



The REVALTER Project

“Multi-scale assessment of livestock development pathways in Vietnam”

Action 3.2: National Subsector Reviews

Review of the Pig Sector in Vietnam

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Introduction

In Vietnam, the pig value chain offers livelihood opportunities for the poor. Lapar et al. (2012) emphasize that high and increasing demand for pork and consumer preferences present market opportunities for smallholder pig producers in Vietnam. Smallholders participate in the pig value chain mostly as producers (RIA, 2013). With about 80% of pig raisers identified as smallholders — those who are likely to be poor or near poor — the development of the pig sector is very important for improving income and generating family employment. Developing the pig sector to benefit poor people will improve their income and stimulate pork demand for the entire economy, but these efforts need special attention from the government. A policy that is focused on promoting the rapid increase in large-scale production in response to rising demand will not necessarily benefit all income groups in developing country context, even with increasing participation by smallholders in economic growth (FAO 2002).

Pig production can play some important roles that can potentially enhance crop-livestock system efficiency and is also environment-friendly. For example, feeding practices that is commonly observed in smallholder pig systems allows effective utilization of feed produced by farmers, especially in crop-based pig systems that are dominant in the country. The sustainability of these systems will be important to ensure that smallholder pig producers will remain viable with lower production costs from more cost-effective feed utilization. Use of household scraps and other feeds that would otherwise be unused or unmarketable allows smallholder pig producers to be less dependent on feed imports and hence sheltered from feed price volatility. Pig producers also capture about half of the value added in the pig value chain, a demonstration of how important they are. This contribution is significant in the context of sector development, and the broader rural development agenda (Lapar et al., 2012).

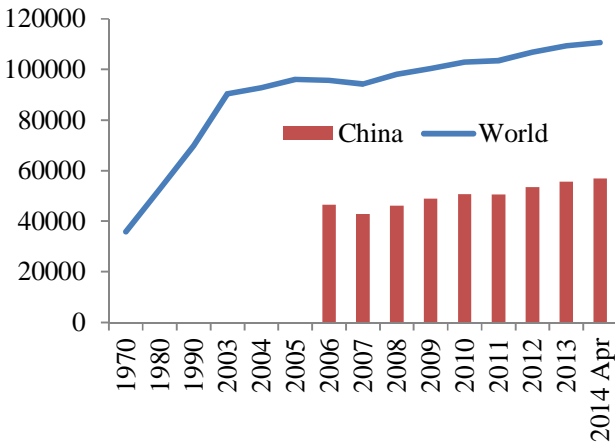
Rising incomes is one of the driving factors for pork demand (Lapar et al., 2012). Vietnamese consumer income has grown persistently at above 4% over the last 20 years. This trend in rising incomes is seen to drive the increase in demand for livestock products over time. Urbanization is also considered as a driver of demand growth for livestock products, as well as dietary shifts towards more processed and prepared foods (Delgado et al., 2003; David et al., 2010). According to the World Factbook (2012), Vietnam attains quite a high rate of urbanization at 3% annually (estimated for 2010-2015), while this figure is nearly 2% for the world total. This is probably one of the main reasons for the rapid increase in meat demand during the last decade, and likely to continue in the coming years. Yet a high rate of urbanization has not made significant impact in changing the Vietnamese consumers' preference for fresh meat. At present, a significant share of demand for pork by Vietnamese consumers is for fresh and traditional pork products. Among smallholders where feeding practices rely more on feed they produce, these feeding practices are likely to supply local markets with pig meat with attributes that are preferred by Vietnamese consumers, e.g., better taste.

This study reviews the current state of the pig sector to provide a broader understanding of the current state, issues, constraints, development prospects, and drivers of growth. This report compiles relevant information about production, consumption, inputs (feed, breed, animal health), markets, and the current policies and programs that affect the pig industry. The report highlights information gaps that could inform the prioritization of key areas for future research.

1. International context: pigs and pork in Asia

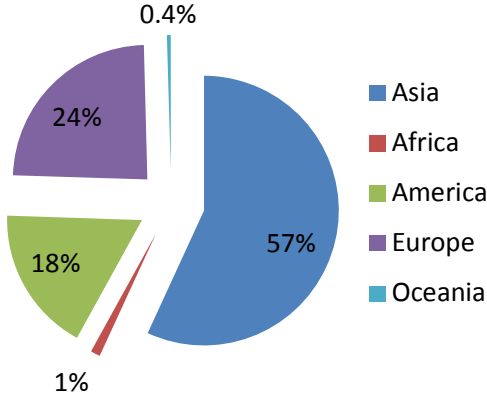
Increasing population combined with improving living standards have been inducing people worldwide to consume more meat. Pork is the most consumed meat in the world, making up approximately 37% of the world’s total meat consumption. Total pork production has increased roughly threefold from 35,793 thousand metric tons in 1970 to 110,703 thousand metric tons in April 2014 (Figure 1). Over 57% of total world’s pork is produced in Asia, followed by Europe (24.1%) and America (17.1%) (Figure 2). China is the largest pork producer not only in Asia but also in the world, which accounts for nearly a half of the world’s production. As a result, China influences the entire world pig industry.

Figure 1: Global pork production ('000 metric tons)



Source: USDA, 2014

Figure 2: Share of global pork production by regions



Source: FAO, 2013

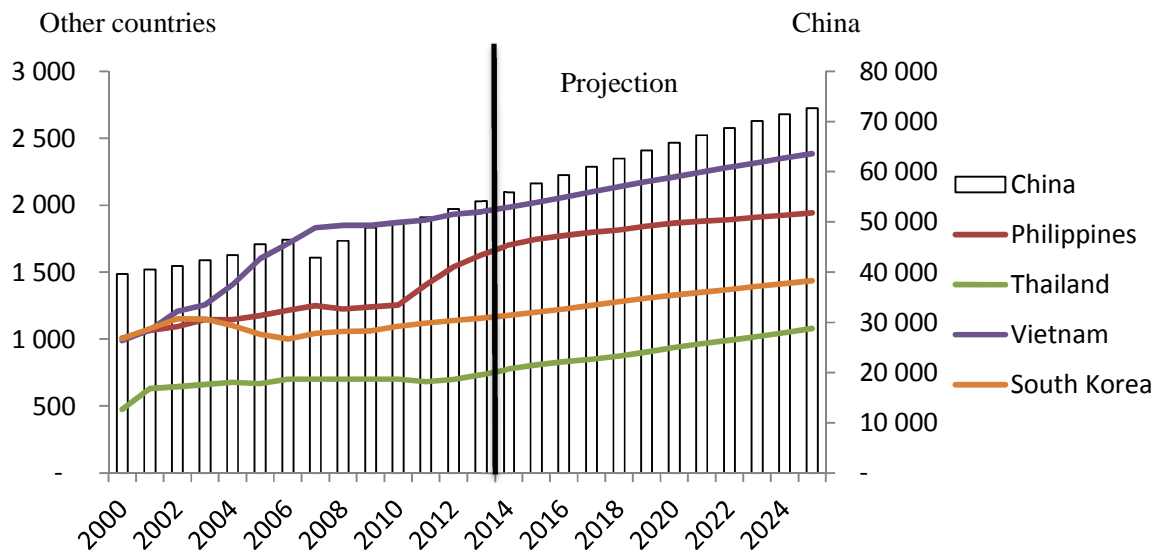
a. Comparing the Vietnamese pig industry with other countries in Asia.

Vietnam, China, Thailand, the Philippines and South Korea all belong to the Asian region and share similarities in terms of the characteristics of pig production and its role in the overall economy. Pig production in Asian countries is still dominated by small-scale or backyard producers. In 2012 these small farms represented approximately 90% in Vietnam despite efforts of the Vietnamese government to develop commercial-scale farms. Some countries, however, have achieved initial success in gradually replacing small farms with commercial ones. For example, in 1983, backyard farms produced 94% of the pigs slaughtered in China. Their contribution dropped to 73% in 1998, and now they represent less than 40% of the total volume. In the Philippines, the share of commercial farms has increased from 19% in 1994 to 36% in 2013 (Pig International, March/April 2014).

Pig production is considered as the major income source of rural households. Increasing pork production over the years has been observed in all of those countries. China obviously is the largest pork producer which produced around 55129 thousand metric tons of pork in 2013 with annual growth rate of 2.4% in the period 2000-2013. Vietnam ranked second with 2386 thousand metric tons of pork meat produced

in 2013, followed by the Philippines. The increasing trend of pig production is projected to continue in coming years but at lower rates (Figure 3)

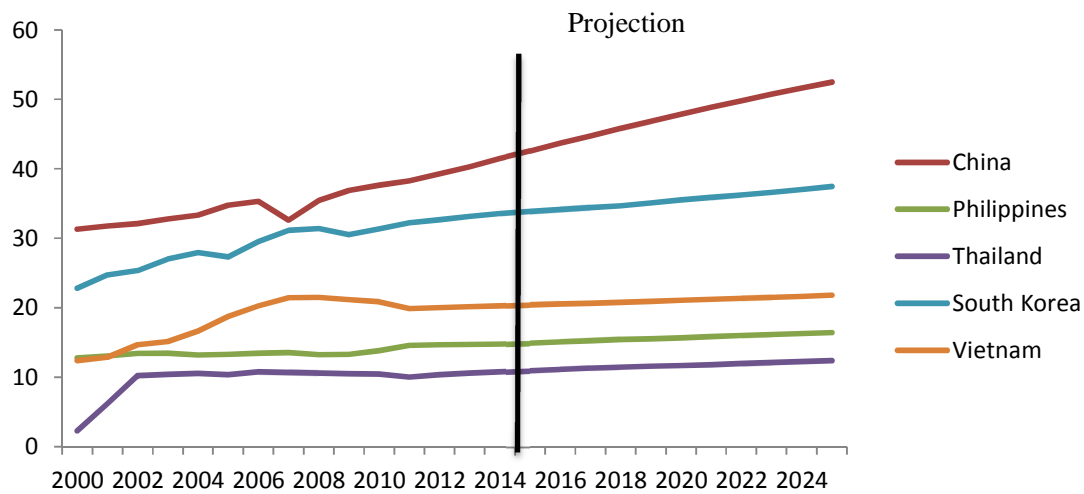
Figure 3: Pig production in 5 Asian countries ('000 metric tons)



Source: World Agricultural Outlook Database, FAPRI, 2014

The growth in pig production is mainly to fulfill increasing domestic demand. As shown in Figure 4, an average Vietnamese in 2013 consumed 20.1kg of pork, almost double compared to a Thai consumer (10.76 kg). This quantity, however, was a half the consumption of a Chinese consumer (40 kg) or two-thirds of a South Korean consumer (33.1kg). Based on the projection of FAPRI until 2025, pork consumption will continue to increase significantly in China and South Korea but modestly in the three remaining countries.

