

POULTRY PRODUCTION SYSTEMS IN VIETNAM

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PREFACE

The preparation of this report was part of the activities for the FAO project "Future prospects for the contribution of village poultry production to food security in developing Asian economies" (GCP/RAS/228/GER) that was funded by the "Deutsche Gesellschaft für Technische Zusammenarbeit GmbH (GTZ)". The production systems of small poultry producers show a significant variety from very low input systems with scavenging birds to those with improved genetic resources, supplementary feeding and animal health interventions. In many countries the exact type of poultry used in the small production systems is presently not well understood. The recognition of the needs to fully consider poultry genetic resources and their genetic diversity has only recently got momentum due to the outbreaks of Avian Influenza and the related control measures. A characterization of the existing poultry genetic resources and the knowledge where and with which numbers they exist is absolutely essential to consider them in disease control programmes. Investigating how local birds are affected by disease outbreaks will help to understand potential specific characteristics of the genetic resources. A good understanding of the production systems of small poultry producers including their priorities and constraints is also required to design and implement appropriate control strategies for the small poultry producers. This will help to achieve cooperation and proper involvement of small farmers in disease prevention and control programmes. It will also assist Governments to make appropriate plans for designing and implementing their disease control strategies. The present report summarizes literature information about smallholder poultry production systems in Viet Nam. It is based on a comprehensive bibliography that is covering published reports and grey literature in the fields of (i) Management and feeding systems, (ii) feed resources, (iii) poultry genetic resources, (iv) marketing systems, (v) poultry health and health control systems and (vi) cultural issues. The complete list of reference and abstracts of this bibliography is available on request from the authors or from the Animal Production Service (AGAP)¹ of the Food and Agriculture Organization of the United Nations (FAO). We hope this report will provide accurate and useful information to its readers and any feedback is welcome by the authors and AGAP.

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1. INTRODUCTION

Viet Nam, a country in Southeast Asia, has a subtropical monsoon climate. Its total area is approximately 330 000 km², with a coastline over 3 200 km long, a population of over 85 million (Statistical Yearbook of Viet Nam, 2007) and a total agricultural land area of 9.412 million ha. The average area per capita is 0.01 ha, including cultivated areas (rice, corn, potato, cassava, etc.) and animal husbandry areas. Almost all poultry production units are privately owned.

Poultry production systems have been in existence for a long time. According to archaeological evidence, poultry production in Viet Nam began 3 000–3 500 years ago in the valley of TamDao and BaVi mountain areas (currently belonging to VinhPhuc and Hanoi Provinces). Poultry is raised and well developed in all regions of the country, mainly in Red River Delta (RRD) with 26 percent, followed by Mekong River Delta (MRD) with 20 percent, the northeast with 16 percent and Northeast South with 10 percent. These four regions account for 72 percent of the country's poultry population (Statistical Yearbook of Viet Nam, 2004).

In 2003, before the emergence of the avian flu, the national poultry population was 254.6 million (Statistical Yearbook of Viet Nam, 2007), including 185.2 million chickens (72.8 percent) and 68.9 x 10⁶ water-birds (27.2 percent). By region, there were 58.4 million heads in RRD, 42.0 million heads in the Northeast, 8.8 mills in the Northwest, 33.2 million heads in North Central coast, 12.5 million heads in the South Central coast, 7.8 million heads in the Central Highlands, 15.4 million heads in the Southeast, and 36.4 million heads in MRD. Duck production is well developed in MRD, accounting for 48.3 percent of the poultry population. In RRD, duck production accounts for 23.5 percent of the poultry population.

The productive value of poultry production ranks second in husbandry industry (15–17 percent) after pig production (75–76 percent). After pork, poultry meat is the second most important meat of the Vietnamese people. In 2006, the total meat yield was 3 073 million tonnes, including 2 505 million metric tonnes of pork (81 percent), 345 million tonnes of poultry meat (11.2 percent) and 3 969.5 million poultry eggs.

Table 1 Poultry production yield, 2001–7

Year	2001	2002	2003	2004	2005	2006	2007
Poultry population (10 ⁶ heads)	218.1	233.3	254.1	218.2	219.9	214.6	226.0
Chicken population (10 ⁶ heads)	160.2	169.7	184.7	159.3	159.9	152.0	–
Duck population (10 ⁶ heads)	57.9	63.6	69.4	58.9	60.0	62.6	–
Poultry meat production (10 ³ tonnes)	323	362	373	316	322	345	359
Egg production (10 ⁶ eggs)	4 161	4 722	4 852	3 939	3 948	3 970	4 466

Sources: Statistical Yearbook of Viet Nam, 2007 and author's calculations

Within the 2001–7 period, the poultry industry reached its peak in 2003; meat yield was 372 700 metric tonnes and egg production was 4 852 million eggs. Poultry live weight per capita per year was 4.5 kg (equivalent to 2.94 kg carcass weight per person). The number of eggs per capita is 60 eggs, or 3.4 kg of eggs per person (Statistical Yearbook of Viet Nam, 2004), which is lower than in China (6.5 kg), Thailand (15.3 kg), Malaysia and the United States of America (49.6 kg) (author's calculations).

In December 2003, poultry industries in Viet Nam became strongly damaged by the bird flu: 38.3 million heads were destroyed and died, accounting for 15.1 percent of the poultry population, of which 50 percent were chickens, 30 percent, ducks and 20 percent, other bird races (Anh, 2004). By March 2004, the bird flu was under control (Anh, 2004). Although the poultry population decreased by 14.13 percent in 2004 compared to 2003, it increased by 0.78 percent compared to 2005. In 2007, the poultry population increased again, by 5.31 percent compared to 2006 (Statistical Yearbook of Viet Nam, 2007).

There are three main systems of poultry production in the country:

The non-intensive system: Practised by 92 percent households of Viet Nam, 5–7 chickens per farm are reared in this system. The efficiency of these households is limited.

The semi-intensive system: Since 1990, some peri-urban farms have switched from the non-intensive to the semi-intensive system. Here, there are more chicken in larger houses, better equipment, better breed and food quality. This system is more efficient than the non-intensive system.

The intensive system: Foreign companies invest in some large farms for housing, equipment and training. Few private farmers use this system.

