DIVERSIFICATION AND EPIDEMIC RISKS OF POULTRY PRODUCTION SYSTEMS IN HANOI SUBURBAN

Phan Dang Thang, Brigitte Duquesne, Philippe Lebailly & Vu Dinh Ton

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The Highly Pathogenic Avian Influenza (HPAI) caused by H5N1 virus in Vietnam from early 2004 with millions of birds culled. A question has been raised: how could Vietnam limit this epidemic? This research aims to address this question and to improve the income of small poultry producers through an identification of poultry production systems and the supply chains with their various constraints, including the diseases and to analyze the explicative factors of the poultry development at local level. The research had been conducted by interviewing and production record keeping system at the household farms which have poultry production at different scales in Hanoi Suburban from December, 2008 to November, 2009. There are four poultry production systems (1) integrated poultry production system with a good bio-security level; (2) layer/reproductive poultry production system at the semi-commercial scale with the minimal to moderate bio-security level; (3) broiler bird production system at the semi-commercial scale with the low to minimal 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 are strictly vaccinated with good calendar. This research showed that the scientific knowledge of farmers is still limited which causes unsettled economic outcome in these systems. Therefore, poultry production in the studied region is 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.

Keywords: poultry production, livestock farming systems, epidemic risks, income, Hanoi Suburban

1. INTRODUCTION

Vietnam is an agricultural country with around 67% of the total population currently living in rural areas. Vietnam has 11.8 millions of households in which about 70% of total rural households (or 8.3 millions) have the poultry production. Poultry production represents about 19% of total income of household; and the poultry meat occupies 15% of total meat consumption in families (VLSS, 2006; MARD, 2008). In 2008, the quantity of poultry flock in Vietnam has reached about 247 million of heads, increasing 9% compared with 2007, but decreasing 3% compared with 2003 due to H5N1 occurred in early 2004 when millions of birds culled. In 2009, the poultry flock occupied to 280 millions of heads, increasing to 13% compared with 2008 (GSO, 2009). This leads to large socio-economic impacts. The loss caused by H5N1 virus was estimated 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 large, particularly on the backyard poultry production systems (FAO, 2005). The Red River Delta is a region having the highest quantity of poultry flock in the whole country, making up about 30% of total flock (Vu Dinh Ton et al., 2008).

Hanoi's Suburban area plays 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 in the context of epidemic of the avian influenza for better responding the demand on the market. In fact, the research on the poultry production basing on system approach and commodity chains is still limited, particularly the relation between the poultry production systems with the epidemic diseases. Thus, this research aims to analyze the explicative factors of poultry development at local level in Hanoi Suburban area located in the heart of the Red River Delta through an identification of poultry farming systems with their various constraints, including the diseases in this province. In addition, this research aims at identifying the major risks of epidemic disease caused by H5N1 virus, the response of breeders facing the epidemic disease.

2. MATERIALS AND METHODS

2.1. Selection of surveyed sites

Households who having poultry production at different scales in Phu Xuyen and Chuong My which represents the main poultry production region in the Hanoi Suburban area, were selected for this research. In each district, we selected 2 - 3 communes basing on the agro-ecological patterns of the region and the diversification of poultry farming systems. This research was conducted from December, 2008 to November, 2009.

2.2. Method

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 the poultry production in this province. Then, the various poultry production systems and sub-systems were identified at the beginning of the study through this secondary information.

The research used random stratification method to select households who have poultry production. Over 270 poultry farms and veterinary agents were eventually interviewed, using a closed structure questionnaire. Information collection allows the characterization of the poultry production (sub-) systems by the production scale of commercial, semi-commercial or village production (number of birds per farms) and type of poultry production through species and productive orientation (industrial integration by the contract; layer/reproduction or broiler). 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 in the farm-households such as cropping, animal production and off-farm activities... are 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 in the period of research. Then, monthly average prices of these products are calculated.