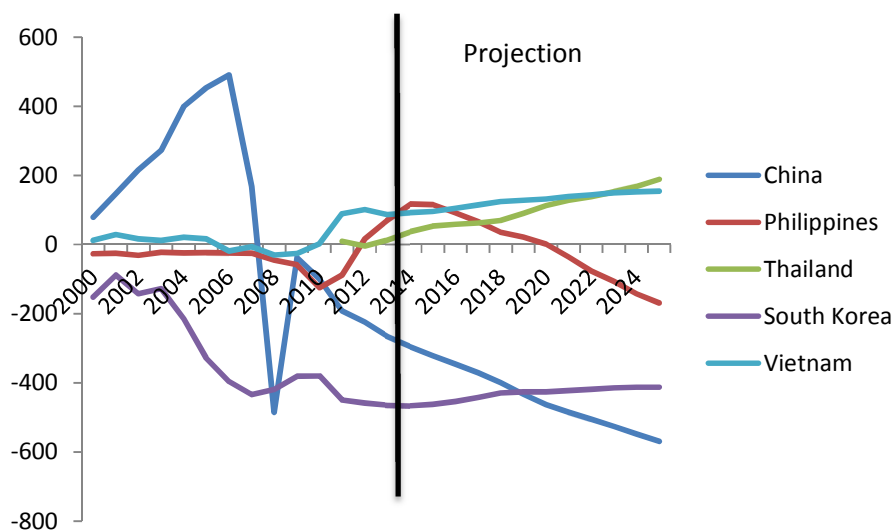
Figure 4: Per capita pork consumption in 5 Asian countries (kg/capita/year)



Source: World Agricultural Outlook Database, FAPRI, 2014.

Increasing domestic pork demand combined with constantly increasing population while land for crop cultivation and livestock is narrowing due to the urbanization progress result in insufficient domestic supply in China, South Korea and the Philippines. As a consequence, these countries have to rely on import sources to meet domestic demand, which is evidenced by consecutive years of negative net export volume (Figure 5). This situation is forecast to be worse in the future, especially for China. In contrast, Vietnam and Thailand are able to produce pork not only enough for domestic needs but surplus for export also. These two countries are considered as two net pork exporters.

Figure 5: Net export volume of 5 Asian countries ('000 metric tons)



Source: World Agricultural Outlook Database, FAPRI, 2014.

b. Trade: imports and exports

Imports

In 2012, Vietnam imported 91,832 tonnes of meat and offal, down slightly compared to the previous year (Table 1), mainly because of an abundant domestic meat supply and relatively lower prices in 2012. Poultry and offal accounted for the largest share of total meat imports during this period. Pork and pig offal imports were only 5.6% and 3.6%, respectively of total import volume during the same period.

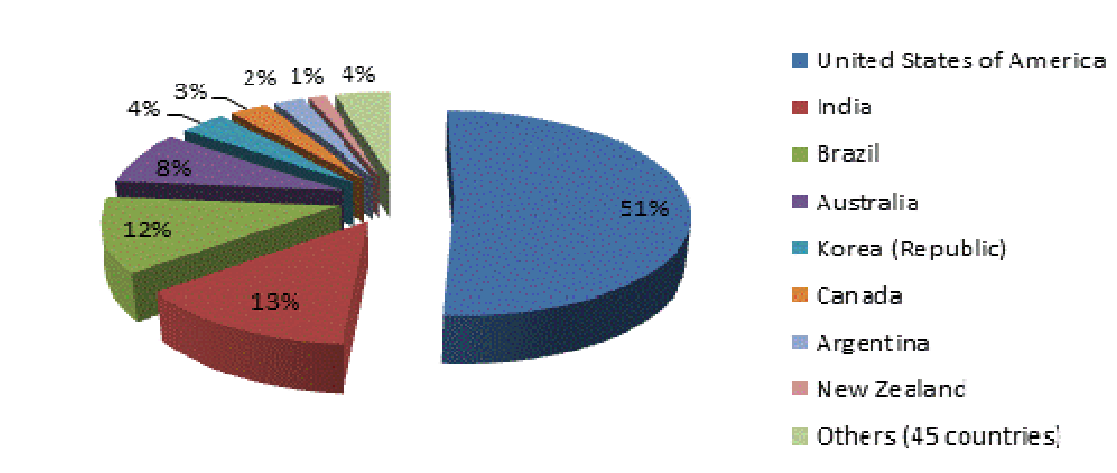
Table 1: Meat and offal imported by Vietnam, 2011-2012 (tons)

Types of meat	2011	2012
Meat and offal of buffalo, goat, sheep	19,651	13,211
Pork and pig offal	6,002	3,287
Poultry and offal	76,521	74,196
Heart, liver, kidney of bovine animals	727	0
Heart, liver, kidney of poultry	4,528	1,138
Total	107,429	91,832

Source: Vietnam Department of Customs (2007-2012).

The U.S. is the leading meat exporter to Vietnam, accounting for about 51% of total meat import value during 2007-2012 (Figure 6). The U.S. and Canada are key suppliers of frozen pork. For frozen pig offal, Hong Kong, the U.S., Poland, Denmark, and Canada are the main suppliers.

Figure 6: Value of meat imported by Vietnam, by exporter, 2007-2012



Source: Data from Vietnam General Customs.

Pig and pork imports usually occur only when there are shortfalls due to disease outbreaks or a large gap between domestic and import prices, as recently experienced. Exports are still limited to historical destinations for specific pork products (suckling pigs) or those with historical bilateral ties that allow special treatment concerning SPS requirements (i.e., Russia). With WTO, Vietnam is committed to phase out tariffs on imports and exports. Reduced import tariffs on pork may stimulate growth of the pork processing industry, especially if domestic production costs remain higher than import prices. However, cheaper imported pigs and pork may again dampen domestic prices and hurt pig farmers. After joining AC-FTA, tariffs on unprocessed meat (including offal) were reduced to zero and this has created a flow of live pigs as well as pork between Vietnam and China during the past years. Some low-quality meat from China was exported to Vietnam, and the inspection and management of imported meat still remains a problem. For example, 550 kg of deteriorated pork was found in Lang Son port and was believed to have been brought from China with a destination of Hanoi in late 2012 (Xaluan, 2013). In such cases, non-tariff barriers may be implemented if there is a perceived threat to the stability of domestic prices and the viability of domestic production (especially by those with strong lobby powers with the ruling party).

Domestic production will continue to be a viable source of pork to meet domestic demand because Vietnamese consumers strongly prefer fresh, unchilled pork. But increasingly, imports will sustain demand from the processing industry, especially if there is a big gap between domestic and import meat prices, and if demand for processed pork products continues to expand with increasing consumer purchasing power, demand for convenience, and variety.

Exports

Export of livestock products from Vietnam is very limited. The export value of meat is quite low and has fluctuated over the years, from USD 59 million in 2008 to about USD 40 million in 2010 (Table 2). While other ASF exports recovered in 2010 after the economic crisis of 2008 and 2009, meat exports slowed in 2010. Generally, pork exports make an insignificant contribution to total exports from Vietnam, with the share decreasing from 0.1% in 2007 to 0.06% in 2010.

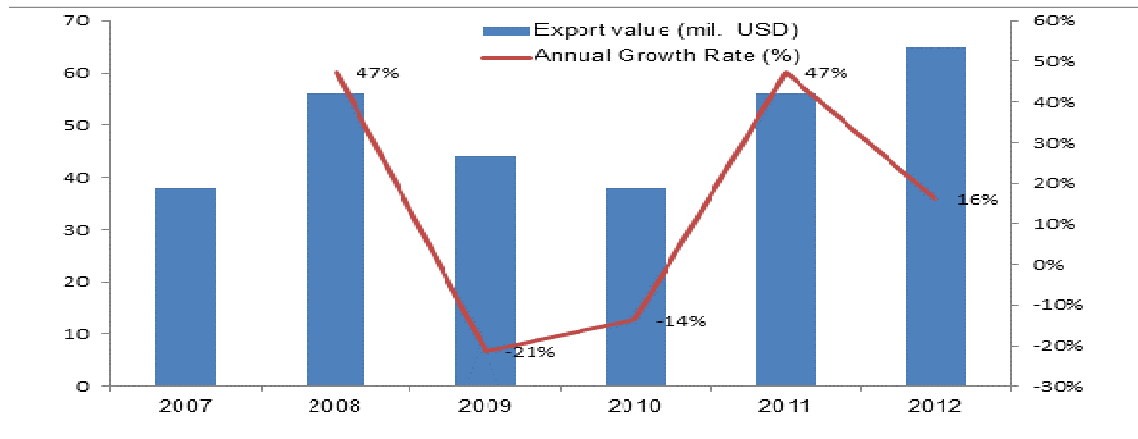
Table 2: Export of meat and other ASF from Vietnam, 2006-2010

Indicators	2007	2008	2009	2010
Export value (mil. USD)				
Frozen and processed meat	48.4	58.9	45.1	40.1
Fishery	3763.4	4510.1	4255.3	5016.9
Other ASF	65.6	129.2	101.1	131.7
Share of total agricultural exports (%)				
Frozen and processed meat	1.2	1.3	1.0	0.8
Fishery	50.6	46.5	48.3	43.8
Meat as a share of total exports (%)	0.10	0.09	0.08	0.06

Source: GSO Vietnam.

Traditionally, Vietnam had exported meat to a number of countries in Western Europe and Asia, but its export market has recently narrowed. Meat exports fluctuated widely during 2007-2012 (Figure 7), largely due to disease outbreaks and higher production costs. In 2009 and 2010, export values dropped sharply as a result of a shortfall in the meat supply for the domestic market, and disease outbreaks that caused many farmers to quit production.