In 2005, poultry was raised by 7.9 million households in Viet Nam, of which 7.3 million households (92 percent) practise the non-intensive system, 474 000 households (6 percent) practise the semi-intensive system, and 150 000 farms (2 percent) practise the intensive system. In the non-intensive system, households usually keep 5–50 heads compared with 50–500 heads in the semi-intensive system and 500–5 000 heads in the intensive system (our calculations).

2. VIETNAMESE POULTRY PRODUCTION SYSTEMS

2.1 Vietnamese poultry management systems

Poultry herd management in the non-intensive system

The non-intensive system is used in traditional small households in Viet Nam. Farmers pay little attention to their chickens and poultry production yield is low. The poultry industry plays an important role in farmers' lives, contributing a large part of total household income. In rural areas, income from poultry production accounted for 32.5 percent of total husbandry income, which followed pig production, with 54.72 percent (Nho *et al.*, 2001). Poultry products are used as a means of credit. People sell chickens, ducks or a dozen of eggs for basic needs and urgencies, including health treatment and medicine, children's books and school fees, etc.

Documentation on the extensive system is rare. Information on the extensive husbandry system is based on personal experiences of the authors while working on private farms in 2002, research on the pig and poultry husbandry system in ThaiBinh funded by the Foreign Affairs Department of Denmark and the Ministry of Agriculture and Rural Development (MARD) of Viet Nam in September 2006; and research on smallholder households in AnGiang and TayNinh in 2006 on the economic impact of the bird flu and biologically safe practices in poultry husbandry in Viet Nam. According to all of the above research, farmers' knowledge on the extensive system in poultry production is passed from generation to generation. The few who received training in poultry husbandry could not apply it into their farms due to limited investment.

In the non-intensive system, farmers lack productive strategies and/or plans to develop their poultry herds. The household head, usually a man, decides on the breed and type of poultry to buy. Feeding and tending the poultry herds are the duties of the women, the elderly and children.

Farmers usually keep 3–5 adult hens and 2–3 adult cocks for breeding, both for chickens and ducks. Eggs are mainly used for the household and sold to those living in the same village. To replace their poultry herds, their eggs are incubated by their hens.

In some farms, more chicken eggs are hatched by turkeys or a small hatching machine. When 70–80 percent of the eggs are hatched, hens take care of new-born chicken themselves. In the first week, farmers feed them bran and rice, including broken rice. Chicks follow their mothers to seek food. Offspring are protected by their mother from eagles, dogs and cats, among others.

In the morning, chickens are fed with rice, maize, cassava and potato, but not on a regular basis. The amount of food depends on crop type and farmers' availability of its by-products. Chickens find food themselves throughout the day in the gardens and on fields and

roadsides. Farmers sometimes feed them again in the afternoon. They eat crop remains, worms, insects and locusts. In the night, the poultry rests in a corner of garden or in cattle or pig stables.

Farmers may not know exactly how many chickens they have. They only recognize changes in animal herds after many chickens die or get sick. For this reason, diseases spread easily between households in the villages, districts or provinces. In one year, each household raised an average of 50–60 chicken heads, but the mortality rate is high, 45–50 percent; only 20–30 heads could be sold or slaughtered and the average poultry flock is 19.1 heads per household (Nho, 2001).

The situation of rearing geese and Bau duck is the same as for chicken. The most common ducks in MRD and RRD are field ducks, which can be reared on remains of droppings of paddy rice in the rice field after harvesting crops. Farmers who raise field ducks need to understand the seasons of harvesting rice crops and suitable hatching times. After they are 3–4 weeks old, field ducks graze freely in harvested fields. Ducks collect and eat 70–80 percent of dropped rice is collected by the ducks in the fields. Farmers need to feed ducks for their first 1–2 months. Field ducks weigh 900–1 500 g at 60–75 days of age (crossbred ducks may reach 2 500–3 000 g). All of them are sold at the beginning of the new rice crop cycle. For the Szarvas duck breed, which was imported from Hungary, the body weight is 2.0–2.5 kg/bird (Man and Quang, 1993). In rural areas, over 65–70 percent of the duck populations are field ducks. Duck meat is produced with low input but high risk of diseases and lengthy rearing. Field ducks are the cause of almost all poultry disease in the country.

Poultry herd management in the semi-intensive system

Farmers with higher income and more knowledge invest in housing, new breeds and better feed for their chickens; 80 percent of households that use semi-intensive system have participated in training courses on feeding, rearing, management, breeding and veterinary services. With little investment only, their poultry houses are small and simple, near their homes (5–10 m away) and their production practices cause heavy pollution. Each farm keeps poultry for one production system: meat or egg production with chickens and ducks; breeding farms of chicken, ducks, geese, etc; or hatching centres for 10 500–50 000 eggs. The eggs for the hatcheries are collected from egg producing breeding farms or other ordinary farms.

Farmers participate in training courses provided by national agricultural extension centres, local agricultural extension centres, poultry breeding centres, the National Institute of Animal Husbandry and agricultural universities. Topics include nutrition, management, new breeds, vaccinated schedules including smallpox, Marek's Disease, Gumboro Disease and Newcastle Disease.

Farmers are taught how to plan, design product strategies and keep financial balance for each farm activity. In the household, men have opportunities to participate in training courses, but it is the women, the elderly and children who take on the important roles in poultry production. Useful information and new knowledge are thus transferred to the wrong targets.

The households that raise 30 breeding females, get high profits after eight months, at about 18.42 percent of the total investment, giving the farm workers daily wages of VNĐ 21 580. However, households that raise 30 broilers over a 4.5 month period, may get 9–11 percent profit from total investment, with daily wages of VNĐ 1 400–15 500 and households that raise 100 heads of broilers for a 4.5 month period get 17.8 percent profit, with a daily wage of VNĐ 18 670 (Nho *et al.*, 2001).

Meat production broiler farms of 95–100 heads are the best size because after 11 weeks, Sasso broilers may reach 2.1–2.6 kg, Kabir 1.8–2.4 kg and TamHoang 1.5–1.9 kg (Binh *et al.*, 2001b).