2.3. Financial analysis

The collected information allows the characterization of the recent poultry production activities and the scale of poultry flock basing on the agro-ecological patterns. The principal income of the farms are calculated such as cropping, poultry production, other animal production at different scales and the income of off-farm activities such as hired labour, handcraft, transformation of agricultural products, commerce and monthly salary, etc. The survey data of 160 poultry farms from production record keeping system is analyzed by using MS Excel 2003.

Financial analysis method is based on the concept of value-added, the whole production processes involves the flow of inputs and outputs, where the functions are used below:

Net Value Added (VAN) = Brut Values Add (VAB) - Amortization costs (Amt) ; in there: VAB = Gross Products (GP) - Intermediate Costs (CI), and:

Net Income (R) are calculated by subtracting between the VAN with financial costs (I), land-tax (T) or labor salary (S), or R = VAN - I - S - T.

The income of off-farm activities is the net income by Vietnam dongs coming from hired labour, handcraft, transformation of agricultural products, monthly salary, etc. per farm household a year.

3. RESULTS AND DISCUSSION

3.1. Typology of poultry production systems

The scale of poultry production and the type of poultry races are really diversified and complicated in each ecological zone in the all districts of Hanoi Suburban. Most of economic activities of surveyed households are partly from poly-culture and animal production. Crop production aims to satisfy the demand of self-consumption and at selling a small overproduction. The cash income comes from animal production and extra-agricultural activities (Vu Dinh Ton et al., 2010). Investigation and results of production record keeping system of 160 households allow us to characterize four main poultry production systems according to the scale by number of birds and type of production 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 of (*sào**)	
				Plant production	Pond fish
Chicken integration by contract between farmers and enterprises (FS1)	Young hens (FS1a)	5	0.2	6	1
	Broiler chicken (FS1b)	15		7	3
Layer/reproduction poultry at semi-commercial (*FS2*)	Layer hens (FS2a)	21	4.8	5	12
	Layer ducks (FS2b)	28		12	15
	Mixed of reproductive hens and ducks (FS2c)	24		8	6
Broiler production at semi-commercial (*FS3*)	Broiler chickens (FS3a)	17	15	11	4
	Broiler ducks (FS3b)	18		7	5
Village/backyard poultry production (*FS4*)		32	80	8	3
Total		160			

* 1 sào is equal to 360m^2

** Calculation from 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 a contract between farmers and chicken production enterprises. The enterprises supply a day old chicks, chickenfeed, vaccines, chicken drugs and technicians. The farmers have to build the hen-house at their area and have to raise chickens according to a good procedure provided by enterprises with a good bio-security level.

The farmers received their wages based on their production results. The quantity of farm of this system is still limited in the whole country but this product is characteristically a commercial production model with high potential productivity such as ISA Brown, Sasso, Cobb 707. There are two sub-systems in these systems which are (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. This system keeps regularly layer hens (FS2a) or ducks and parent hens, ducks or Muscovy ducks (FS2c) at semi-commercial scale using industrial feed. Parent hens are both confined and grazed in good facilities or personal fields while layer ducks and reproduction Muscovy ducks are commonly raised in area around villages or in rice fields. The layer hens are ISA Brown, Egypt and Ross 508 bought from enterprises, center of poultry research. The layer ducks (FS2b) are Super egg ducks that are imported from Triet Giang (Chine) and French Muscovy ducks. Layer ducks are raised in the rice fields for taking the residual paddy. These poultry farming sub-systems minimal to moderate bio-security level by intensive production but farmers' technical and epidemic sanitary knowledge are still inadequate. Only layer or reproduction chickens are strictly vaccinated before a laying period, but not layer ducks and reproduction Muscovy ducks. In addition, there are some different flocks of reproductive birds such as hens, ducks and Muscovy ducks in the FS2c sub-system in the same farm. They are raised together within a limited area.