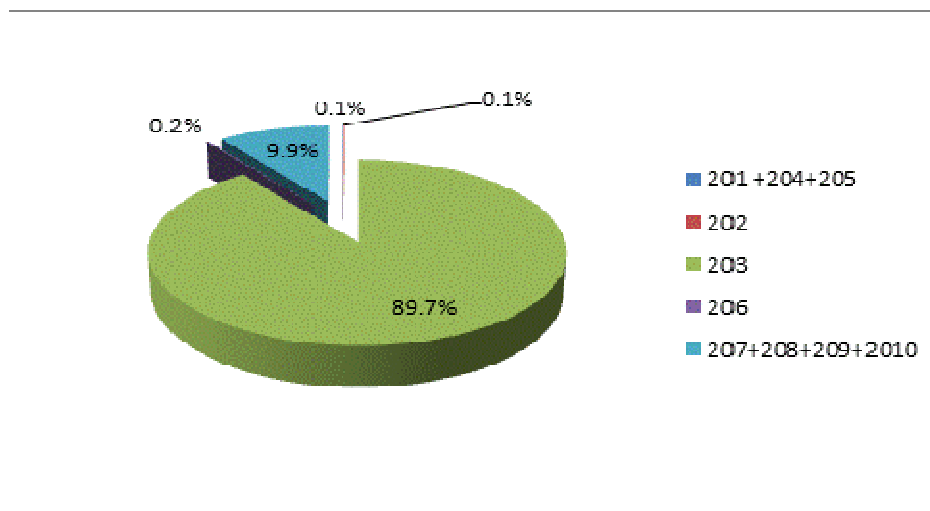
Figure 7: Trends in export of meat and edible offal from Vietnam, 2007-2012



Source: Data from Vietnam General Custom Office.

Among livestock commodities exported from Vietnam, swine meat — fresh, chilled, or frozen — dominated with a share of about 90% during 2007-2012 (Figure 8), including carcasses and half-carcasses, hams, shoulders and cuts thereof with bone in for fresh, chilled, or frozen products. Export of other meat products is very limited.

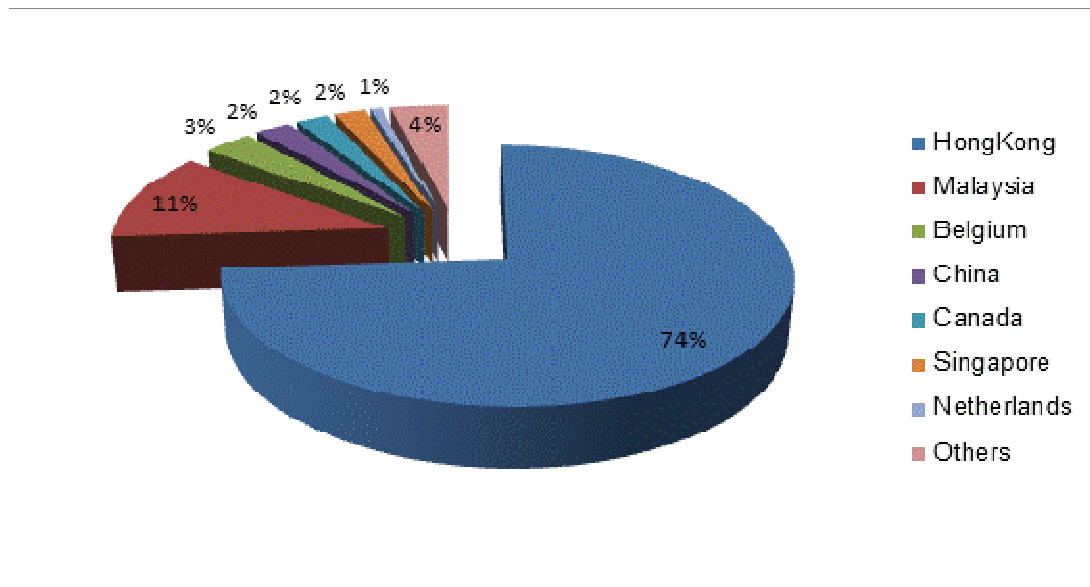
Figure 8: Value of meat exported from Vietnam, 2007-2012 (%)



Source: Data from Vietnam General Customs Office.

During 2007-2012, Hong Kong and Malaysia were the top importers of meat from Vietnam, with a share in export value estimated to be 74% and 11%, respectively (Figure 9). Vietnam exports mainly suckling pigs, and in the past it exported carcasses of pigs and suckling pigs (frozen) to Western countries. At present, most pork exports are live pigs to China (Minh Tam, 2012).

Figure 9: Top importers of meat from Vietnam (% of value), 2007-2012

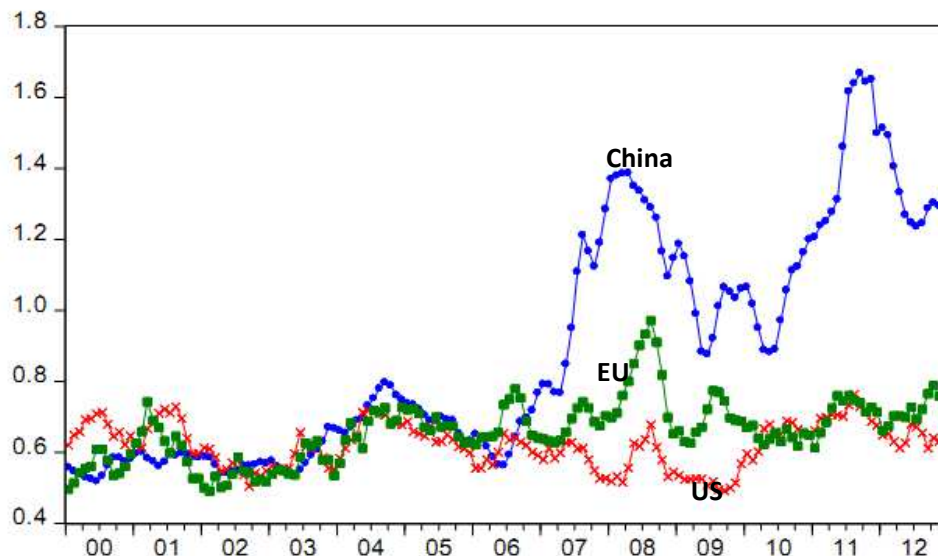


Source: Data from Vietnam General Customs.

c. International price overview of pork meat and main feed products (impacting the price of pork meat)

Global pork prices tend to fluctuate over time under the impact of outbreaks of diseases, the economic downturns, and the interaction of supply and demand in major markets. Currently, China is the largest consumer and producer of pork, accounting for nearly half of the world's pork production and consumption; the EU is the second largest producer and the largest exporter of pork, and the United States is the third largest producer and the second largest exporter of pork in the world. The three markets together hold about 80 % of the world production and therefore put significant influence on the prices of pork in the global market.

Figure 10: Monthly market prices of pork in China, EU, the U.S (2000-2012)



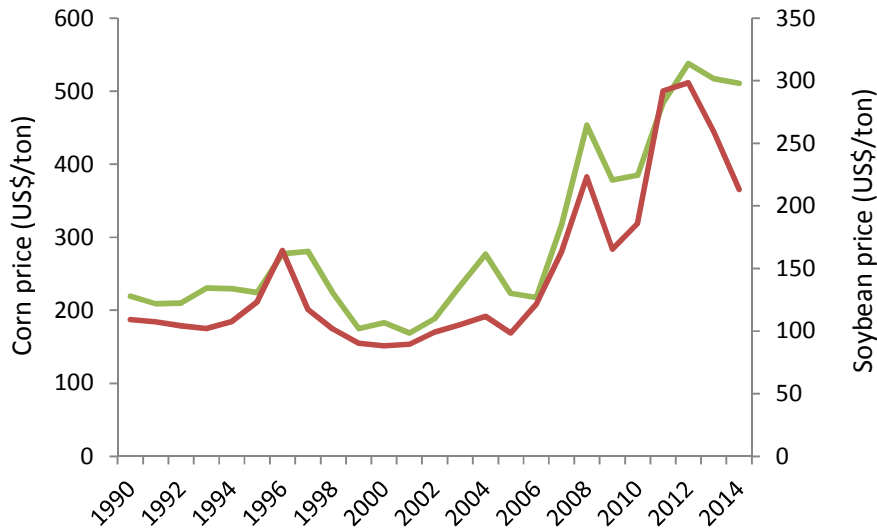
Source: Cited from the article “Hog Price Transmission in Global Markets: China, EU and U.S.”
Original sources: USDA, European Union public data, China National bureau of statistics.

As shown in Figure 10, pork prices in the three markets went in line in the period 2000-2005. Since 2006, Chinese pork prices rose significantly above the U.S. and EU prices. Increasing pork prices in China likely stemmed from the rising costs of pork production due to raising feed costs. The feed costs increased from US\$25 in 2006 to US\$44 per pound of pig live weight in 2010, an increase of 77% (USDA, 2013). Meanwhile, the pork prices in U.S. and EU were relatively steady because of lower feed costs and higher productivity.

Feed costs represent 65 -75% of the variable costs of pork production. The prices of feed ingredients, therefore, have a substantial impact on the prices of pork. Corn and soybean meal are the major feed ingredients for pork production. Their prices have varied over the years based on supply and demand conditions of the U.S. - the leading producer of corn and soybean in the world. As shown in Figure 11, feed ingredient prices were relatively flat in the period 1990-2005 with the exception of 1995 for corn due to weather and disease factors and 2003-2004 for soybean due to escalating Chinese demand for soybeans. Since 2006, price volatility for both feed ingredients escalates dramatically driven from the competition for supply by ethanol distillers which now surpasses 40% of the total U.S. corn production since 2011, exceeds all livestock use. Corn and soybean are substitute crops which are produced largely on the same farmland. With the strong expansion of the ethanol industry, growing corn offers significantly higher profits than growing soybean, resulting in lower volume of soybean and higher prices for both ingredients. Even though the collapse of world markets in 2009 due to the economic crisis saw commodity prices drop sharply, they were soon off and running again as world demand began to rise and temporarily shuttered ethanol plants came back on line with rising oil prices. The droughts in 2012

and 2013 caused remarkable decrease in corn and soybean production and dramatically impacted feed ingredient prices.

Figure 11: Prices of U.S corn and soybean (1990-2014)



Note: U.S. No. 2 yellow, FOB Gulf of Mexico ports; Soybean No. 2 yellow, Chicago Board of Trade

Source: <http://worldfood2.apionet.or.jp>

2. Presentation of the sector

a. Production

Main production systems and scale distribution

Pig production is usually a component of mixed farming systems in Vietnam. Traditionally, rearing pigs has been a common activity in farm households, where use of leftover food to feed pigs is a usual practise and pigs are considered a form of savings (Kinh and Hai, 2008).

