened. Veterinary human resources were still limited in all communes and villages. This led to limitations of information of epidemic diseases in order to apply epidemic prevention measures. Thus, it is necessary to have a better legal means for establishing animal products with good traceability.

3.2. Typology of poultry production systems

The scale of poultry breeding and the type of poultry races were diversified and complicated in each ecological zone in the all districts of suburban Hanoi. Most economic activities of surveyed households were poly-culture and animal production. Crop production aimed at satisfying the demand of self-consumption and at buying a small overproduction. Cash income came from animal production and extra-agricultural activities (Vu Dinh Ton et al., 2010). Investigations and results of the production record keeping system of 160 households allowed us to characterize four main poultry production systems according to the type of production and the risk level of epidemic disease which are presented in Table 1.

Table 1: Typology of the poultry production systems

Poultry farming systems (FS)	Sub-systems	Farms	Percent of farms** (%)	Areas (sào*)	
				Plant production	Pond fish
Chicken integration by contract with high bio-security (FS1)	<i>Young hens (FS1a)</i>	5	0.2	6	1
	<i>Broiler chicken (FS1b)</i>	15		7	3
Layer/reproduction poultry at semi-commercial with minimal to moderate bio-security (FS2)	<i>Layer hens (FS2a)</i>	21	5	5	12
	<i>Layer ducks (FS2b)</i>	28		12	15
	<i>Mixed of reproductive hens and ducks (FS2c)</i>	24		8	6
Broiler production at semi-commercial with low to minimal bio-security (FS3)	<i>Broiler chickens (FS3a)</i>	17	15	11	4
	<i>Broiler ducks (FS3b)</i>	18		7	5
Village/backyard poultry production with low bio-security (FS4)		32	80	8	3
Total		160			

* Sào is an area unit used in rural areas of the North of Vietnam. 1 sào is equal to 360m²

** Calculation by the data of General Statistics Office of Ha Tay Province and Statistical Offices of Phu Xuyen and Chuong My Districts (2007)

+ **FS1:** The farming system of chicken integration production by contracts between farmers and chicken production enterprises with high bio-security level. The enterprises supplied day old chicks, chickenfeed, vaccines, chicken drugs and technicians. The farmers built the hen-houses in their land area and raised chickens in compliance with a good procedure provided by enterprises. The farmers received wages based on their production results. The quantity of poultry of this system was still very limited in the country as a whole; but characteristically, this is a commercial production model with a high potential productivity such as ISA Brown, Sasso, Cobb 707. There were two sub-systems in this system: (FS1a) - the production of young hens, being raised about 4 months; and (FS1b) - the production of industrial broiler chickens, being raised about 42 days.

+ **FS2:** The farming system of layer or reproduction poultry at semi-commercial with minimal to moderate bio-security level. This system kept regularly layer hens (FS2a) or ducks and parent hens, ducks or Muscovy ducks (FS2c) at semi-commercial scale using industrial feed. Parent hens were both confined and grazed in good facilities or personal fields while layer ducks and reproduction Muscovy ducks were commonly raised in areas around villages or in rice fields. The layer hens were ISA Brown, Egypt and Ross 508 bought from enterprises or the center of poultry research. The layer ducks (FS2b) were super egg ducks that were imported from Chinese Zhejiang and French Muscovy ducks. Layer ducks raised in the rice fields were to make use of the residual paddy. This poultry farming sub-system was with a moderate bio-security level of intensive production; but farmers' technical and epidemic sanitary knowledge were still inadequate. Only layer or reproduction chickens were strictly vaccinated before a laying period, but not layer ducks and reproduction Muscovy ducks. In addition, there were some different flocks of reproductive birds such as hens, ducks and Muscovy ducks in the FS2c sub-system in the same farm. They were raised together within a limited area.