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

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

3.2. General characteristics of poultry production systems

The semi-commercial poultry production in the system FS2 began in early 1990s, however integration chicken production started much later, in 2000s. Thus, the farmers typically have only from 6 to 12 years experience of poultry production. The average age of household head is from 41 to 46 years old. In general, each household has two main familial actives for keeping the poultry. However, in backyard poultry production system (FS4), the head of the farm is more than 50 years old and some young farmers are about 30 years old. A small part of products is directly consumed in the family during the Tet festival or different celebrations and the other major part of poultry are sold to earn some income in cash. General characteristics of these poultry production systems are presented on the Table 2.

Most households adopt these systems to raise chicken around their residence or in various areas surrounding the village. In fact, there are many farmers don't purchase of chicks, and don't purchase of any feed. The agricultural by-products of the farms or village were usually used for the chicks. System FS1, the young hens and broiler chickens are kept in the industrial mode by a

contract between the farmers and enterprises and all birds are vaccinated against different disease. Broiler and layer ducks in FS2 and FS3 are grazed on rice fields or in gardens and fish ponds, but they are not isolated from other domestic animals. The production cycle is short with broiler ducks such as French Muscovy, CV Super Meat ducks and Bau Canh Trang ducks. However, in the system FS4, there are different types of birds in very small scale farms. The day old chicks are bought in local farms or produced in the same farm. The production cycle is long and the chicken feed comes from by-products of the farm.

Table 2. General characteristics of poultry production systems in Hanoi Suburban

Systems Characteristics	System FS1	System FS2 & FS3	System FS4
Scale of production per year	> 6,000 young hens and 18,000 broilers	About 500 hens/layer ducks; 1,200 - 2,600 broiler chickens/ducks	Few hens, 60 broilers
Poultry races	ISA Brown, Cobb 707	Luong Phuong, Egypt, ISA Brown with chickens CV Super M, Super Eggs, French Muscovy ducks, Bau Canh Trang	Local breeders
Source of day old chick	Enterprises	Private farms / farms themselves	Farms themselves
Poultry kept	Indoors	Indoors with some layer hens and white broiler chicken farms Fields and gardens color reproduction hens, CV Super M ducks, Muscovy ducks and broilers Transhumant with layer ducks and broiler ducks	Outdoors
Source of feed	Industrial/enterprises	Industrial and mixed of industrial with paddy, maize	Agricultural by-product
Duration of breeding	45 days with broiler chickens 4 months with young hens	Broiler ducks: 1.7 - 2 months Broiler chickens: 2.2 - 5 months Layer hens: 12 - 16 months Layer Ducks: 18 - 26 months Reproduction Super M: 12 - 14 months Reproduction hens: 12 - 16 months Reproduction Muscovy ducks: 12 -14 months	Broiler chickens: 4 - 6 months Hens: 3-4 years
Contact with other birds	None	Yes	Yes
Preventive sanitary (vaccine, disinfectant)	Good	Some vaccines with layers, reproductions No vaccines with broiler ducks	Not vaccines
Surface of fields and gardens	1 - 3 sào/farm	6 - 12 sào in system 2 4 - 5 sào in system 3	3 sào/farm

3.3. Structure of poultry flock

Poultry production is really diversified in these communes with some different poultry breeds in a household. There are 53% of household farms both raising chickens and ducks on the same area in the Red River and Mekong deltas (Phan Dang Thang et al., 2009). In systems FS2 and FS3, layer

ducks and Muscovy ducks are kept indoors or on the fields around the village in daytime and confined at night. The broiler ducks are kept indoor in the night time or by free-grazed around the village. According to the MARD/DLP (2008), the poultry production at semi-commercial scale is limited and outputs are still low. The scale of poultry production is still low per year at all farming systems (Table 3).