There are four types of pig production in Vietnam — smallholder or backyard with 1-10 pigs, small-medium with 5-20 sows or 30-100 fattening, medium with 20-500 sows or 100-4,000 fattening, and large with more than 500 sows or 4,000 fattening pigs (Table 3). In 2000, commercial farms were classified as production units that produce more than 100 pigs/year or generate products with a value of at least VND 40-50 million. From 2011, a commercial farm is one sells VND 1 billion, equivalent to pig herd of more than 200 sold in a year.

Table 3: Pig production holdings in Vietnam, classified by production scale

Holding type	Herd size	% of national herd (1999)	% of national herd (2006)	Breed
Smallholders or backyard	1-10 pigs	80	64	North: mostly local South: mostly cross with exotic
Small-medium	5-20 sows or 30-100 fattening	10	20	Cross and exotic
Medium	20-500 sows or 100-4000 fattening	5	10	Exotic
Large	>500 sows or >4,000 fattening	5	6	Exotic

Source: Kinh and Hai (2008)

Farms with more than six pigs accounted for only 2% of the total of pig farms in 1994 (Tung et al., 2005). According to Vietnam's Agricultural Censuses for 2001 and 2006, the percentage of pig-raising households with at least 21 pigs rose from 0.3% in 2001 to almost 2% in 2006. At present, small-scale production predominates. There are more than 4 million pig-raising smallholders in the country, of which 52% are raising 1-2 pigs (Table 4) (GSO, 2011). Household pig production supplies at least 80% of Vietnam's pork (Lapar et al., 2011)

Table 4: scale of household pig holdings, 2011

Number of pigs	Share of pig-rearing households (%)
1-2	51.9
3-5	25.7
6-9	8.9
10-49	12.8
>50	0.8

Source: GSO (2011)

Many small mixed-production households that produced several different crops and raised pigs that consume by-products or excess crop production have become large farrow-to-finish production units. There is significant growth in the number of commercial pig farms in all regions in the country. In 2011, the total number of commercial livestock farms was 6,202, or 31% of the total commercial farms in the country, of which commercial pig farms were 23% (Table 5).¹

¹The lower number is due to a change in criteria for commercial pig farms, set by MARD in 2011.

Table 5: Types of commercial farms in Vietnam, year 2011

Type of farm	Total units	Share of total (%)
Cultivation	8,642	43.1
Livestock	6,202	30.9
Beef cattle	29	0.1
Pigs	4,676	23.3
Chicken	1,497	7.5
Forestry	51	0.3
Fishery	4,433	22.1
Fish	455	2.3
Shrimp	3,399	16.9
Mixed	737	3.7
Total	20,065	100.0

Source: GSO (2011)

Among the seven regions in the country, commercial livestock farms are mostly concentrated in the Red River Delta and the South East, which account for 39% and 30%, respectively, of the total. In the South East, pigs are mostly raised on large commercial farms.

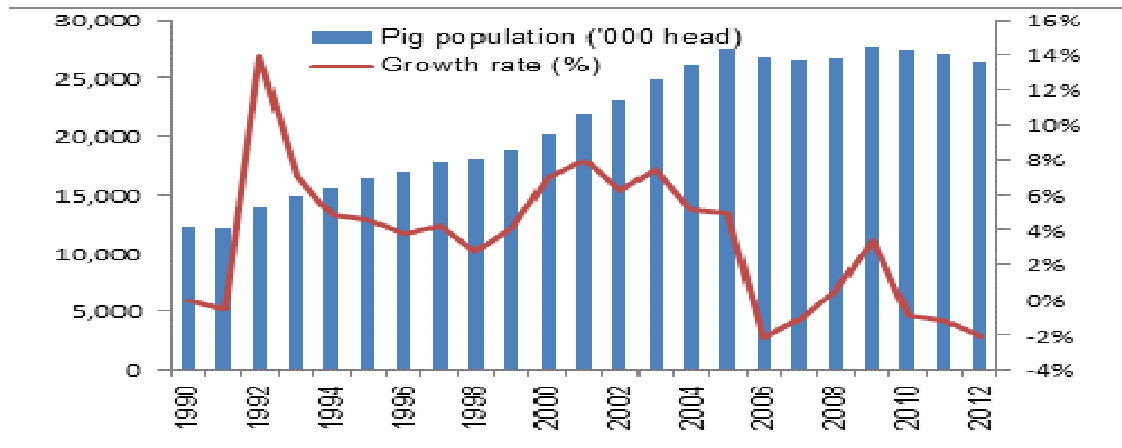
Evolution of the sector

Pig population numbers exhibited a persistent upward trend during 1990-2012, although at a slowly declining growth rate. In 2006, an FMD outbreak reduced the total pig population, and Porcine Reproductive and Respiratory Syndrome (PRRS) occurred in 2008. The Department of Livestock Production in MARD has acknowledged that 2009-2010 was one of the toughest periods for livestock production in general and pig production in particular, due to widespread disease outbreaks, especially PRRS and FMD. Rising input costs (16% increase in electricity rate, 43% increase in the price of coal, 12-14% increase in feed prices, 20% increase in transportation costs, and 9% increase in interest rates) have also discouraged pig producers from expanding production. Problems in the marketing of pigs and pork, among other factors, might have caused a zero growth rate of pig production in 2010. There were issues along the supply chain in marketing of pig and pork from stable to table, where there exists a big gap between farm gate price and retail price, and between regions (MARD, 2011). MARD also suspected that there was speculation of live pig prices in some areas. Rising feed prices vis-a-vis relatively lower pig liveweight prices also discouraged farmers from expanding pig production, especially in the latter half of 2012.

The growth rate of meat production, including pig production, is slowing for several reasons (Figure 12). The number of farm households engaged in livestock production has decreased over the years because of unfavourable movement of relative input-output prices, urbanization that draws land and labour out of the agricultural sector, environmental problems, and especially disease outbreaks. As long as the growth rate of meat production is greater than growth in demand (which depends on population growth and growth in per capita meat consumption), meat imports will largely depend on price gap (between

domestic and import prices) and quality (mainly based on demand for high quality meat). Among livestock animals, pigs produce the highest volume of meat for human consumption, with total live weight estimated at 3.16 million tonnes in 2012, followed by poultry and beef.

Figure 12: Pig population and annual growth rate, Vietnam, 1990-2012



Source: GSO data

The pig sector consistently contributed about 74-80% of total meat production in Vietnam during 2000-2012 (Figure 13), and pigs and poultry consistently make up about 90% of total meat production. The trends of their contributions are opposite, suggesting that these two products might be substitutes.

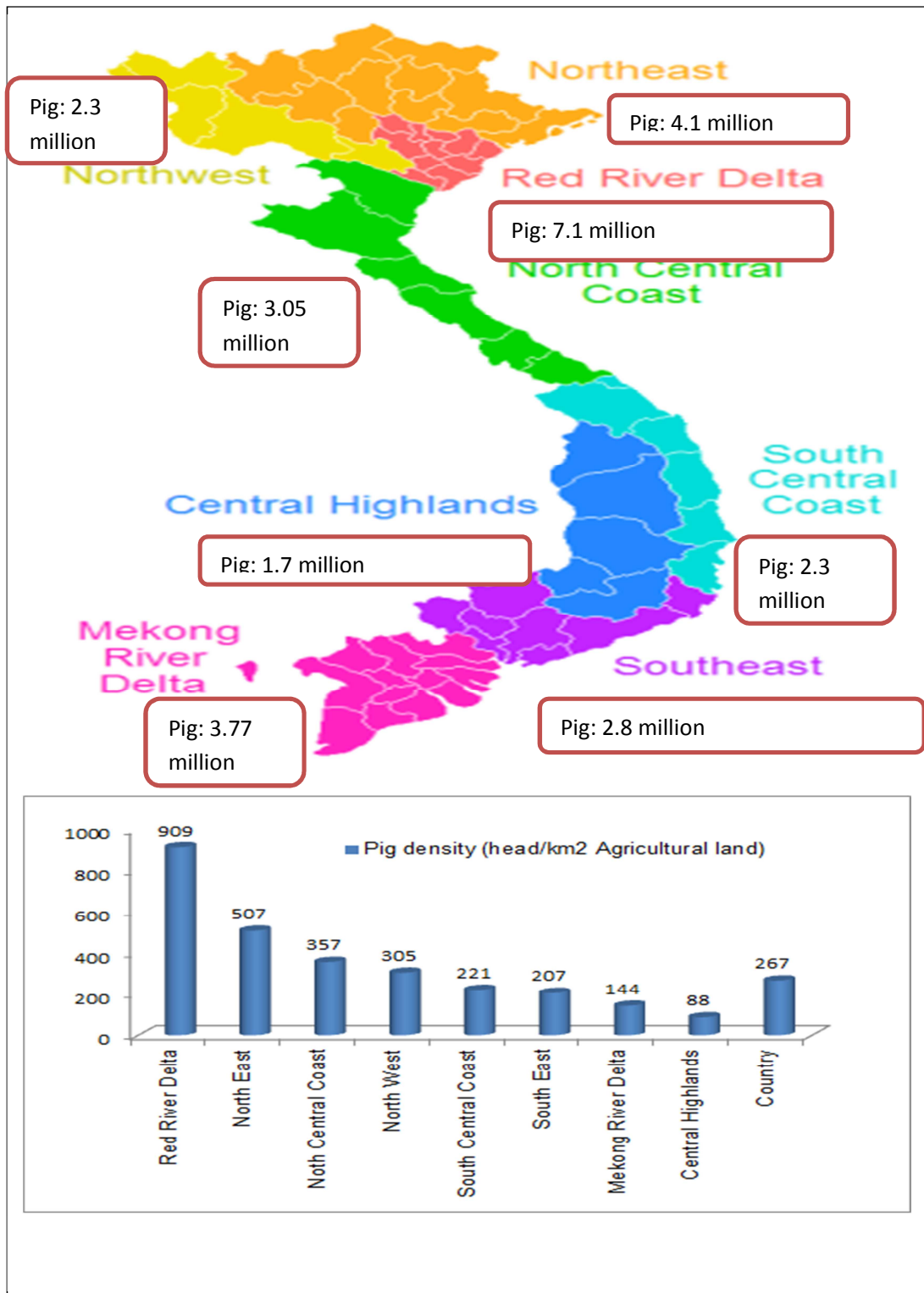
Figure 13: Share of major types of livestock products, 2000-2012



Source: GSO data

In 2011, the Red River Delta had the largest pig population in the country with about 7.1 million, and the Central Highland recorded the lowest number with 1.7 million (Figure 14). RRD had the highest pig density of 909 pigs/km² of agricultural land, followed by the North East and North Central Coast.