+ **FS3:** In a broiler production system at semi-commercial scales with low to minimal bio-security level, most farms kept different chickens and ducks in the same household. Only white industrial chickens (FS3a) were confined and strictly vaccinated in some farms. The local chickens and broiler ducks freely grazed in farmers' privately-owned allotments or transhumant on rice fields for making use of the residual paddy. The cross-bred meat ducks or imported breeds (FS3b) were popularly raised such as broiler ducks of Bau Canh Trang, CV Super Meat and French Muscovy ducks. Most of broiler chickens and ducks were not vaccinated. The broiler production was very intensive with many flocks (cycles) per year by using industrial feed. Especially, the hen-houses of broiler transhumant ducks were very limited or inexistent.

+ **FS4:** Village/backyard poultry production system with low bio-security level. General characteristics of this farming system were low investment, free poultry ranging, and farmers' self-production of old day chicks and local breeds. Normally, the birds were not vaccinated. Farmers used different poultry breeds in the same farms. According to the Department of Livestock Production (2006), the country as a whole had 90% of small-farms at small scale, producing about 65% of national poultry production.

3.3. General characteristics of poultry production systems

The semi-commercial poultry production in Vietnam began in the early 1990s, however integration chicken production started much later, in the 2000s. Thus, the farmers typically had only 6 to 12 years experience of poultry production. The average age of the head of the household was 41 to 46 years old. In general, each household had two main family members for keeping the poultry. However, in backyard poultry production system (FS4), the head of the farm was more than 50 years old and some young farmers were about 30 years old. A small part of products was directly consumed in the family during the Tet festival or different celebrations and the other major part of poultry were sold to earn some cash income.

System 1, the young hens and broiler chickens were kept in the industrial mode with a high bio-security level and all birds were vaccinated against different disease. According to the DLP, this poultry production system was limited and outputs were still low.

Ducks, Muscovy ducks were commonly kept in system 2 and 3 with low to minimal bio-security levels. Broiler and layer ducks were grazed on rice fields or in gardens and fish ponds, but they were not separated from other domestic animals. The breeding duration was short with broiler ducks such as French Muscovy, CV Super Meat ducks and Bau Canh Trang ducks. However, in system 4, there were different types of birds in very small scale farms. This poultry production system was a low bio-security level. The day old chicks were bought from local farms or produced on the same farm. The breeding duration was long and the chicken feed came from by-products of the farm.

In system 1, the scale of young hens was about 6,610 heads/year with a contract of two flocks a farm/year and broiler chickens were about 18,227 heads per year with a contract from 2 to 4 flocks a farm/year. In poultry production systems at a semi-commercial level, the layer or reproduction birds were about 500 heads/farm/year and only 1,130 broiler chickens and 1,600 broiler ducks/farm/year. The heads of bird in the backyard poultry production was really limited with only 5 parent hens, 2 layer ducks, 60 broiler chickens and 35 broiler ducks per farm a year. So the structure of bird flocks was very low and the poultry production was dispersed at small scale in each household farm.

3.4. The implicit risks in poultry production

3.4.1. Source of day old chicks and ducklings

Before the epidemic disease of avian influenza at the beginning of 2004, poultry research centers, state enterprises and foreign enterprises played an important role in supplying household farms with day old chicks. Therefore, the origin and the quality of day old chicks were well controlled. Since the occurrence of the avian influenza at this time and the application of the government control measures against the avian influenza, poultry egg incubation was limited or forbidden, while the demand of day old chicks from breeders was really high due to the lack of poultry meat on the market after each campaign against the epidemic disease. Since then, the explosion of a private hatching incubator made this production out of control of appropriate authorities.

In fact, day old chickens were mainly supplied from private incubation farms of poultry eggs in which color parental poultry were the same as of the commercial poultry production farmers.

Particularly, ducks and Muscovy ducks were mainly kept in the Phu Xuyen District, and then these day old chicks and ducklings were sold to farmers of many provinces. In the systems 2 and 3, there were 70% of household farms who bought day old chicks for laying from private hatching incubators. Only 10% of household farms in these systems bought day old chicks from enterprises or poultry research centers. The origin of day old chickens supplied from the private incubatory farms occupied over 80% of household farms. Thus the technical and scientific knowledge of breeders depended on the system used in the private incubatory farms. Avian influenza risk was high in those private incubatory farms due to the lack of control from authorities; and the parental poultry flocks were not vaccinated against the avian influenza. In the backyard poultry production system, day old chicks were bought in the same village or were bred at the same farm households which still occupied an important role.