Table 3. Number of birds raised per farm per year according to poultry production systems

Unit: head of birds/farm/year

Systems	System FS1		System FS2			System FS3		System FS4 (n = 32)
Poultry	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)	
Hens	6,610	0	530	4	220	0 - 16	3	5
Layer ducks	0	0	0 - 15	450	120	0 - 10	0 - 7	2
Muscovy ducks	0	0	0	0 - 300	92	0 - 40	0 - 60	3
Broiler chickens	0	18,227	0 - 600	14	120	1,130	12	60
Broiler ducks	0	0	0 - 400	400	160	0 - 150	2,600	35

There is only chicken in system FS1 with the scale of young hens is about 6,610 heads/year with a contract of two flocks a farm/year and broiler chickens are about 18,227 heads per year with a contract from 2 to 4 flocks a farm/year. While the systems FS2, FS3 and FS4 have some different races of birds. The heads of bird in the backyard poultry production is really limited with few parent hens and 60 broilers per farm a year. So structure of bird flocks is very low and the poultry production is 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 for supplying household farms in day old chicks. Therefore, the origin and the quality of day old chicks were well controlled. Since the avian influenza in this time and government control measures against the avian influenza, poultry egg incubation is limited or forbidden, while the demand of day old chicks from breeders is really high by the lack of poultry meat on the market after each campaign against epidemic disease. Since then, the explosion of private hatching incubator made this production out of control of appropriate authorities.

In fact, day old chickens are mainly supplied from private incubation farms of poultry eggs in which color parental poultry are the same as of the commercial poultry production farmers. Particularly ducks and Muscovy ducks are mainly kept in the Phu Xuyen District, and then these day old chicks and ducklings are sold to farmers of many provinces. In the systems FS2 and FS3, there are 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 private incubatory farms occupying over 80% of household farms. Thus the technical and scientific knowledge of producers depends on the system of private incubatory farms. In fact, through our research, avian influenza risk is high in those private incubatory farms due to the lack of control from authorities; and the

parental poultry flocks are not vaccinated against the avian influenza. In the backyard poultry production system, day old chicks are bought in the same village or are brooded at the same farm households which still occupied an important role.

Currently, the chicks and ducklings resources are largely depended on unofficial imports from China such as the breeds of Luong Phuong chicken, Bau Canh Trang duck, Triet Giang layer duck... The white chicks (industrial chickens) are 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... are mainly supplied by some state enterprises and the poultry research centers but these resources are very limited. So an another important resource of color chicks and ducklings are provided by the private hatching farms in Phu Xuyen District but the quality control measures in these facilities are still very limited. In addition, the local chicks are supplied from the small households in each village.

3.4.2. Feed source and the knowledge of producers

There are 100% of farm households in the system 1 having 100% of the diet from a contract between the enterprises with farmers. 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 FS3. Agricultural by-products only played a central role in poultry production at small scale in system FS4 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 farmers 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 animal production. The farmers 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 FS4 who had ever participated in a course.

Most of the farmers did not know the name of vaccines against avian influenza disease caused by H5N1 virus, particularly in the systems FS4. The use of antibiotics is popular in poultry production in the whole farming systems for treating sickness of poultry flocks. In this research, there are from 40% to 65% of farmers in the systems FS2 and FS3 buy themselves medicines to treat their birds with an average duration from 3 to 5 days. If the birds couldn't be survived after this duration, the sick adult bird is mainly sold at low prices to consumers through intermediaries (equal from 25% to 50% of the normal prices). The dead chicks and ducklings are thrown out in public rivers, ponds or rice-fields.

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

3.4.3. Vaccination and the avian influenza epidemic risks

The Vietnamese Government used the vaccination program against HPAI on poultry flock caused by H5N1 virus such as a good effective tool to deal with this epidemic disease in Vietnam. This is based on the support of political systems (Communist Party, Authorities and social organizations at various levels...) and social popular organizations for implementing effective preventive measures. This program is directly carried out from the central government to villages in each region, provinces, districts, communes and villages. Vaccines are imported and given to the provinces and then distributed to districts and communes. The surveillance program of H5N1 virus after vaccination is financed on equal part from the State budget and the provincial budget and some international organizations such as World Bank program...