Figure 14: Pig population distribution and density in regions of Vietnam



Source: GSO data

b. Marketing channels and main input and output industries

Along the value chain, pigs are produced as piglets, weaner/growers, fatteners, slaughter pigs, pig meat/pork (all types), offal, and processed pork products and sold in a variety of market outlets.

Live pigs

Piglets/suckling pigs are inputs for pig production. Farmers either produce the piglets on farm or buy from various sources, such as small farmers, who keep only a few piglets to raise from litters they produce. Piglets normally weigh from 10-15 kg at 40-45 days old. Piglets are also supplied by large commercial farms, state breeding centers, and nucleus farms of animal feed/food companies such as C.P., DABACO, and ANCO. A suckling pig is the new-born offspring of a sow that suckles its mother for milk for the first two to four weeks. Suckling pigs are normally processed to make ready-to-eat food. In the pig value chain in Vietnam, processed suckling pigs are not a common product produced at the household level, partly because of complicated cooking procedures that are not easily done by household consumers on a regular basis (i.e., roasting). Suckling pigs are mainly targeted for export to other locations such as Hong Kong.

Growers usually weigh from 20-35 kg at 70-80 days old. Growers are not as widely used by pig farmers because today not many farmers practice a grow-to-finish (fattening) pig production system. In some regions where demand for meat is low, growers weighing 30-35 kg might be slaughtered before they reach slaughter weight (usually from 80-100 kg liveweight) for meat and then marketed because retailer-cum-slaughter operators are generally able to sell all of the pork within a day. Such a practice is commonly found in middle and mountainous areas in Nghe An province, for example, where demand for pork is more localized and population density is lower compared to more urban areas (RIA, 2013).

Finished pigs (or slaughter pigs) normally undergo four to five months of fattening, and weight varies greatly depending on breed and market demand. The volume of retail market demand for pork shapes the marketing behavior of pig traders and farmers. For example, a finished exotic pig weighs 80-130 kg, while an indigenous pig weighs 10-40 kg. Finished pigs or slaughter pigs are the final product from the farm and are the type of pigs that usually move from farmers to collector, slaughterhouse, trader, or even individual consumers.

Pig meat

Pigs are transformed into meat during the slaughtering process. Both pig meat and offal are edible products for human consumption. Vietnam's Ministry of Science and Technology defines meat as "all edible parts of slaughtered animals, including edible offal" (TCVN 6162 – 1996). The pig carcass rate in Vietnam normally varies from 65-75%, depending on breed and feeding practices. Exotic pigs produce higher carcass rates than local ones.

The classification of pork meat cuts varies among countries. In Vietnam, where consumers mostly buy meat in open/wet markets, they often differentiate these meat cuts: head meat, shoulder meat, loin, bacon, leg, and ham. Bones (with meat) are generally identified as head bones, ribs, and hocks.

Among the meat cuts classified above, loin is the most tender and usually the most expensive cut. Fresh loin is usually prepared at home for children, old people, and people on a special diet. Shoulder butt, ham, ribs, and belly are common meat cuts for daily home meals.

Blood is also sold fresh in markets or slaughterhouses, either separately or combined with the intestinal tract to make blood sausage.

Organ meat can be used for food as well, including the liver, gall bladder, stomach, and large and small intestines. Among these, stomach is the most expensive. Other organs such as the heart, kidneys, and lungs are also sold fresh in the market. Among these organs, heart is more expensive, even more so than loin.

Frozen meat is not preferred by Vietnamese consumers. In Vietnam, frozen meat is usually sold in grocery shops, convenience stores, supermarkets, or outlets of meat processing companies. Frozen meat is usually sold as meat cuts or ground meat, packed and labelled. During times of excess demand for meat and a shortfall in the domestic supply, meat imported to Vietnam is largely frozen, which accounted for approximately 0.2% and 0.1% of total pork supply in Vietnam in 2011 and 2012, respectively.

Processed pork products in Vietnam take numerous forms, ranging from very simple, traditional products to the more sophisticated. Pork as processed commodities is driven by consumer demand for traditional processed products, especially during festivals and other traditional events.

Some simple and traditional processed products in Vietnam include:

- Steamed meat (head meat), tail, leg (trotter), and intestinal tracts (small and large intestines), blood sausage, liver, lungs, gall bladder, and stomach. These are prepared by small processors, and mostly sold on the open market.
- Ear meat is steamed, sliced, and mixed with special rice powder to make “nem tai”.
- Pork loaf is made from lean meat (gio lua) and other variations of pork loaf depending on added materials (e.g., lean pork loaf with ear meat). Head cheese includes the ears, snout, cheek, tongue, and ham hocks (because they contain mostly skin and a small bit of pork meat). This is combined with black fungus, fish sauce, garlic and shallots, and black peppercorns and congealed to a chewy and crunchy goodness.
- Salted shredded meat (pork floss) is a common product, made from loin.
- Vietnamese/Chinese pork sausage is made from intestinal tract, lean meat, fat meat, pepper, and other spices.
- Roasted pork is made largely from belly/shoulder butt, or ham, suckling pig, or whole young pigs.
- Other products include salted ham, rump, roasted pork loaf, and fermented pork.

More sophisticated forms of processed pork products are produced by food and meat processing companies in Vietnam, which include sausage, pate, ham, canned meat, salted pork, pork loaf, fermented pork products, meat balls, and others. With the development of a meat processing industry in Vietnam through investments by large companies (e.g., Vissan, C.P), the expansion of modern retail

distributors (e.g., Big C, Coop Mart, Hapro Mart), and a gradually changing life style of Vietnamese consumers, processed pork products have been appearing more often in daily meals, especially in urban settings.

Preferred market outlets

Vietnamese consumers prioritize convenience as one important criterion when selecting market outlets for meat. Two of the most preferred meat retailers are permanent markets and temporary neighborhood markets (Table 6) (Lapar et al., 2010). Modern retail outlets are ranked lower by consumers in general. In terms of location, consumers in Ho Chi Minh City gave higher ranking scores for modern meat outlets than Hanoi consumers. Mobile meat vendors, a type of traditional temporary outlet for meat, were ranked lower in both places.

Vietnamese consumers appreciate the quality and shopping experience of supermarkets, but low- and middle-income households generally buy food at traditional markets and small-scale shops because of better prices and more convenience (Figuié and Moustier, 2009).

Table 6: Average rank score of market outlet preference, by location

Types of market outlets	Hanoi	HCM	Overall
Mobile vendors	2.83	2.61	2.74
Meat retailers in temporary neighbourhood market	1.29	1.67	1.43
Meat retailers in permanent open market	1.36	1.25	1.29
Meat retailers of branded meat	2.80	2.14	2.27
Grocery shops/convenience stores	3.42	2.95	3.13
Supermarkets	3.02	2.69	2.79

Note: Ordinal ranking was used with 1 as most preferred; hence, average rank with lowest value would indicate highest preference among respondents.

Source: Lapar et al., 2010

c. Consumption pattern and consumers preferences

Consumption patterns

Among different types of meat consumed by Vietnamese consumers, pork takes the largest share, followed by poultry and beef. GSO (2012a) reports that chicken (including broilers) consumption was estimated at 5.8 kg/capita/year during 2010, and consumption of beef and buffalo meat was quite limited at only 2/kg/capita on average during the same year).

USDA (2011) data show that the trend for pork consumption was quite stable during 2007-2011 at about 21 kg/capita/year, compared with poultry (broilers) at about 6-7/kg/capita/year during the same period. Meanwhile, consumption estimates from VHLSS data are relatively lower. During 2010, per capita consumption of pork was estimated at 13.7 kg (Table 7). Using the same VHLSS data, pork consumption

by an urban consumer during 2010 was about 14.8 kg/year compared to about 13.2 kg/year by a rural consumer. The same pattern is observed for chicken and other poultry meat and beef. Recent trends show that rural consumption is catching up with urban consumption of pork in terms of quantity per person, with urban pork consumption growth slowing relative to that of rural pork consumption over the last decade. If this trend continues, the meat consumption gap, including pork, between the two areas will likely narrow and possibly converge over time.

Table 7: Per capita consumption of pork in Vietnam, selected years (kg)

Region	2002	2004	2006	2008	2010	Average annual growth rate (2002-2010) (%)
Country						4.5
Urban	13.5	15	16.4	14.4	14.8	1.2
Rural	9.1	10.7	12.1	10.2	13.2	5.6

Source: Calculated from VHLSS data, various years

While pork is the most important and popular meat in the Vietnamese diet, its share in total meat consumption has dropped from 62% during 2002 to 57% during 2010 (Table 8). Note that these figures might actually be considerably higher because out-of-home consumption of pork and processed pork products are not captured in these estimates. Pork accounts for about two-thirds of meat production, and the volume of pork imports is greater than exports. Shares of beef and chicken meat, on the other hand, have been increasing during the same period, although they are still relatively lower (and significantly smaller in the case of beef), in absolute terms, than that of pork.

Table 8: Per capita meat consumption in Vietnam, selected years (%)

Meat	2002	2004	2006	2008	2010
Pork	62.3	65.9	68.9	60.6	57.1
Beef, buffaloes	5.6	5.0	5.7	8.0	8.3
Chicken	21.6	19.6	17.6	21.8	24.2
Other poultry meat	10.5	9.5	7.8	9.6	10.4
Meat total	100.0	100.0	100.0	100.0	100.0

Source: Calculated from VHLSS data, various years.

Pork consumption was highest in the North East (NE) at 18.3 kg/capita during 2010, followed by the Red River Delta (RRD) and the North West (NW) (Table 9). Per capita consumption of pork was lowest in the South Central Coast (SCC), at only 9.7 kg during 2010 and equivalent to about one-half of that in the NW. Growth in pork consumption is highest in the NW, North Central Coast (NCC), and the Central Highland

(CH), with per capita pork consumption during 2010 increasing by 50% compared to 2002 in these regions.