Currently, chicks and ducklings resources were largely dependent on unofficial imports from China such as the breeds of Luong Phuong chicken, Bau Canh Trang duck, Zhejiang layer duck... The white chicks (industrial chickens) were principally supplied by the foreign enterprises such as CP Group of Thailand, Japfa of Indonesia and some state enterprises such as Luong My, DABACO...

The color chicks such as Luong Phuong chickens... were mainly supplied by some state enterprises and the poultry research centers but these resources were very limited. So another important resource of color chicks and ducklings came from the private hatching farms in Phu Xuyen District; but the quality control measures in these facilities were still very limited. In addition, the local chicks were supplied from the small households in each village.

3.4.2 Feed source and the knowledge of producers

100% of farm households in the system 1 had a contract on food supply with enterprises to cover 100% of the food demand. The semi-commercial poultry production systems used industrial feed for raising birds, in which 80% to 100% of the diet for layer hens, Muscovy ducks, CV Super Meat and 50% to 100% of the diet for industrial broiler chickens and ducks in system 3. Agricultural by-products only played a central role in poultry production at small scale in system 4 because farmers in other systems mainly use industrial feed for birds. Thus, the industrial feed is crucial in poultry production. The fluctuation of feed price is disadvantage with farmers in the crisis period of food and finance in the world at present.

The technical and scientific knowledge of the breeders are still poor among the whole systems. In particular in semi-commercial and backyard systems, there are only 20% of household's head who had ever participated in a course talking about the breed expansion. The producers only improved their knowledge from their accumulated experiences and from the marketing program of veterinary enterprises. However, there are 3% of household's head in the system 4 who had ever participated in a course. These farms are sometimes not poultry producers but they play a significant role in small villages or communes.

Most of the farmers did not know the name of vaccines against avian influenza disease caused by H5N1 virus, particularly the backyard poultry production households. Therefore, the scientific knowledge of poultry breeders was still very limited, particularly in the systems 2 and 3. The use of antibiotics was popular in poultry production in the whole farming systems for treating sickness of poultry flocks. In this research, there were from 40% to 65% of farmers in

the systems 2 and 3 purchased medicines by themselves to treat their birds with an average duration from 3 to 5 days. If the birds couldn't survive after this duration, the sick adult bird would be sold at low prices to consumers through intermediaries (at 25% to 50% of the normal prices). The dead chicks and ducklings were thrown out in public rivers, ponds or rice-fields.