Organization of a vaccination campaign is directly implemented from Sub-Departments of Animal Health (SDAH) under Sub-Departments of Agriculture in each provinces to Stations of Animal Health in each districts, and then to Board of Veterinary Agents at each communes. The groups of vaccination are established at commune and implemented at villages or hamlets. The flocks with more than 50 birds are vaccinated at farm households and the flocks with fewer than 50 birds have to take the birds to a point of vaccination at village. The State organized two vaccination campaigns against H5N1 per year but there is an additional vaccination between campaigns since 2007 in some provinces. Since July 2007, it has been obligated to vaccinate every new bird flock. The birds are vaccinated two doses per campaign for layer, breeders in some provinces but one dose in most of province. The broilers, having a life cycle below 60 days are vaccinated one single dose. Each vaccination campaign is implemented from 10 - 15 days.

Many poultry herd 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 4).

Table 4. The use of vaccine and avian influenza epidemic risks in poultry production (%)

Systems	System 1		System 2			System 3		System 4 (n = 32)
Use of vaccine	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

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 present. Over 60% of households have encountered a problem with epidemic disease with an important poultry death rate. In recent years, the French Muscovy ducks have often contracted an epidemic disease with up to 70% of households. So a lot of households are 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 is nowadays used as a good strategy against HPAI for the restructure of poultry production in Vietnam. But, the effect on vaccination campaign is still dependent on the policy economic conditions of each province; and 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.

3.5. Poultry commercialization according to fluctuation of prices of inputs/outputs

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

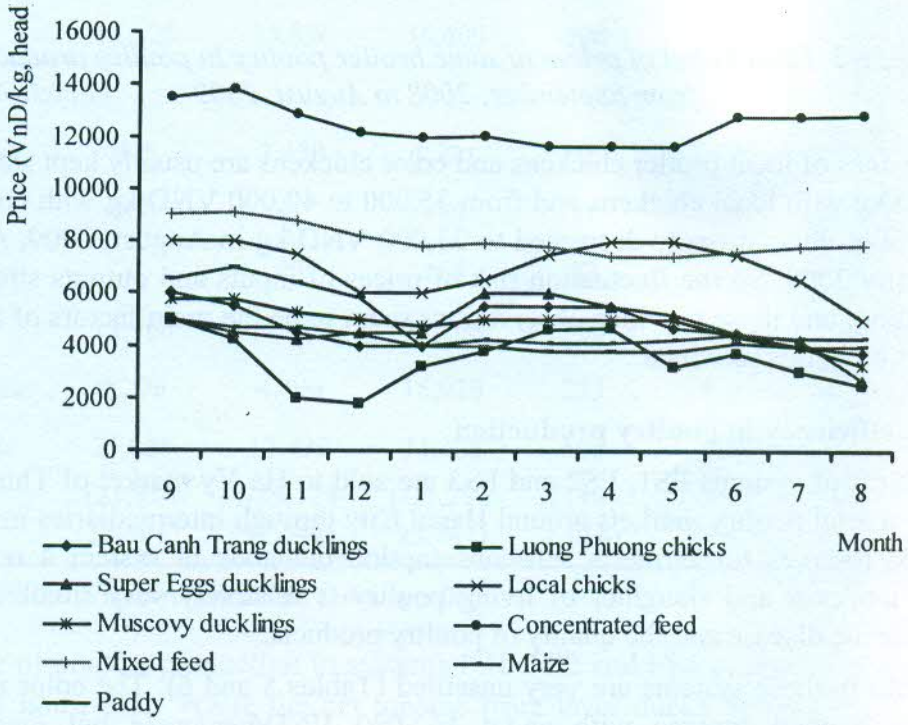

Figure 1. Fluctuation of prices of some chickenfeed and day old chicks/ducklings in poultry production from September, 2008 to August, 2009

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.