The food conversion rate (FCR) is 2.5–3.2 kg. At 12 weeks of age, the weight of Sasso and Kabir reach 2.6–2.7 kg for males and 2.2–2.3 kg for females, FCR is 3.2–3.3 kg/kg. In this system, the feed cost for producing 1 kg chicken meat is 7 100–12 900 VNĐ and the price of chicken is 16 600 VNĐ /kg, allowing farmers to yield a high profitability (Binh *et al.*, 2001b). If farmers follow correct procedures, they will yield a high profit in this system (Cu *et al.*, 2001, Son *et al.*, 2001; Tien *et al.*, 2001a and 2001b).

Poultry herd management in the intensive system

In 1993, in Viet Nam, the first intensive chicken production farm was established through funds of the Cuban Government. At present, there are 11 national poultry breeding centres with 3 000 pure breeds and 18 000 grandparent chickens. There are 106 local poultry breeding farms including ten farms belonging to foreign companies, 20 farms belonging local companies and the rest belonging to private companies.

The characteristics of poultry intensive production system are high investment, good management and a short husbandry period. Broilers have a short feeding period allowing farmers to raise 4–5 batches per year. Exotic poultry breeds have a high growth rate. Breeding poultry is supplied by foreign companies or national breeding centres. One million parent and 4 000–5 000 grandparent chickens per year are imported to produce commercial chicken for meat or egg production.

2.2 Poultry nutrition

There is a high potential for high-carbohydrate feed for animals in Viet Nam. The amount of high energy food for animal in Viet Nam is 3 453 000 metric tonnes of maize, 1 790 000 metric tonnes of rice, 2 569 000 metric tonnes of broken and bran rice, 115 000 tonnes of cassava, 100 000 tonnes of cassava by-products and 461 000 tonnes of dry sweet potato. But high-protein food is scarce in Viet Nam. In 2005, 1 million metric tonnes of high-protein feed were imported to fill half the national demand. Viet Nam thus depends strongly on imported resources (Kinh, 2006). There is a variety of different ingredients used for the different kinds of poultry production used in different systems.

Nutrition in the non-intensive system

The non-intensive system is a traditional system of poor households with little knowledge of rearing poultry. Their experiences are transferred from generation to generation.

Poultry is fed with by-products of agricultural crops such as maize, dry cassava, dry potato, broken rice and rice bran. Kitchen waste is one of the poultry feed resources used in this system.

Broilers can collect 20–25 percent of their protein needs from the environment (Minh, *et al.*, 2001) ranging freely for four hours per day; Ri and Tam hoàng chickens can collect 22–29 percent of their crude protein and energy requirements from free ranging. The price of 1 kg of eggs of free-scavenging chickens is 15–30 percent less than those of chickens raised in cages (Minh, 1999).

Free ranging ducks can collect 70 percent of dropped rice in fields and catch small fishes, shrimps, helixes and worms, among others, to fill their protein needs. Consequently, food for free ranging ducks is not an issue of concern for these farmers (Man and Quang, 1993).

The level of feed supplementation given by the farmers to their poultry depends on the importance of the poultry production to their family or the availability of their by-product resources. In the non-intensive system, there is no standard of feeding and tending. The poultry are never fed according to a nutritional requirements and waste energy by seeking food. Their performance is consequently low. Moreover, they are at high risk of disease infection. In order to provide chickens with the necessary nutritional balance, their supplementary concentrate feed should consist of: 32 percent fish powder; 63.5 percent soybean seed cake; 3 percent minerals; 1.25 percent vitamins; and 0.25 percent salt (Tien, 2001b). For a higher efficiency of poultry production farmers are encouraged to mix this concentrate feed with the right amount of maize or broken rice. However, this formula is very expensive due to using fish powder and soybean seed cake, so few farmers can actually afford to mix it at the right proportion. They mix it at a lower rate, which reduces efficiency (Tien, 2001b).

Nutrition in the semi-intensive system

The development of poultry production is one of the country's priorities. Some farmers have therefore been provided with training in new techniques, land and credit to develop their production. Many switched from the non-intensive system to the semi-intensive system. Concentrate feed is used for different breeds in different periods. The price of poultry feed in

Viet Nam is 10–20 percent higher than in other Southeast Asian countries, due mainly to the cost of rich protein resources and supplementary foods as well as the importation of nearly all processing feed machines (Kinh, 2006). Farms are small. Feed costs are higher due to the small size of bags or consignments. Further, an extensive delivery system also increases the price. In order to reduce the feed price, a great deal of research has been carried by the National Institute of Animal Husbandry (NIAH) and agricultural universities on the use of local food resources for different kinds of poultry. Many studies on imported breeds, new crossbreeds and nutrition have also been carried out. In 1996–2001, the national programme of biotechnology KHCH (Scientific and Technology) project 08–13 (1996–2001) studied local chicken breeds such as Ri, DongTao and TauVang, as well as selection and improvement of keeping and feeding conditions. Results of the project after five years show that meat production has increased 40–60 percent and eggs production, 30–50 percent. Studying imported, coloured chicken breeds such as TamHoang and Lương phương (China), Kabir (Israel), ISA-colour and Sasso (France), meat production and reproduction ability gets 90–100 percent, compared to the origin. Sixteen of these breeds have been studied in order to adapt poultry husbandry to different regions. Other studies on the breeding and feed of coloured chicken in the semi-intensive system were carried out in Scientific and Technology Project 08–13, 2001.

Broilers in the semi-intensive system are fed by different rations for different age groups: 0–4 weeks, 5–8 weeks and 9–12 weeks, which have, respectively: energy levels of 2 950 kcal, 3 000 kcal and 3 100 kcal; crude protein levels of 19.0 percent, 18.0 percent, and 17 percent; lysine levels of 1.05 percent; 0.9 percent and 0.7 percent; and methionin and cystin levels of 0.09 percent, 0.61 percent and 0.82 percent, respectively. To reduce food prices, 15–20 percent cassava powder is mixed in. This can be used as a reference for other coloured chicken breeds (Viet *et al.*, 2001). Broilers fed at 0–10 weeks old with rations containing animal protein (fish powder) or soybean seed cake have the same survival rate. But the growth rate of broilers fed with rations containing fish powder is 7–10 percent higher than those fed with rations without fish powder (Vang *et al.*, 2001b). Sasso, Kabir, TamHoang broiler breeds fed with or without fish powder yield the same result (Binh *et al.*, 2001a). Farmers can replace maize in rations by 15.7 percent cassava for 0–4-week-old chickens and 37.9 percent for 5–7-week-old chickens. Maize can be replaced by 5 percent broken rice in 0–4-week-old chicken and 10 percent in 5–7 week-old chicken (Hoan, 1995). Powder worm and powder cassava leaf is used as a source for chicken feed to obtain high efficiency (Minh *et al.*, 2001).