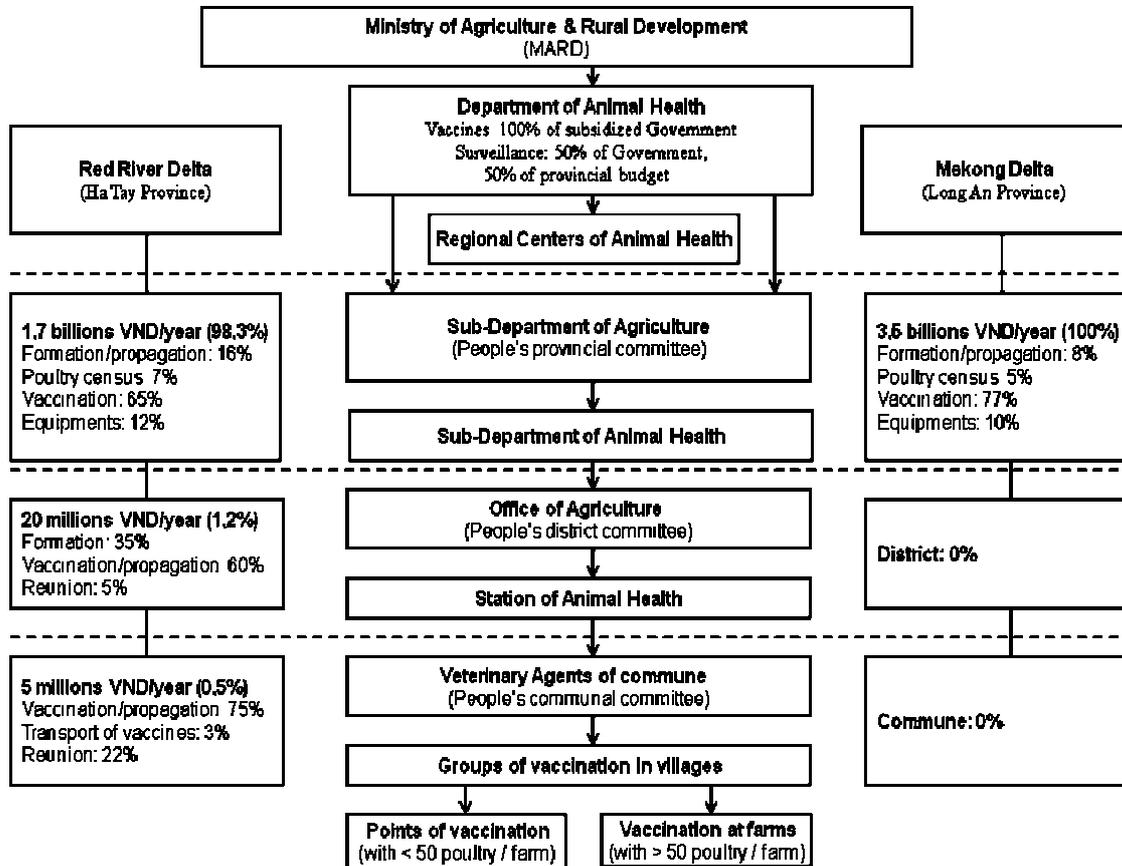
In fact, the propaganda information through the public communication means highly affected consumers regarding poultry products within the epidemic times. Before the appropriate authorities proclaimed avian influenza caused by H5N1 virus, most farmers did not know the danger of this epidemic disease. 40% to 60% of farmers still killed dead or sick poultry. After the Government propagandized information on the avian influenza, 30% to 40% of farmers who had culled their birds because of being unable to sell the birds. In the backyard poultry system, the value of poultry was not important; a part of birds was consumed in households or sold at reduced price to the local market (42% of farmers sold at a reduced price, 52% of farmers still consumed and only some other farmers culled their birds). Therefore, farmers in commercial farming systems had a habit to sell their birds at a low price; while an important part of birds in the backyard system were consumed.

3.4.3 Vaccination and the avian influenza epidemic risks

The use of an vaccination program against HPAI on poultry flock caused by H5N1 virus, launched by the Vietnamese Government, was a good effective tool to deal with this epidemic disease in Vietnam. The program's effective preventive measures were implemented under the support of the political system (Communist Party, Authorities and social organizations at various levels...) and social popular organizations. This program was carried out thoroughly top-down, from the central government to each region, province, district, commune and village. Vaccines were imported and provided to provinces, then distributed to districts and communes. The surveillance program of H5N1 virus after vaccination was financed on equal part from the State budget and the provincial budget and some international organizations such as the World Bank...

There was a steering committee at each level from the central level (Ministry of Agriculture and Rural Development) to province level (Department of Agriculture and Rural Development), district level (Office of Agriculture) and commune level (People's Committee). In addition, some groups of vaccination were organized at each commune or village. Most of the birds were directly vaccinated at farms. The preventive vaccination program was obligatorily to birds according to the specific rules applied to each bird and poultry production scale. Among them, the enterprises and the farms with more than 2,000 birds had to vaccinate their birds by themselves. The small-holders and commercial farms were subsidized to 100% of vaccines and vaccinated expenditures. Under the Central Vaccination Program, a plan on vaccines and expenses estimate and a surveillance system for each vaccination campaign was created by the Department of Animal Health (DAH) under Ministry of Agriculture and Rural Development (MARD). (See Figure 1).