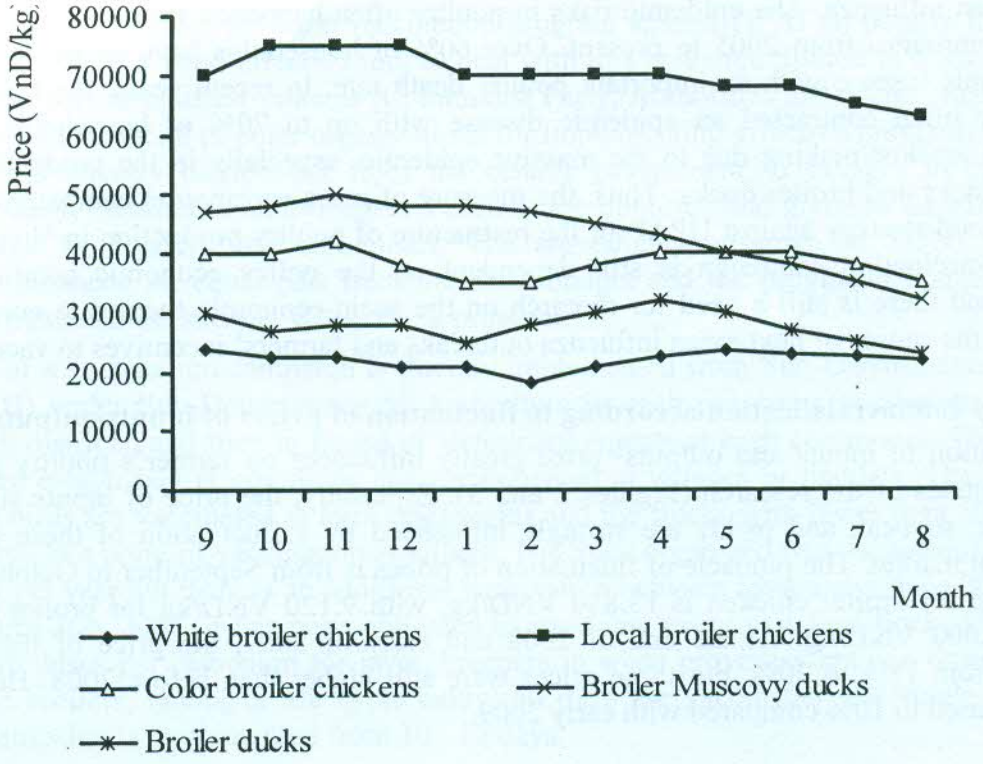

Figure 2. Fluctuation of prices of some broiler poultry in poultry production from September, 2008 to August, 2009

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.

3.6. Economic efficiency in poultry production

Over 86% of birds of systems FS1, FS2 and FS3 are 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 reserves for farmer's self-consumption demands in system 4 occupies to 40%. However, the transport and slaughter of living poultry is relatively very small. It is difficult to control the epidemic disease and the quality of poultry products.

Economic results in these systems are very unsettled (Tables 5 and 6). The color reproductive hen production has a good income with about 164,000 VND/hen/cycle but many layer ducks, reproductive Muscovy ducks and broiler ducks farms are loss-making due to epidemic disease and the great fluctuations of prices of input and output in poultry production. Many farms lost up to 65.8 million dongs/year in reproductive ducks CV Super M. Broiler poultry production at semi-commercial scale has a lower economic efficiency, with average is from 10 to 17 million dongs/farm/year.

Table 5. Economic efficiency of young and reproductive poultry production

(Unit: 1,000 Vietnam dongs)