Nutrition in the intensive system

In 2005, there were 249 feed processing factories in Viet Nam. In 2001, the animal food industry supplied 27 percent of national demand, compared with 38 percent in 2005 (5.34×10^6 metric tonnes); the remaining food is supplied by farmers' own resources. There are many problems in the feeding system in Viet Nam. First, the price of concentrate feed is high, 10–20 percent higher than in other countries. Next, the quality of animal feed is insufficient for many reasons, including: few laboratories to analyse food quality; the fact that low quality food can be easily sold in the market; the fact that 60 percent of farms produce their own food without a nutritional balance; food becomes contaminated with fungus, mould, toxicants and poisons due to poor maintenance of raw materials and animal feed. Also, the price of animal husbandry products is high (Kinh, 2006).

2.3 Poultry breeds

Poultry breeds in the non-intensive system

The most important native poultry breeds in Viet Nam are Ri, TauVang, Mia, DongTao, Ho chicken breeds and Co, Bau, KyLua, Muscovy duck breeds. In the non-intensive system, most of poultry breeds are local breeds. The most important breed of chicken is the Ri breed in northern Viet Nam and the TauVang breed in southern Viet Nam. Other local breeds are raised in other smaller regions, some only in one village, district or province.

Chicken breeds

The largest populations of native chicken breeds in Viet Nam are as follows:

Ri chicken: Ri chicken is the most popular native breed, mainly found in northern Viet Nam, where it accounts for 90 percent of poultry population. Characteristics, performance as well as selection of Ri chicken have been studied in-depth by many researchers in the country (Long, Thu and Lung, 1994; Lung et al., 2001; Lung et al., 2003; Vang et al., 1999a; Dat et al., 2006; Hoan, 2008). Ri chicken is crossed with different local chicken breeds whose performance and colour are different from Ri. The rate of fast-growing feathers for females is 76.73 percent compared to 55.63 percent for males. The rate of slow-growing feathered birds is 23.27 percent for females compared to 44.37 percent for males. The skin and legs of Ri chicken are yellow. Its live weigh is light: 310–330 g at 60 days old in the extensive system. However, in the intensive system, at 60 days old, Ri male broilers are 600–620 g, and 510–530g for females (Lung et al., 2003). After 20 years of selection and improved environmental conditions in small-scale households practising the extensive system, the live weight of Ri chicken has doubled – the number of eggs per year is 123 compared to 65 eggs in the Ri population without selection (NIAH, 1985). Since 1985, there has been an increase by 10 eggs (8.8 percent). At present, the survival rate of Ri chicken is 95–96 percent. Presently, in the non-intensive system with poor conditions in different villages, the survival rate is 60–70 percent and performance is low and varies from different flocks.

Photo 1: Ri Chicken



TauVang chicken: TauVang is the most popular native chicken breed in southern Viet Nam. Its live weight is 637g at 60 days old. At 80 days old, the live weight of males is 1300g and 1 060gr for females. It lays 120 eggs per year. In poor conditions such as in village areas, its performance is 10–15 percent lower (Tien, et al., 2001a).

Mia chicken: Mia chicken is raised in the SonTay District, HaTay Province. At present, the Mia breed population is very limited, at risk of extinction and in need of conservation. To use the genetic resource of this breed, it is necessary to identify the performance and breeding values for selection and multiplication (Long et al., 2008). The live weight of Mia chicken is 800–900 g at 60 days old and 3 500–4.000 g and 2 500–3 000 kg for cocks and hens, respectively, at 140–150 days, respectively. They lay 55–60 eggs per year (Lung and Long, 1994).

DongTao chicken: Dong Tao chicken is raised in some communes of KhoaiChau District, HungYen Province with a limited population. This breed provides good meat. The live weight of the DongTao chicken breed is 700–800 g at 60 days old and 3.200–4.000 g at 140 days, while hens weight 2 300–3 000 g. It lays eggs 55–65 eggs per year (Lung and Long, 1994).

Ho chicken: Ho chicken is raised in Song Ho commune, ThuanThanh District, BacNinh Province. In LacTho village, the population of Ho chicken is just a few hundred heads. Ho chicken breed are characterized among Vietnamese local poultry breeds by their slow

movement and large body size. At 50 days old, the live weight of males is 2 500 g and the live weight of females is 1 750 g; at 8–11 weeks old, it is 3 692 g for males and 2 235 g for females. Eggs weigh on average 53.3 g (Thien *et al.*, 1994).

Choi chicken: The Choi chicken breed is used for cock fighting. As opposed to other breeds, farmers raise more cocks than hens because of this main function. In rural areas, cock fights are held annually in Vietnamese festivals.

The cocks and hens have similar feather colours, usually black, grey, white and brownish, five-colour, apricot and white with grey. The leg colour is usually black, white, ash-grey, yellow or slate; skin colour is red; ears are yellow, black, red, white and deep brown; and the comb colour is pea or chestnut.

The shanks of Choi chickens are very strong. At birth, the body weight is 32.2g; at 16 weeks, it is 1 370.0 for males and 948.16g for females. The survival rate is relatively high, at an average of 98.9 percent. The adult body weight is approximately 2 836.60g for males and 2 445.2g for females. Eggs are first laid at 211.08 days. Egg production is 54.04 egg/hen/year, of which 82.26 percent are first-class (Anh *et al.*, 2008).

Ri, TauVang, Mia, DongTao and Ho are all traditional chicken breeds in their regions. Rural people have a great deal of affection for them. Pure selection is done according to performance. The best performing local breeds become precious chicken meat at very expensive prices. Few households can afford to raise them. At present, Mia and DongTao are developed in other regions and Ho chicken is kept as a genetic resource. Similar results are found in studies by Xuan *et al.* (1999) and Vang *et al.* (1999b).