Table 9: Regional per capita pork consumption in Vietnam, selected years (kg)

Region	Quantity (kg)			Comparison
	2002	2008	2010	2010/1002
Red River Delta	12.8	14.3	17.1	1.3
North East	13.1	13.2	18.3	1.4
North West	9.1	9.6	13.5	1.5
North Central Coast	8.3	9.0	12.6	1.5
South Central Coast	6.8	8.1	9.7	1.4
Central Highland	7.8	9.0	11.4	1.5
South East	10.5	12.9	12.2	1.2
Mekong River Delta	8.3	9.3	11.1	1.3

Source: Calculated from VHLSS data, various years

Expenditures

Vietnamese consumers spend the largest share of their meat budget for pork, 34% and 38% in urban and rural areas, respectively (Table 10). Consumers in both areas also rank pork as the most important meat in the meat basket. While beef and carabeef are 28% of total meat spending for urban consumption, this figure is very low in rural areas, at 7%.

Table 10: Percentage of household meat budget spent on different types of meat and seafood

Type of meat and seafood	Urban households		Rural households	
	%	Rank	%	Rank
Pork	34	1	38	1
Beef and carabeef	28	2	7	2
Fish and seafood	20	3	27	3
Poultry	18	4	27	4
Total	100		100	

Note: Total figures may not equal 100% due to rounding

Source: ILRI (2010)

On average, pork accounted for 63% of total spending for meat during 2002, but this figure decreased to 54% during 2010 (Table 11), which is a little bit higher than those inferred from Table 10 provided by

ILRI. Consumers also allocated about 12% of their total food expenditure for pork during the same period (Table 11).

Table 11: Per capita monthly spending for food and meat in Vietnam, selected years

Spending category	2002	2004	2006	2008	2010
Per capita monthly food and drinks ('000 VND)	140.9	182.5	229.3	353.1	555.9
Food in total household expenditure (%)	52.0	48.6	47.6	47.1	49.7
ASF in total food and drink expenditure (%)	33.1	34.5	35.6	35.1	32.5
Meat in total food and drinks (%)	20.2	20.5	22.0	21.6	21.2
Meat in total ASF (%)	61.2	59.5	61.7	61.6	65.4
Pork in total meat (%)	63.1	65.1	63.5	59.4	53.9
Pork in total food expenditure (%)	12.76	13.33	13.96	12.86	11.45

Source: Computed from VHLSS data

According to Lapar et al. (2010), dietary patterns are increasingly shifting from a predominantly starch-based diet to one with a relatively high proportion of animal-sourced proteins, fruits, and vegetables. Vietnamese consumers tend to diversify their diet towards higher shares of seafood, poultry, eggs, and beef as their incomes rise, but pork remains the dominant meat in the diet (Lapar et al., 2012). The projections according to this study indicate that the proportion of pork in meat consumption will change minimally, with incremental changes in total meat expenditure. This suggests that demand for pork by Vietnamese consumers will keep growing, albeit at a slower rate, as their incomes increase.

Demand for pork attributes

Most Vietnamese consumers prefer lean pork (Lapar et al., 2011). With rising awareness of food safety, especially toxic residues in pork, consumers are willing to pay a premium for improved meat quality. Consumers can assess lean meat in the market, but other attributes cannot be directly observed, hence, information about meat quality is asymmetric. Some quality information (e.g., carcass weight and liveweight, lean meat ratio) pertaining to buyer preference also filters down to the farm via traders, and pig farmers reported that traders prefer pigs with high lean meat ratio. Pigs fed with non-industrial processed feed are not preferred by traders and usually get lower prices because of low lean meat ratio and lower carcass rate. Meanwhile, a group of consumers who perceived that pork from these pigs tastes better and is safe, is willing to pay a premium.

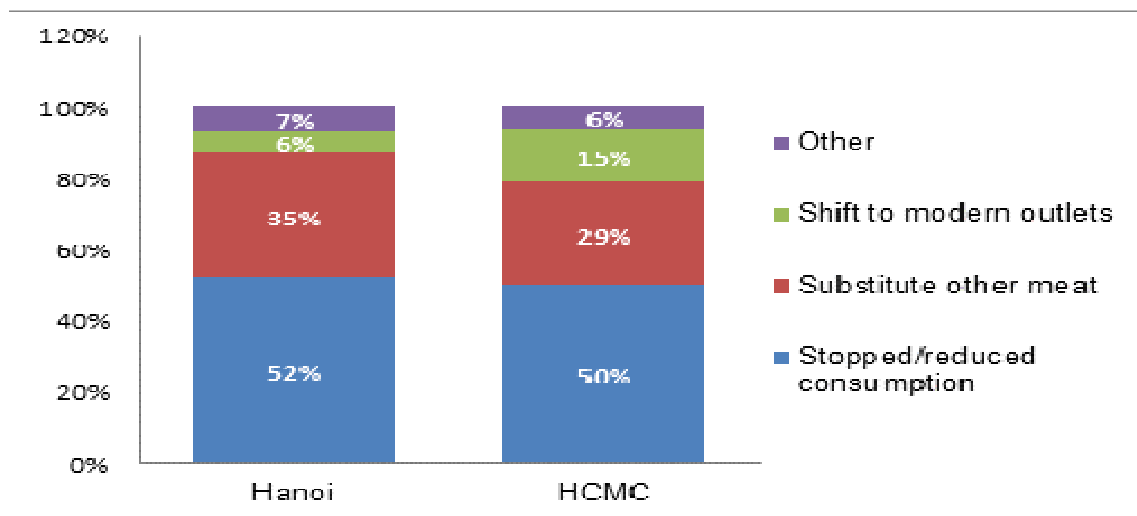
In addition to a high lean meat ratio, Vietnamese consumers prefer other attributes such as light colour, good smell and consistency, and freshness (Lapar, 2010). Pork from black/indigenous pigs that are often perceived to have better taste and quality is also preferred. In addition, Vietnamese consumers have strong preferences for fresh meat over chilled/frozen meat because the cooking quality is better.

Wet/open markets are the first choice of consumers to buy fresh meat, rather than modern retail outlets such as supermarkets and other food stores (Lapar, 2010).

In addition to their strong preference for fresh, unchilled pork and lean meat cuts, Vietnamese consumers are also concerned about meat quality, especially in urban areas. More than one-half of surveyed consumers were willing to pay more for fresh pork with guaranteed improved hygiene, more than one-third (36%) of respondents were willing to pay more for pork with good colour, 30% for pork with less extra-muscular fat, 26% for pork from pigs not raised on manufactured feed, and 25% for pork with less intra-muscular fat (Pedregal et al., 2010). The premium for better quality meat depends largely on income and location. Vietnamese consumers were willing to pay up to VND 1,800 (or 4.3% above average price) more per kg of pork with good colour or less extra-muscular fat (Lapar et al., 2010). Willingness to pay for pork from pigs not raised on manufactured feed was VND 1,700 (or 4% above average price) more per kg. Consumers were willing to pay twice that amount for pork with improved hygiene, nicer colour, and less extra-muscular fat.

Meat safety is currently a top concern for consumers, especially after toxic residues were recently found in meat (clenbuterol, salbutamol, or the lean-meat additives). For example, Radio Vietnam (2013) reported that some pork samples in Binh Duong province were positive for toxic substances of and Hanoi DARD found pork samples positive for Beta-Agonists (Giaoducvietnam, 2012). Consumers are willing to buy safe pork at a higher price. Vietnamese consumers were willing to pay a premium of up to VND 2,000 more per kg of fresh pork with better hygiene (5% above the average price) (Lapar et al., 2010). Certifying safe pork and gaining consumer trust are critical for the meat industry in Vietnam. RUDEC (2010) reports that about 36% of interviewed consumers were confident about the quality of pork sold in the market, and fewer than one-third of respondents could easily find food of the same quality as before. According to the report, consumer trust in labelling is low, with nearly 56% of consumers agreeing that certification by veterinary authorities is not important when choosing meat. During a time of disease outbreaks, about half of consumers either stop or reduce pork consumption, while about one-third substitute other meats (Figure 15). More consumers in Ho Chi Minh City (HCMC) than in Hanoi have shifted to modern outlets for pork. Consumers also limited eating out to avoid low quality food (RUDEC, 2010).

Figure 15: Consumer response to pig disease outbreaks

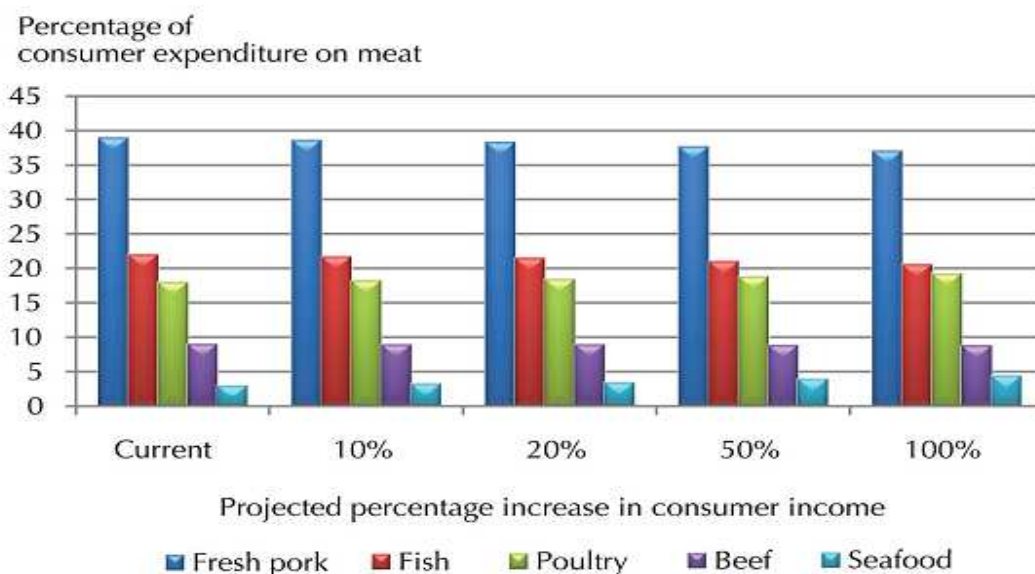


Source: Lapar et al. (2011)

Pork demand and market share projections

ILRI (2010) estimates expenditure elasticity for several types of ASF. Fish, fresh pork, and beef have elasticity estimates of less than one, while seafood is quite elastic to expenditure. The study also projects that future increases in consumer income are expected to lead to a significant rise in consumer demand for pork and diversification of meat consumption to include seafood and poultry (Figure 16).