Items \ Farming systems	Young and reproductive hens				Layer and reproductive ducks		
	FS1a (n=5) Young hens	FS2a (n=21) Layer hens	FS2c (n=24) Repro. hens	FS4 (n=13) Backyard hens	FS2b (n=28) Super eggs	FS2c (n=15) Super M	FS2c (n=18) Muscovy Ducks
GP/flock/farm	240,272	226,512	99,522	1,593	262,130	131,610	78,513
CI/flock/farm	187,409	205,748	60,942	1,038	250,098	113,897	71,093
Chicks	37,518	32,016	4,049	110	7,316	5,059	3,798
Feed	139,401	170,564	54,963	926	241,365	107,345	65,958
Veterinary	9,500	2,629	1,662	2	1,152	1,392	1,132
Energy	990	540	268	0	265	101	205
VAB	22,120*	20,765	38,580	555	12,032	17,713	7,420
Amt	6,895	4,896	2,171	48	1,117	857	1,997
VAN	15,225	15,896	36,409	508	10,916	16,855	5,423
Redistribution/flock/farm							
Financial cost	975	3,430	1,721	0	727	503	1,715
Land-tax	300	0	480	0	90	37	621
Income/head/flock	4	23	164	83	24	14	23
Income/flock	12,960	12,439	34,208	508	10,098	16,316	3,087
Income/labour/year	9,296	4,490	15,920	233	1,951	8,092	1,387
Income/farm/year	25,920	12,439	34,208	508	4,162	16,316	3,087
(min - max)	(21,714-28,568)	(-19,124-92,547)	(-21,294-93,747)	(190 - 1,018)	(-37,878-39,912)	(-65,825-145,978)	(-38,538-38,932)

* Sum of money that the farmers received after finishing a flock

The net income of poultry production in systems FS1, FS2 and FS3 occupied from 30% to 60% of total income of household. While the net income from layer ducks in system FS2, and backyard production system is less than from 3.5 to 4.2 million dongs/farm/year, occupied about 8% of net income in a household (Table 7 and Figure 3).

Table 6. Economic efficiency of broiler poultry production

(Unit: 1,000 Vietnam dongs)

Farming systems / Items	FS 1	FS 3		FS 4	
	Broiler chickens (n=15)	Broiler chickens (n=17)	Broiler ducks (n=18)	Broiler chickens (n=26)	Broiler ducks (n=20)
GP/flock/farm	285,033	21,967	24,831	2,749	1,268
CI/flock/farm	244,303	16,198	20,844	1,061	878
Chicks, ducklings	35,087	1,895	2,767	158	126
Feed	194,920	13,413	17,834	866	740
Veterinary	11,927	735	164	29	8
Energy	2,370	155	78	7	4
VAB	22,083*	5,769	3,987	1,689	390
Amt	5,919	2,727	1,547	335	145
VAN	16,164	3,042	2,439	1,354	245
Redistribution/flock/farm					
Financial cost	1,736	0	207	0	0
Land-tax	250	0	0	0	0
Income/head/flock	3	12	3	44	14
Income/flock	11,809	3,042	2,233	1,354	245
Income/labour/year	19,347	5,614	8,909	1,551	367
Income/farm/year	41,610	10,369	17,336	3,466	717
(min - max)	-4,667-120,903	-26,117-54,005	-8,972-48,028	45 - 11,268	55 - 2,780

* Sum of money that the farmers are received after finishing a flock

Table 7. General economic results of agricultural production of the farms per a year

(Unit: 1,000 Vietnam dongs)

	FS 1		FS 2			FS 3		FS 4
	Broiler chicken	Young hens	Layer hens	Layer ducks	Mixed	Broiler chicken	Broiler ducks	
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
VAN/labour	29,345	19,760	15,973	24,054	47,922	26,603	24,323	20,105