Figure 1: Repartition of the vaccination costs according to different administrative levels



Source: Result of research in Red River and Mekong River Deltas, 2007

A vaccination campaign was implemented from a Sub-Departments of Animal Health (SDAH) under a provincial Sub-Department of Agriculture to the district's Station of Animal Health, and then to the Commune's Board of Veterinary Agent. The groups of vaccination were established at commune and implemented at villages or hamlets. In the North, the flocks with more than 50 birds were vaccinated at farm households; the flocks with fewer than 50 birds were taken to a designated place to be vaccinated at the village. In the South, all birds were vaccinated at the household level. The State organized two vaccination campaigns against H5N1 per year but there was an additional vaccination between campaigns since 2007 in some provinces. Since July 2007, it was an obligation to vaccinate every new bird flock in Red River and Mekong Deltas. The birds were vaccinated two doses per campaign for layer, breeders in some provinces in the South but one dose in most provinces in the North (Table 2). The broilers that had a life cycle below 60 days were vaccinated one single dose. Each vaccination campaign was implemented between 10 – 15 days.

Table 2: Differences in the vaccination program between Red River & Mekong River Deltas

Red River Delta	Mekong River Delta
<ul style="list-style-type: none"> - 1 dose per campaign and no vaccination for layers during laying period (losses in productivity) - No additional vaccination campaigns before July 2007 - Since July 2007 every new flock has to be vaccinated - Vaccination at the centers for farms with under 50 heads - Vaccination at the farm for more 50 heads. 	<ul style="list-style-type: none"> - 2 doses per campaign (layers, breeders). 1 dose for broiler birds under 60 days old - Additional vaccination in between campaigns since 2006 - Since July 2007 every new flock has to be vaccinated - Vaccination at the farm for all the farm sizes.

Source: Result of research in Red River and Mekong River Deltas, 2007.

The budget for vaccination campaigns was depended on each province economic conditions. There was a mandatory vaccination for the birds in some provinces of Red River and Mekong Deltas and Central Coast. The vaccine was imported with 100% of Government's budget; while the budget of vaccination was shared between the central and local budgets or between the administrative levels. There were normally two principal vaccination campaigns per year; and since July 2007 additive vaccination campaigns were applied to new flocks.

Many poultry herds were infected with HPAI caused by H5N1 virus in the first and second outbreaks of 2003 – 2005. After the avian influenza outbreaks in Vietnam, a large number of farms had been vaccinated for some birds' diseases such as Newcastle, Gumboro and against avian influenza. In whole systems of poultry production, only birds in the system 1 and layer or reproductive hens are vaccinated by a strict schedule. While the layer ducks and French Muscovy ducks are regularly not vaccinated, especially these birds are not vaccinated during the layer period. In addition, the broiler ducks are often not vaccinated by a schedule and the birds in the backyard system are not vaccinated (Table 3).

However, still many birds were found infected by H5N1 virus after the vaccination campaigns against avian influenza. The epidemic risks in poultry often happened from this year to another in research communes from 2005 to the present. Over 60% of households encountered a problem with epidemic disease at a high poultry death rate. In recent years, the French Muscovy ducks often contracted an epidemic disease with up to 70% of households. So a lot of households were lost-making due to the massive epidemic, especially in the production of French Muscovy ducks and broiler ducks. Thus, the measure of mass vaccination campaigns was nowadays used as a good strategy against HPAI for the restructure of poultry production in Vietnam. But, the effect on vaccination campaign was still dependent on the provincial economic capacity; and there was still a need for a socio-economic research to comprehensively understand the causes of next avian influenza outbreaks and farmers' incentives to vaccinate.