Figure 16: Projected expenditures for meat products based on scenarios of percentage increases in consumer income



Source: ILRI (2010)

Minot et al. (2010) generated several projections for pork demand in Vietnam under different scenarios using the Vietnam Livestock Sector Model (VLSM).² The model estimates suggest that if Vietnamese per capita income growth over a 10-year period is 10%, consumption of traditional pork products (fresh, unprocessed pork) will grow at about 9% per year, and consumption of modern pork products (chilled, frozen, and processed pork products) will increase at 19% per year. Consumers will more likely shift towards consumption of modern pork products due to higher income elasticity, and partly because it is a tradable commodity. Under another scenario where there is no technological growth in the traditional pig sector (small-scale producers characterized by minimal use of hired labour, on-farm production of feeds, and use of local and hybrid breeds), consumption of traditional pork grows at close to 5% per year, while the consumption of modern pork products grows at about 14% per year (Minot et al., 2010). Nonetheless, the share of modern pork products will likely remain small, and only grow from 2% of total pork consumption to 4% over the 10-year projection period.

Overall, model projections show that Vietnam will remain self-sufficient in pork in the next 10-20 years. Rapid growth in domestic demand will likely absorb domestic production, leaving very little or none for exports. Indeed, VLSM model estimates suggest that pork product exports will likely phase out within 10 years in most simulated scenarios because of the rapid growth in domestic demand. The only exception is when there is a high rate of technological change within the sector that will significantly boost productivity, leading to a higher domestic supply.

3. Government policies

The Livestock Development Strategy to 2020 maps out the livestock sector development pathway as envisioned by the government. The strategy explicitly defines targets and directions and the accompanying policies that support them. The vision for the pig sector in this strategy is that of a modern sector that will see increasing shares of exotics vis-à-vis local pig breeds, increasing the share of closed production units with enhanced bio-security features, and establishment of modern slaughtering, processing, and market facilities that will service the needs of the sector. Not explicit in the strategy is the direction of development for small and household-based pig production, although later amendments to the strategy explicitly acknowledged the importance to the sector of these small yet dominant production units in Vietnam. A number of policies and programs that directly or indirectly support pig production in general are discussed below.

On 9 May, 2014, the Ministry of Agriculture and Rural development ratified Decision 984/QD-BNN-CN approving the “Livestock sector restructuring scheme towards greater added value and sustainable development”. On the same day, the Ministry also promulgated Decision 985/QD-BNN-CN on the Action Plan for implementation of the sector restructuring scheme. The highlights for the pig sector are as follows:

²This pig sector partial equilibrium model was developed as a component of the project on Improving Competitiveness of Smallholder Pig Producers in an Adjusting Vietnam Market, with funding from the Australian Centre for International Agricultural Research (ACIAR).

Restructuring pig raising regions

- Reducing the pig herds from 25.74% in 2013 to 15% in 2020 in the Red River Delta; from 10.51% to 5% in the South East;
- Increasing the pig herds from 24.1% in 2013 to 30% in 2020 in the Northern Midlands and Mountain areas; from 19.38% to 24% in the North Central Coast; and from 6.58% to 15% in the Central Highlands.

Restructuring pig breeding

- Increasing the proportion of exotic sows from 19.8% in 2013 to 30-33% in 2020;
- Developing slaughtered pigs from exotic breeds or cross-breeds with over 75% exotic blood.

Restructuring pig raising scheme

- Increasing the number of pig heads and pig production in commercial farms from 30% and 40% respectively in 2013 to 52% and 60% in 2020;
- By 2020, Vietnam is targeted to export 1.0 million tons of live weight pork.

Solutions to achieve above targets focus on building pig raising areas that are far from the inhabitants, having favorite condition for disease isolation, and environment treatment; improving the quality of breeding stock; and applying high technology in pig production.

a. Priorities and programs

MARD implemented programs to develop crop seed and seedlings, animal breeds, and forestry seed during 2000-2010, to be continued in 2010-2015. The program to enhance the capacity to produce good quality seeds, animal breeds, fishery stock, and pigs is one focus. Under this program, organizations and individuals investing in production of foundation seeds and great grandparent breeds would be entitled to borrow development investment credit capital from the state and enjoy the highest tax incentives. National and local assistance funds for scientific and technological development will finance experimental projects on crop varieties or breed production and processing.

MARD gives priority focus for pig production in the RRD, North Central Coast, and the South East, where local government and line agencies are required to have incentives for pig production. The strategy for development of market-oriented pig production covers feed production, breeds, veterinary services, and marketing.

The Livestock Competitiveness and Food Safety Project (LIFSAP) is being implemented over five years in 12 provinces and cities in Vietnam. The project's development objective is "to improve the competitiveness of household-based livestock producers by addressing production, food safety, and environmental risks in livestock product supply chains in the selected provinces". LIFSAP includes three components — upgrading Household-based Livestock Production and Market Integration, Strengthening

Central Level Livestock Production and Veterinary Services, and Project Management and Monitoring and Evaluation.

MARD (DLP and NIAS) joined SNV (Netherlands development organization) to implement the Biogas Program for the Animal Husbandry Sector of Vietnam in 2003. This project continued to gain success and enjoyed high acceptance among provincial authorities and animal breeders. Since its implementation in 2005, the biogas program expanded from 12 to 46 provinces by 2010 (Dung, 2011). MARD then approved the extended project for 2007-2012, implemented by NIAS.

MARD also prepares national programs in the field of agriculture and rural development, for example, the National Target Program on New Rural Development and the National Food Security Program. Four other prioritized programs for 2011-2015 include Improving the Competitiveness of the Livestock Sub-sector; Encouraging the Development of Livestock in Farmhouse, Industry and Slaughtering and Concentrated Processing; Developing Animal Feeds; and Control of Disease in Livestock.

A pilot insurance program for agriculture for 2011-2013, under which insurance for livestock production (buffalo, cow, pig, and poultry) was applied in nine provinces, and the poor enjoy special treatment, i.e., 100% of the insurance cost is paid by government.

To help reduce production risks and improve food security in pig production, MARD approved the Good Animal Husbandry Practices (GAHP) for pigs in households in 2011. MARD also introduced requirements for organizations qualified to issue VietGAHP certificates in pig, cattle, poultry, and bee production.

MARD signed an agreement with Sweden to implement the project Poverty Alleviation through Livestock Development for Northern Provinces in Vietnam, Phase 3 (2011-2014). The project was implemented during 2005-2010 by Sweden Development Cooperation (SDC), MARD, and Agronomes and Veterinaires Sans Frontieres VSF-CICDA (or AVSF).

b. Public investments, credit, sanitary programs

Public investments and programs

Agriculture investors enjoy preferences and support from government in two main areas. They are charged lower rent or zero rent on land owned by the government, and receive support to rent land from individuals/private organizations (up to 50% in the first five years). Government provides other support for selected investors in:

- Labour training costs (up to 100% for very small enterprises investing in special areas),
- Market development support can be up to 70% of total cost of advertising,
- Consultant services support up to 50% of in areas of investment, law consultant, R&D, and others,
- R&D support up to 50% of the cost of research projects that aim to invent new technology, and
- Transportation support could be up to 50% of the cost of actual transportation, under certain conditions.

In emergency cases, MARD has implemented actions to solve problems in livestock production and food markets. For example, in September 2011, Vietnam experienced high meat prices and a shortage of meat in domestic markets due to disease outbreaks during 2010-2011 and high input prices. MARD proposed some emergency solutions to support livestock production to increase food supply and stabilize food prices, effective in the last quarter of 2011. Commercial livestock farms³ enjoyed credit incentives (50% interest discounted) when buying/producing animal breeds to expand livestock production, and both large and small livestock producers were subsidized for vaccinations for PRRS and classical swine fever. Import tariffs for maize and wheat were reduced from 5% to 2% for maize and 5% to 0% for wheat. MARD proposed to cover more beneficiaries to include livestock producers, and also proposed to support individuals or organizations that establish livestock production facilities with modern equipment to reduce diseases and improve food safety.

Credit

The key source of credit for farmers, including pig producers, is provided by the Vietnamese banking system through a diversified system of banks and credit institutions such as VBARD, VBP, PCF, Joint-Stock Commercial Banks (JSCB), and State-Owned Commercial Banks (SOCB). However, only a small proportion of smallholder livestock farmers are able to obtain credit from these state-owned facilities. Access to informal credit is likewise limited or loan amounts are insufficient. Smallholders still face many difficulties in obtaining a state loan because their conditions do not satisfy complete loan requirements procedures such as a land title, valuable assets, a feasible production plan, and the ability to generate income. The non-secured or non-guaranteed loan now widely available due to credit policy changes has met a part of smallholders' capital requirements. Unfortunately, the aim of credit institutions is not consistent with that of farmers in terms of capital security and restoration.

Farmers' capital needs are relatively high, particularly in the rainfed region, where weather directly affects cropping patterns and animal husbandry practices, and farmers are able to produce only one seasonal crop during the rainy season even though they have enough labor and arable land for more than one crop. This subsequently limits opportunities to generate additional income from crop and animal production. The ability to obtain credit to smooth cash flow throughout the cropping cycle has enabled farmers to invest in productivity-enhancing technologies and subsequently improved their income. Conversely, the current lack of access to credit for many farmers has prevented them from investing in improved technologies. This suggests a need for policies to help ease this credit constraint. There is a need to pay attention to rural women, who often play an important family role in capital management. Lending directly to women is considered an important motivation. This helps increase their confidence, gives them a chance to earn more income, eliminates their economic dependency, and increases their autonomy. Requirements and procedures for credit loans need to be simplified. One important aspect is to minimize transaction costs for both creditors and debtors.