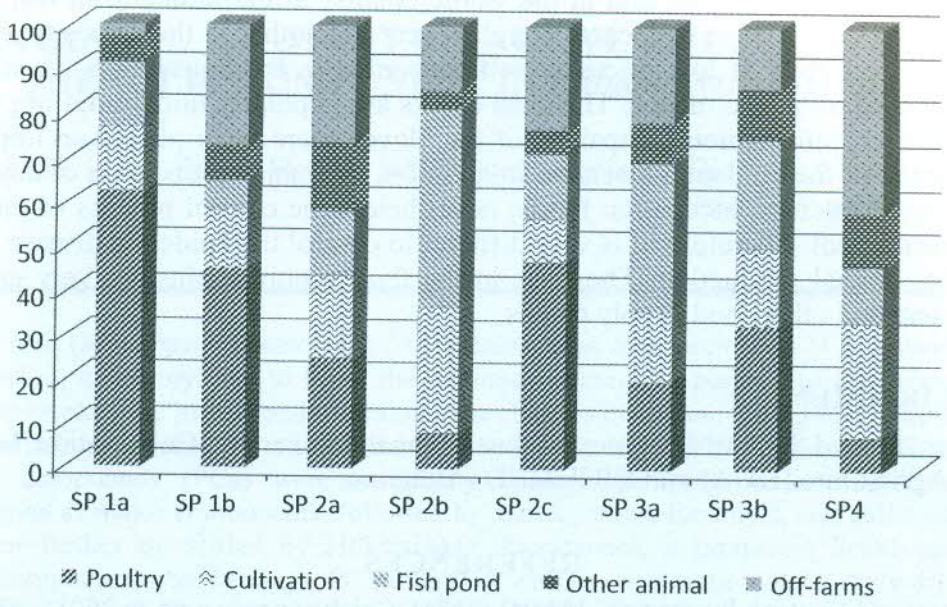

Figure 3. Structure of net income according to poultry production systems

Therefore, poultry production in the studied region is facing serious difficulties with low income in most farmers. 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 to farmers. This is able to aim at reducing the epidemic risks and aim at producing the products with good traceability in poultry supply chains in the country. In addition, the Government needs to provide the useful information on the poultry production region and international markets and it is necessary to encourage establishment of a network of poultry production and poultry products supply chains with good quality and good traceability.

4. CONCLUSION

There are four major poultry production systems practiced in Hanoi Suburban area (1) Chicken integration production by a contract between farmers and chicken production enterprises with high bio-security level, (2) Layer or reproduction poultry at semi-commercial with minimal to moderate bio-security level, (3) Broiler poultry production at semi-commercial scale with low to minimal bio-security level, and (4) Backyard poultry production system with low bio-security level. The layer or reproductive hens in the systems FS1 and FS2 in system FS3 are strictly vaccinated before a laying period but layer ducks, reproductive Muscovy ducks in system FS2, broiler ducks in system FS3 are not usually vaccinated due to limited knowledge of keepers, inflexible time of vaccination and the sensitivity of layer ducks. In addition, broiler ducks are not vaccinated caused by a very short production cycle in system FS3 and few birds in FS4.

Economic results in these systems are very unsettled, but the color reproductive hen production and chicken integration production have a good economic performance, up to 34,208 thousand Vietnam Dongs in system FS2c, from 25,920 to 41,610 thousand Vietnam dongs in the systems FS1a and FS1b per year; nevertheless many farms are loss-making or low income with layer ducks, reproductive Muscovy ducks (from 3,087 to 4,162 thousand Vietnam Dongs per year) and broiler ducks caused by epidemic and the great fluctuations of input and output prices. The quality of day old chicks and ducklings are not controlled. In addition, the raising is very intensive but the technical and epidemic sanitary knowledge of the producers are still limited. It is a cause of epidemic diseases to the poultry production, particularly in Phu Xuyen District in the period of research.

The large fluctuation of prices of inputs, outputs and epidemic diseases in poultry production are important problems. These previous observations seem to be the main factors of an unsustainable

poultry production in this province and in the whole country at the moment. In fact, the epidemic risks in poultry production often happened from this year to another in these recent years. The birds are usually bargained away at low prices or self-consumed in the households when the epidemic disease is announced on media means. The dead chicks are popularly thrown out in public rivers or rice-fields. However, information campaigns of the Government have played an important role in limiting the spread of the epidemic diseases. In addition, the major proportion of day old chicks is provided by private hatching incubation farms; nevertheless the control process of these household farms is still insufficient. Therefore, it is very difficult to control the epidemic disease on the poultry flocks and other animal production. The risks in the food supply chains are very great in poultry production system and other food supply chains.

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