In addition to these most popular local poultry breeds, Viet Nam owns 28 local chicken breeds with different genotypes with respect to performance and quality of products. Many of them are protected by genetic resources conservation and development including Ac and H'Mong chicken (Tieu *et al.*, 2008). Ac chickens are used as a traditional medicine for pregnant women, old people and children. They are kept in households practicing the extensive and semi-intensive systems. The weight at eight weeks is 296 g for males and 260 g for females. Ac hens lay 90–95 eggs/year. There are different colours of feather in Ac chickens; skin, legs, meat, bone are black (Thien *et al.*, 1999).

H'Mong chickens originate from Son La, but presently, they are kept largely in other regions. Feathers are of different colours; the skin and meat are black; and its meat is delicious and highly nutritious. The survival rate at 16 weeks old is 97 percent. The weight at 16 weeks old for males and females is 1 230 g and 1 075 g, respectively. Egg production is 70 eggs per year (Cuc *et al.*, 2002).

Duck breeds

Vietnamese native duck breeds can be divided in groups according to purpose of production. Co duck is raised in large areas in the north of the country. Moc duck is raised in the central coast. In MRD, almost of farmers raise exotic breeds or crossbreeds such as AnhDao crossbred (Cherry valley crossbred), agricultural crossbreeds and BachTuyet duck breed.

Co duck breed: There are eight different colour types, but almost all are brown with small black spots. The live weight is 900gr at 60 days old and 1 050 g at 75 days old (Truong *et al.*, 1994). In the intensive system, their live weight is 1 000–1 300g at 60 days old. Co duck graze freely in the field or on sea coasts to collect feed such as droppings of rice, shell-fish, mussel and crab. After the harvesting period of the paddy rice crop, these ducks graze freely in harvested fields to seek rice droppings. After 2 months, the duck are sold or slaughtered.

Co ducks account for 85 percent of total ducks. Co ducks are concentrated in the Red River Delta and the central coast. In the south, there are few Co duck, as they are replaced by exotic breeds, or crossbreeds between exotic breeds and local breeds (Truong *et al.*, 1994)

Co ducks lay an average of 225.5 eggs per female per year (Truong *et al.*, 1994). In the DaiXuyen Duck Breeding Research Centre zones, after several generations of selection, the live weight of Co ducks reaches 1 193 g for males and 1 027 g for females, at 8 weeks old. Females lay 247–267 eggs per year (Minh *et al.*, 2006). After ten years of successful selection in the NIAH, the average of number of eggs has increased by 33–35 (15 percent) (Minh *et al.*, 2006).

Bau duck breed: Bau duck is raised for meat. Its live weight is 1 100–1 200 g at 60 days old and 1 400–1 600 g at 70 days old; adult weight of males and females is 2.0–2.05 kg and 1.7–2.0 kg, respectively (Nho *et al.*, 1994). Its reproduction period depends on the season – the main reproduction periods are spring-summer and autumn-winter. Bau duck lays 165–

175 eggs per female per year (Nho *et al.*, 1994). Its fertility rate is 87–88 percent and hatchability, 73 percent (Nho *et al.*, 1994). One female duck can produce 100–110 ducks per year. In some regions, Bau ducks have specific characteristics and the local subtypes are considered as separate lines, such as the BauQuy duck breed in QuynhChau-NgheAn Province and BauBen duck breed in Ben Market, HoaBinh Province. The live weight of BauQuy at 70 days is 1 544–1 788 g and the live weight of BauBen is 1 587–1 806g for both sexes (Thieu *et al.*, 2003).

KyLua duck breed: KyLua duck originated in Lang Son Province. Its live weight at 10 weeks is 1 615–1,708 g, according to Tam *et al.* (2006b). It is raised in flat and mountainous areas.

In southern Viet Nam the local duck breeds are not as popular or numerous as in the northern areas. However, a few Co and Bau duck breeds are raised for egg production.

Muscovy duck breeds: Muscovy duck husbandry has been practised for a long time in different regions. The breed is able to collect food in water areas and in fields and gardens. Muscovy husbandry does not depend on season. Muscovy ducks do not require high quality feed resources (Ky, 1999). There has been little scientific research on Muscovy husbandry, because it is given little concern.

There are three kinds of local Muscovy duck breeds in Viet Nam: (i) White Muscovy (*Re* Muscovy), which is covered in white feathers, has a slim body, moves easily and accounts for 30.06 percent of total local Muscovy; (ii) spotted white Muscovy (*Dom* Muscovy) accounts for 67.41 percent; and (iii) black Muscovy (*Trau* Muscovy), which has black feathers, a heavy body and slow movement, accounts for 4.5 percent (Ky, 1999).²

There is no difference in live weight of spotted Muscovy and white Muscovy ducks: 1 700–1 900 g at 11 weeks old for females and 3 800 g at 12 weeks old for males. Muscovy ducks lay 65–69 eggs per female per year (Thuy, 1994). The live weight average of male and female Muscovy ducks at 12 weeks age is 3 002 g and 1 750 g, respectively. Egg production is 66–70 eggs per year (Thuy *et al.*, 1999.)

At present, some French Muscovy lines with large bodies are imported to Viet Nam. The live weight of the R51 line at 56 days is 2 570 g for males and 2 062 g for females; The live weight of the R31 line at 56 days is 3 100 g for males and 1 885 g for females. The survival rate of both lines is high, at 95–97.5 percent. R51 female Muscovy ducks lay 143 eggs in 63 weeks, 2.5 times higher than local Muscovy ducks; R31 female Muscovy ducks lay 118.7 eggs in 29 weeks, 2.5 times more than local Muscovy ducks. Presently, some more exotic Muscovy ducks are imported and developed in different regions in Viet Nam. Farmers in some regions yield a high profit with Muscovy husbandry.