Table 3: The use of vaccine and avian influenza epidemic risks in poultry production (%)

Systems Use of vaccine	System 1		System 2			System 3		System 4 (n = 32)
	Young hens (n = 5)	Broiler chickens (n = 15)	Layer hens (n = 21)	Layer ducks (n = 28)	Mixed hens and ducks (n = 24)	Broiler chickens (n = 17)	Broiler ducks (n = 18)	
Regular use	100	100	57.14	71.43	95.83	82.35	44.44	6.25
Sometimes	0	0	38.10	25.00	0	11.76	27.78	43.75
Not use	0	0	4.76	3.57	4.17	5.88	27.78	50.00
Avian influenza epidemic risks in poultry production								
Already epidemics	0	33,33	14.29	46.43	41.67	35.29	38.89	28.12
None still with epidemics	100	66,67	85.71	50.00	54.16	64.71	61.11	68.75
Not to know of cause*	0	0	0	3.57	4.17	0	0	3.13

* The poultry is profusely dead but don't know the cause

3.4.4 Fluctuation risk of prices of inputs and outputs

The fluctuation of inputs and outputs' price greatly influenced farmer's poultry production in the research communes (Figures 2 and 3). Especially, the prices of inputs such as animal feed, maize, soybean and paddy were strongly influenced by the fluctuation of the relevant international prices. The pinnacle of fluctuation of prices was from September to October, 2008. The concentration for broiler chicken was 13,850 VND/kg, with 9,120 VND/kg for broiler duck and the maize was 5,000 VND/kg. At the end of 2008 and early of 2009, the prices of these feed decreased from 15% to 20%, but still higher than they were before 2008. However, these prices increased 10% compared to early 2009.

The farmers will normally reduce their animal production scale when the price of feed increased and the price of outputs such as broiler poultry and its products began to decrease. The prices of day old chicks and ducklings continuously decreased from 2008 to 2009, or reduced from 20% to 65% for Luong Phuong chicks at Phu Xuyen District. Sometimes, the prices of these products highly increased in a short time.

However, the prices of local broiler chickens and color chickens are usually kept stable from 65,000 to 70,000 VND/kg with local chickens and from 35,000 to 40,000 VND/kg with color chickens but the price of broiler duck strongly decreased to 23,000 VND/kg in August, 2009, reducing to 25% compared to early 2008. So the fluctuation risk of prices of inputs and outputs strongly influenced poultry production; and these previous observations seem to be the main factors of an unsustainable poultry production in this province.

Figure 2: Fluctuation of prices of some chickenfeed and day old chicks/ducklings in poultry production from September, 2008 to August, 2009

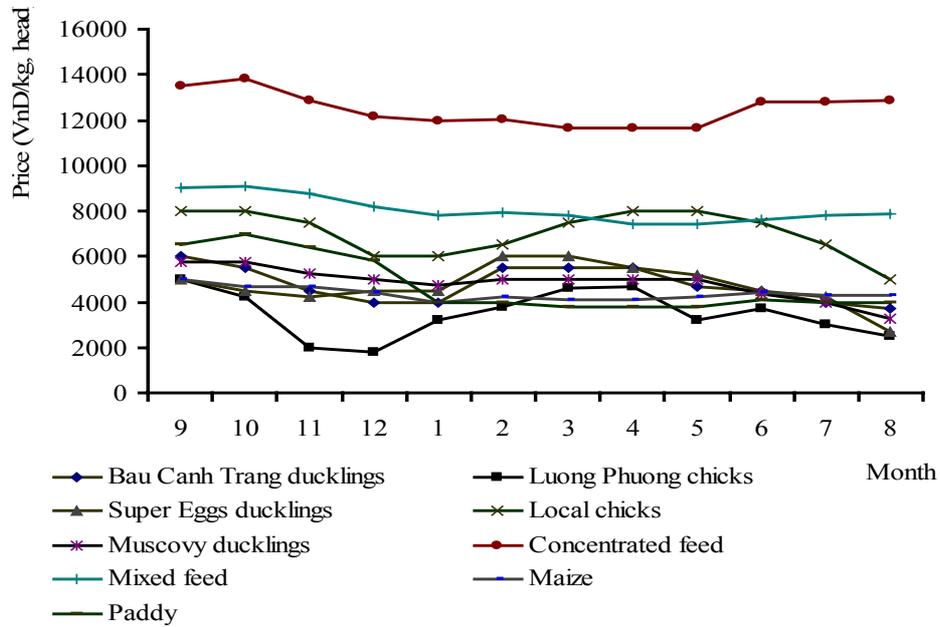
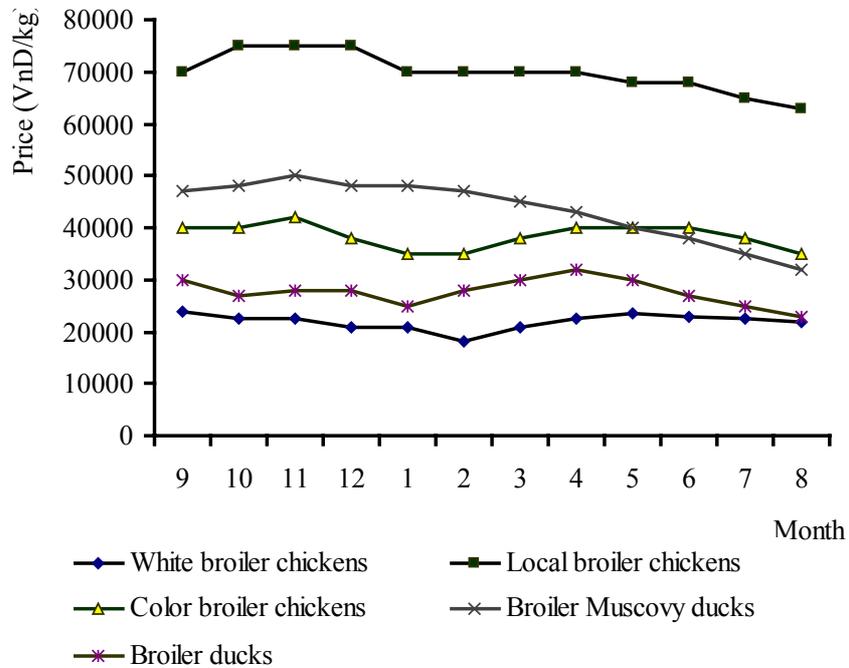