There are some specific genetic studies on production traits. Heritability of live weight of Mia chicken is 0.50 ± 0.14 at nine weeks and 0.50 ± 0.13 at 12 weeks. Heritability of three months of laying is 0.24 ± 0.11 and egg weight is 0.53 ± 0.14 (Long *et al.*, 2008). Studies were carried out on: the genetics of some productive characteristics of KyLua duck; heritabilities of live weight at 56 days at $h^2_S = 0.425 \pm 0.20$; $h^2_D = 0.599 \pm 0.15$; $h^2_{S+D} = 0.512 \pm 0.11$ (Tam *et al.*, 2006a); the physical, chemical and biological standards related to the growth rate of some local chicken breeds (Coi *et al.*, 1999); the selection for local breeds (Dat *et al.*, 2006; Dat and Tung, 2007); crossbreeding between Ri and imported breeds (Dat *et al.*, 2008; Tien *et al.*, 2008); an analysis of DNA polymorphism in growth hormone genes of some Vietnamese chicken breeds (Hoan and Vang, 1999); the specific intron 1 structure in growth hormone genes of some Vietnamese chicken breeds (Hoan, Vang and Luong, 2000); analysed growth hormone genes of Ri chicken breed by PCR-RFLP techniques (Hoan, Vang and Lan, 1999; Hoan *et al.*, 2008); TauVang in situ chicken breed genetic conservation in southern Viet Nam (Bac *et al.*, 2004). All of these studies help identify the characteristics of Vietnamese local poultry breeds.

Poultry breeds in the semi-intensive system

Since 1990, some households have switched from the non-intensive to the semi-intensive system. Many suitable chicken breeds for small farms have been imported and developed, such as TamHoang, Luong phuong (China); Kabir (Israel); and Sasso, ISA Colour (France). Some studies on these breeds show that they have good adaptability and are well developed in Viet Nam (Dat and Tung, 2007). Their performance is shown in Annex 2.

² *Re*, *Dom* and *Trau* Muscovy are the Vietnamese names for three different types of Muscovy ducks.

Using genetic resources, several crossbreeds from two or three chicken breeds have been tested and developed. Performance of crossbreeds of local and exotic breeds is similar to the average of their parents, but they are easier to feed and better quality of meat. Through heterosis, crossbreeds have 2–13 percent greater live weight at slaughtering compared to the average of their parents (Vang *et al.*, 2001a; Nga *et al.*, 2000; Nga *et al.*, 2002; Thu *et al.*, 2000; Xuan *et al.*, 2001, Xuan, Tien and Nga, 2001; Tien *et al.*, 2003a; Tien *et al.*, 2003b; Coi *et al.*, 2006). Performance of crossbreeds is showed in Annex 3.

Imported breeds such as Super Meat (SM) duck, France Muscovy duck, Kakhi Campbell duck or CV2000 layer breeds are popular in farms that use the semi-intensive system. TrietGiang duck breed (a high egg-producing duck) is imported from China.

Poultry breeds in the intensive system

Since 1973, farms under the intensive system have been established in the country. Many high-productivity breeds were later imported and developed in different areas (Annex 4) such as AA (France), Ross 208 308 and 508 (United Kingdom), Avian (Thailand), Lohman (Germany), Cobb, Hubbard (United States); and egg breeds such as Leghorn (Cuba), Goldline 54 (the Netherlands), Miravia (Czech Republic, Brown Nick (United States), Hisex Brown (the Netherlands), Hiline (United States) and ISA Brown (France).

There are also meat duck breeds such as Super M₁, M₂, M₃ (United Kingdom); French geese including R₃₁, R₅₁ and R₇₁, and Super Meat lines such as E, F, G, H (France). There are some egg duck breeds such as Kakhi Campbell, layer CV2000 (United Kingdom) and some Chinese high egg-producing duck lines. There are one million parent poultry and 4 000–5 000 grand parent poultry are imported per year to produce commercial crossbreed offspring.

Due to different climates, poor husbandry equipment and low quality feed, the performance of exotic breeds has achieved 90 percent only of the original place.

2.4 Marketing poultry products

Product marketing in the non-intensive system

Egg and meat products are used to fill household needs. Some of the products are sold to markets or neighbours. Poultry is sold live. Poultry products serve as credit for households. When farmers need cash for medical services, medicine, school fees, and children books, etc., they sell eggs or chickens. Poultry is slaughtered when guests visit. Frozen chicken meat is not popular for rural people. It is considered unfresh or less tasty. Other hand, without the necessary infrastructure and equipment, frozen chicken meat cannot reach the rural areas.

The price of local chicken meat (including bone and skin) is 60 000 VNĐ /kg; 45 000 VNĐ /kg for chicken meat from the semi-intensive system and 30 000 VNĐ /kg for the intensive system. The price of local chicken eggs is 2 000 VNĐ per egg; 1 200–1 400 VNĐ per egg from the intensive system. The information on prices is not representative for the whole country and prices are not stable. (1 US\$ = 16 500 VNĐ)

Product marketing in the semi-intensive system

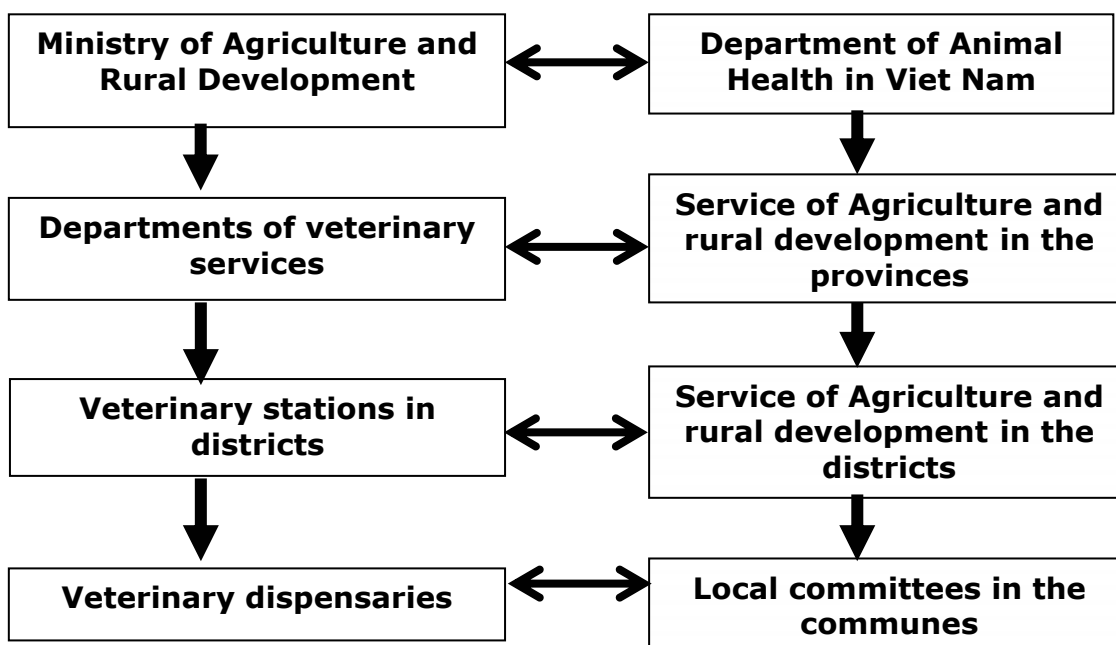
Poultry products are sold on farms. Traders bring poultry products to markets or cities. The poultry products are then brought to smaller markets, the local markets in the city. Small traders slaughter poultry before it is sold. Price fluctuation is high in different places and times, depending on the season and the amount of poultry sold by the farmers. Without standard delivery systems, poultry products are traded through direct agreement between the seller and the buyer.

Product marketing in the intensive system

In the intensive system, farmers have contracts with traders and slaughterhouses to sell their poultry products. Poultry slaughtering plants are still small and old, with a capacity of 300–500 heads per day. There are 28 abattoirs with high capacity and model systems in the country. Total slaughtered poultry meat is 25 000–30 000 metric tonnes per year, representing 8 percent, while 92 percent for poultry meat was sold by live birds.

2.5 Animal health services and epidemic prevention for poultry

The Vietnamese veterinary management system, from the national to the local level, is shown below:



Commune veterinary agents are farmers who have been selected and trained by district veterinarians. They may be paid a small salary for their work, but their main income comes from their own crops and husbandry activities, from local animal health services. According to annual disease reports, the most common diseases in Viet Nam are as follows: Newcastle Disease, Pasteurellosis avium, chicken cholera, Marek's Disease, chicken pox, coccidiosis and Salmonellosis avium.

Animal health networks in the non-intensive animal production system

In the non-intensive poultry production system, farmers become accustomed to the risks of diseases and climate and pay little attention to treatment and prevention.

There are several species of poultry (chicken, duck, Muscovy duck) and several breeds with different ages in a single poultry herd. It is very difficult to vaccinate all of them. Vaccines are used efficiently in the intensive system. The price for a 1 000-dose bottle of emulsified vaccine against Marek's Disease or Gumboro's Disease is too expensive for farmers in the non-intensive system. Farmers are not completely aware of the situation of their poultry herds that run freely all day and are confined in cages in the evening. It is very difficult to vaccinate all poultry herds.

There are few studies on poultry health in the non-intensive system, in which only 30–40 percent is vaccinated. This is the cause for the increasing spread of epidemic diseases each year (Nho, 2001). The death rate in the non-intensive system is 40–60 percent. In some areas, it rate increases to 70–80 percent, even 100 percent. With low eco-technical measures, few veterinary services, little attention paid by farmers and high dependence on natural resources, farmers cannot control the diseases on their farms.

Animal health in the semi-intensive system

In the semi-intensive system, farmers pay more attention to their poultry health. They have direct access to veterinary services and assistance. Broilers are vaccinated against Newcastle Disease, smallpox, Gumboro Disease and others. Breeding chickens are vaccinated against Marek's Disease and Gumboro Disease, among others, before the laying period. The death rate is 5–10 percent, lower than in the non-intensive system (Nho *et al.*, 2001).

Animal health situation in the intensive system

In the intensive system, with large economic and technical support, poultry farms manage diseases through strict procedures for each kind of poultry. The death rate is 5–7 percent.

2.6 The relationship between poultry and Vietnamese society

Poultry industry has one of the longest histories of the different animal husbandry systems. It contributes approximately 30 percent of farmers' total income. It is a very important resource for farmers' living conditions and culture.

The cultural associations of poultry products

One beautiful Vietnamese tradition is bringing eggs to neighbours, to the sick, or to pregnant women as a gift.

If the poultry herd of a farmer dies from disease, their relatives bring him or her some poultries to replace those lost. Sometimes, children receive poultry as birthday gifts.

According to legend

Four thousand years ago, My Nuong, the daughter of Hung King, was proposed to by both Mountain King and River King. Hung King ordered a betrothal gift that included nine elephant tusks, nine cock spurs and nine horses' manes.

An annual gift was given to the King

Some breeds of chicken in special areas were offered to the King, such as Mia chicken in Mia village, Dong Tao chicken in Dong Tao village and Ho chicken in Dong Ho village. If the King was satisfied, he would give these villages gold. This represents an honour for people in these villages. As a result, they took great care in maintaining the breed quality. Crossbreeding was not allowed in these villages to maintain very important genetic resources.

Folk paintings and poetry

Paintings of poultry, particularly the Dong Ho and Hang Trong breeds have been popular for hundreds of years in Viet Nam. The most popular one is of a Ho chicken herd, which includes a hen and an intelligent baby chick setting on her back while looking for food in the garden. In the Tet holiday (the Lunar New Year), people buy this painting to signify a fortunate, successful and healthy New Year.

Different local chicken breeds have also appeared in poetry. Chicken herds symbolize peacefulness in rural areas, as in a famous poem by Hoang Cam.

Chicken competitions

Highly experienced farmers rear good chicken herds, generally one cock and four hens. In the spring season, the Ho chicken competition is in the spring each year in Song Ho village, ThuanThanh District, BacNinh, with strict criteria. Ho breed is still a pure breed.

Cock-fighting

In local tradition fairs, cock fighting attracts many people. Choi is the breed used for fighting. Fighter cocks are fed by experienced farmers. People train their chickens carefully. They are very happy if their cocks win in the poultry fitting games.

Moreover, pigeon competitions were also held in local fairs. Pigeon was trained to flight following their demands. Bird misses competition was held in different places in Viet Nam.