Figure 3: Fluctuation of prices of some broiler poultry in poultry production from September, 2008 to August, 2009



3.5. Economic efficiency in poultry production

Over 86% of birds of systems 1, 2 and 3 were sold to Ha Vy market of Thuong Tin District or some small special poultry markets around Hanoi City through intermediaries in this region. The number of bird reserved for farmer's self-consumption demands in system 4 occupied 40%. However, the transport and slaughter of living poultry was relatively very small. It was difficult to control the epidemic diseases and the quality of poultry products.

Economic benefits in these systems were very unsettled. The color reproductive hen production had a good economic efficiency with about 164,000 VND/hen/cycle but many layer ducks, reproductive Muscovy ducks and broiler ducks farms were loss-making due to epidemic diseases and the great fluctuation of prices of input and output in poultry production. Many farms lost up to 65.8 million dong/year in reproductive ducks CV Super M. Broiler poultry production at semi-commercial scale had a lower economic efficiency, on average from 10 to 17 million dong/farm/year.

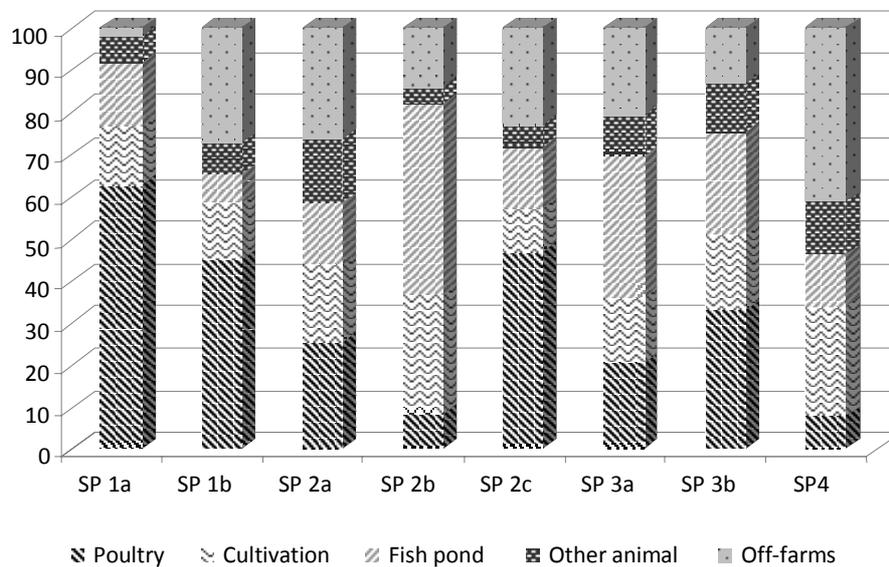
The net income of poultry production in systems 1, 2 and 3 occupied 30% to 60% of total income of household. While the net income from layer ducks in system 2, and backyard production system was less than 3.5 to 4.2 million dong/farm/year, making up about 8% of net income in a household (Table 4 and Figure 4).