3. CONCLUSION

There are three kinds of poultry husbandry systems in Viet Nam:

The *non-intensive system*: The non-intensive system, which requires limited investment and care, is the most widespread in Viet Nam. Poultry scavenge freely for a long time, without vaccination. The efficiency of the small poultry production system is therefore low. The replacement is taken from their own herds, relatives and neighbours. Poultry products fill family needs and a small part is sold to the market or neighbours. This poultry production

is largely used for home consumption in the self-sufficient farm mode, which is practised in 85 percent of total households in Viet Nam. The system contributes more than 65 percent of the poultry products in the country.

The semi-intensive system: The *semi-intensive system*, or the *semi-intensive poultry production system*, is developing in Viet Nam; farmers invest more in this system than in the non-intensive system. They raise coloured breeds of poultry with average performance. Each farm raises 500–5 000 heads per year (3–4 batches per year). They buy breeding chickens from national or private breeding centres. Veterinary services are better than in the non-intensive system. Poultry products are sold directly to consumers or traders. In the country, 10–12 percent of the households practise this system, which produces 10–15 percent of national poultry products.

The intensive system: This system was established in Viet Nam in 1973. From 1995 to the present, the number of intensive system farms has increased. These farms need large investment, high quality breeds, improved techniques and good veterinary services. High quality poultry breeds are selected and provided by national breeding centres or foreign companies. This intensive system produces 20–25 percent poultry products in the country, of which 3 percent are produced by the private farmers.

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ANNEXES

Annex 1: Performance of local Vietnamese poultry breeds

Breeds	Ri	Mia	DongTao	TauVang
I. Breeding				
<i>Survival rate (%)</i>				
Period: 0– 9 weeks old	95	88	85	94.5
Period: 10– 19 weeks old	97.8	97	92	96
Laying first egg (day)	134 – 135	133– 135	150	135
Quantity/hen/year	128	100–120	75	123
Egg weight (g)	41– 42	45.2	54	43
Feed for producing 10 eggs (kg)	2.65	3.6	4.4	2.9
Embryo rate of eggs (%)	96.5– 97	90.0	89.2	86.9
Hatching rate (%)	78–81	71.9	68.5	79.8
II. Fattening				
Weight at 12 weeks old (g)	1 100–1200	1 230	1 370	1 180
FCR (kg)	3.20	2.99	3.10	3.07
Mortality rate (1–12 weeks) (%)	95–96	96	90	95

Source: Author's calculations

Annex 2:

Performance (1992–2005) of colourless poultry breeds imported to Viet Nam

Breeds	TH 882	Jiang cun	Lương phượng	Kabir	Sasso	ISA JA57	ISA colour
<i>Survival rate (%)</i>							
Period: 0–6 weeks old	96	96	98.5	98	97	97	96.5
Period: 7–19 weeks old	95.5	95	97.5	96	95	95	97
Laying of first egg (day)	138–140	140	138	160	165	154	
Quantity/hen/year	144	158	171	187	197	177	179
Egg weight (g)	55	51.8	55.3	57	57.5	59.5	
Feed for producing 10 eggs (kg)	3.3	2.92	2.6	2.4	2.3	2.4	2.83
Embryo rate of eggs (%)	95	96	96.3	95.2	96.1	87.8	
Hatching rate (%)	79.2	80.4	86.7	85.3	78.8	78.8	68.2
Weight 9 weeks broilers				2 075	2 192	2 179	1 947
Weight 12 weeks broilers	1 850	1 810	1 986				
FCR	3.0–3.2	3.2–3.3	2.5	2.65	2.45	2.48	2.30
Surviving rate until slaughtering (%)	95–97	95–97	96.0	95	93.5	96.3	96

Source: Author's calculations

Annex 3: Performance of crossbreds between Vietnamese native and exotic poultry breeds

Crossbred	Age (weeks)	Weight (g)	Surviving rate(%)	FCR
♂ Dong Tao x ♀ Jiangcun	12	1 683	96–98	2.9–3.1
♂ Kabir x ♀ Jiangcun	12	2 230	93.3	2.9
♂ Rhoderi x ♀ Jiangcun	12	1 550	95	3.2
♂ TH 882 x ♀ Rhodri	12	1 800	94	3.0
♂ Kabir x ♀ F ₁ (Rhodri x Jiangcun)	12	2 013	94	2.9
♂ Mia x ♀ Kabir	12	1 725	89	3.28
♂ Ri x ♀ Kabir	12	1 683	93.5	3.17
♂ Kabir x ♀ Ri (VP1)	12	1 706	89.9	3.56
♂ TH 882 x ♀ F ₁ (Rhodri x Jiangcun)	12	1 900–2 050	94–98	3.0
♂ Kabir x ♀ Lương phượng	12	1 635	98	3.06
♂ Kabir x ♀ TH 882	12	1 608	98	3.10
♂ TH 882 x ♀ Lương phượng	12	1 550	98	3.20
♂ Sasso x ♀ Lương phượng	9	2 369	96	2.4–2.5
♂ F ₁ (Sasso x LPhuong) x ♀ LPhuong	10	2 406	96	2.51
♂ Sasso x ♀ ISA color	9	1 612	98.5	2.41
♂ Kabir x ♀ ISA	9	1 780	96.3	2.32
♂ Lương phượng x ♀ ISA	9	1 773	96.7	2.33
♂ S77 x ♀ ISA	9	1 724	98.3	2.37

Source: Summarised from different reports

Annex 4: Performance of imported poultry breeds in Viet Nam

Breeds	Origin	First year	No. of eggs	Broiler weight (49–56 day old)
BE.88	Cuba	1993	135–140	2.1–2.3
AA (Arbor acres)	United States	1993	160	2.3–2.4
ISA MPK	France	1994	165	2.2–2.4
Avian	Thailand	1993	175	2.3–2.4
Ross–208, 308, 408	England	1993	155–160	2.3–2.5
Lohmann	Germany	1995	160	2.2–2.4
Cobb	United States	1997	160	2.3–2.4
Hubbard	United States	1997	155	2.2–2.3
Goldline.54		1990	230–255	
Brown Nick	United States	1993	235–260	
Hisex Brown		1995	235–260	
Hyline	United States	1996	250–265	
ISA Brown	France	1998	230–245	

Source: Author's calculations