Table 4: General economic results of agricultural production of the farms per a year

(Unit: 1,000 VND)

	FS 1		FS 2			FS 3		FS 4
	<i>Broiler chicken</i>	<i>Young hens</i>	<i>Layer hens</i>	<i>Layer ducks</i>	<i>Mixed</i>	<i>Broiler chicken</i>	<i>Broiler ducks</i>	
Cultivation	9,435	7,735	8,763	14,198	10,356	8,069	9,493	11,605
Fish pond	10,000	4,000	7,229	22,661	14,167	17,000	12,778	5,469
Other animal	4,267	4,300	7,524	2,000	5,479	4,853	6,056	5,648
Off-farms	1,333	15,876	12,887	7,136	23,057	10,659	7,139	18,398
Poultry	41,610	25,920	12,439	4,162	46,721	10,369	17,336	3,471
Total	66,645	57,831	48,842	50,156	99,780	50,950	52,801	44,590
<i>VAN / active</i>	<i>29,345</i>	<i>19,760</i>	<i>15,973</i>	<i>24,054</i>	<i>47,922</i>	<i>26,603</i>	<i>24,323</i>	<i>20,105</i>

Figure 4: Structure of net income according to poultry production systems



Therefore, poultry production in the studied region was facing serious difficulties. In order to sustain the production development in the next years, it is necessary to apply the good scientific knowledge or good practical poultry production systems such as HACCP. In addition, the Government needs to provide useful information on the poultry production region and international markets; it is also necessary to encourage the establishment of a network of poultry production and poultry products supply chains with good quality and good traceability

4. CONCLUSION

There were four major poultry production systems practiced in Hanoi Suburban area (1) Chicken integration production by a contract between farmers and chicken production enterprises with a high bio-security level, (2) Layer or reproduction poultry at the semi-commercial with a low to moderate bio-security level, (3) Broiler poultry production at the semi-commercial scale with low bio-security level, and (4) Backyard poultry production system with low bio-security level.

The measure of mass vaccination campaigns was now used as a good tool against HPAI for the restructure of poultry production in Vietnam but the effect on vaccination campaign was still dependent on the economic capacity of each province. There is still a need for research on the socio-economic themes to comprehensively understand the causes of next avian influenza outbreaks and farmers' incentives to vaccinate.

Economic benefits in these systems were very unstable; the color reproductive hen production had a good economic efficiency; nevertheless layer ducks, Muscovy ducks and broiler ducks were loss-making. The quality of day old chicks and ducklings were not controlled. In addition,

the raising was very intensive but the technical and epidemic sanitary knowledge of the breeders were still limited. It was a cause of epidemic diseases to the poultry breeding.

The large fluctuation of prices of inputs, outputs and epidemic diseases in poultry production were huge issues. These previous observations seemed to be the main factors of an unsustainable poultry production in this province and in the whole country at the moment. The birds were usually bargained away at low prices or self-consumed in the households when the epidemic disease was announced on the mass media means. However, information campaigns of the Government played an important role in limiting the spread of the epidemic diseases. In addition, the major proportion of day old chicks was provided by private hatching incubation farms; nevertheless the control process of these household farms was still insufficient. Therefore, it was very difficult to control the epidemic disease on the poultry flocks and other animal production. The risks in the food supply chains were very severe in poultry production system and other food supply chains.

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