³Commercial farms are considered to make more efficient use of resources (land, labor), create employment, are likely to be new champions in agricultural production, and stimulate commercial production instead of self-sufficiency.

c. Sanitary and quality management regulation

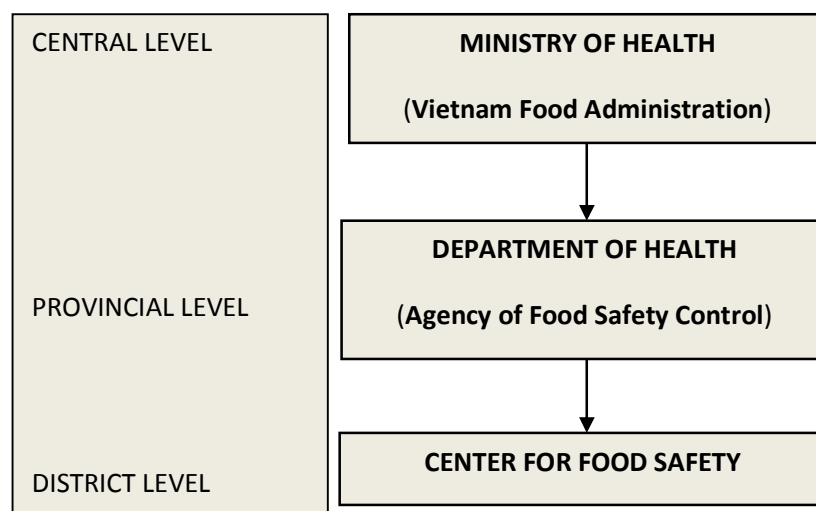
The Vietnamese food safety law mandates national assessment for high-risk products (including meat, fish, and vegetables) for both export and domestic products. In practice, however, this food safety law has not been effected in informal markets because there is insufficient capacity to enforce the law, assess risks, and manage food safety, thus enabling a climate with frequently prevalent food-borne problems as a result of viruses, parasites, mycotoxins, food additives, pesticide residues, and heavy metals (Sarter et al., 2012).

The new food safety law designates three leading bodies as responsible for food safety — the ministries of Health (MOH), Agriculture and Rural Development (MARD), and Industry and Trade (MOIT). These ministries and the subordinate departments at all levels are intended to regulate food safety, but it can be argued that MOH bears the heaviest responsibility for food safety (Figure 17) (National Assembly of Vietnam, 2010; Hung, 2013). This ministry is mandated to monitor food and drinking water, as well as to manage food safety for both imported and domestically distributed goods. MOH further coordinates food testing institutions, and is expected to anticipate and intercept potential food safety risks. MARD is positioned to supervise food safety and health of all agricultural, forest, and aquatic products along the chain, from input to marketing. MOIT merely monitors imported goods and the value adding processes along the chain (FAO, 2009). Although MOH holds overarching responsibility for food safety, MARD and MOIT are in charge of food security, which is strongly associated with food safety (Tiên, 2012). All three ministries hold very distinct mandates that might complement each other and foster collaboration, or might not converge in the desired direction.

Food safety remains a high priority in Vietnam with the growth of export markets and increasing food imports, thus the need to rapidly build capacity to reduce the threats of foodborne disease becomes increasingly important. The Vietnam Food Administration (VFA) is responsible for managing food hygiene, safety, and quality and has made significant progress since its establishment in 1999 at the central level. VFA has embarked on an innovative capacity-building activity with technical assistance from the World Health Organization (WHO).

VFA was established to advise the Ministry of Health. Under this mandate, the tasks and responsibilities of VFA are quite broad and include drafting food standards and coordinating safety regulations; information, extension, and communication (IEC) on food safety; testing food products; inspecting and licensing joint venture enterprises; investigating food poisoning outbreaks; and working with Provincial Preventive Health Centres and District Preventive Medicine Teams to achieve food safety goals.

Figure 17: Structure of the public health sector involved in food safety



In general, food safety policies regulate: (i) procedures to control animal slaughtering; (ii) order and procedures for quarantine of animals and animal products, and veterinary hygiene inspection; (iii) regulations for inspection, sanitation surveillance, and animal slaughtering; and (iv) hygienic veterinary conditions for pig slaughterhouses.

Unfortunately, at present there is little coordination among the ministries that are involved in food safety. The legal framework is complex, overlapping, and confusing. Certain special commodities such as infant formula and nutritional supplements are subject to additional quality standards and health requirements.

Policymakers' knowledge about stakeholders seems to fall short, as demonstrated by legislation that was unrealistic to enforce in Vietnam's current situation. This may be associated with the little research that is specific and touches upon the real issues that Vietnam and its society encounter.

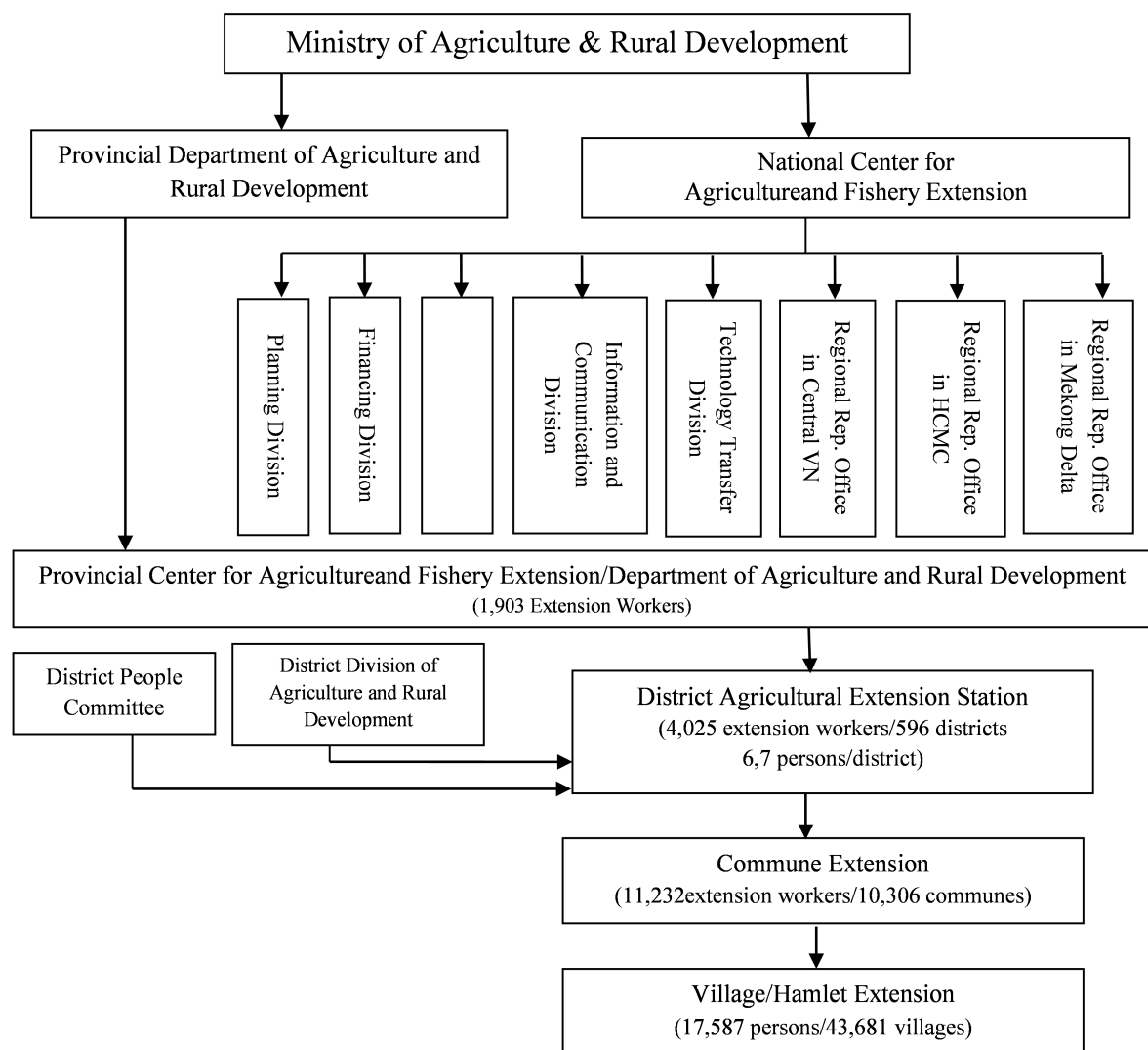
d. Access to other resources: knowledge system

Agricultural research and extension each have knowledge systems, but the link is weak, with no coordination to avoid overlapping functions. The research system includes research institutes and research centres/stations that belong to MARD or provinces. The results of research experiments are transferred to farmers through the agricultural extension system after they are approved by a group of specialized scientists of the Scientific Council. Coordination between these two systems is weak and as a result research outputs do not address the actual needs of farmers. Cooperation among extension workers and researchers needs to be improved for the extension system to become an effective bridge between farmers and researchers. Currently, the field research approach and participatory technology development (PTD) are promoted to create good platforms for researchers, extension workers, and farmers to work together (Van, 2010).

These actors have extension duties under the current system: (i) government extension system (extension centres); (ii) research institutions; (iii) universities; (iv) enterprises; (v) NGOs; and (vi) volunteer extension organisations (associations, local common interest groups). Research institutions, universities, and enterprises are mainly transferring their own technologies and products.

The agricultural extension system in Vietnam is mainly based on a top-down approach. It is a step-by-step approach developed from central to local levels associated with the agriculture sector, farmers, and rural development (Figure 18).

Figure 18: Structure of the public agricultural extension network in Vietnam



Agricultural extension activities fall under a national network in the agriculture sector (agriculture, forestry, and fishery). The state encourages development of volunteer institutions for agricultural extension among Vietnamese and foreign socioeconomic organisations. Agriculture extension is defined to include: (i) dissemination of technical advances in cultivation, animal husbandry, processing technology, storage of products of agriculture, forestry, and fishery, as well as achievements by successful production units; (ii) strengthening skills and knowledge for economic management among farmers to enable increased production and improved economies; and (iii) in cooperation with other units, providing farmers with information on markets and prices for agricultural products to enable them to adjust production and achieve improved economic results.

Current extension activities in livestock including pigs focus on the following key areas:

(i) Models are set up to demonstrate advanced technologies and techniques for transferring to farmers. The models concentrate on introducing new varieties and techniques/technologies. Parallel to this, extension workers organise field days to train and respond to questions from farmers.

For the last 20 years (1993-2013), extension programmes about livestock mainly focused on application of advanced technologies for breed improvement, and adoption of livestock breeds with high productivity and quality; moving from scattered and extensive livestock production systems to intensive medium- and large-scale livestock farms; and adoption of advanced technologies for livestock nutrition, disease prevention, and food safety. There are a number of critical extension programs such as the oxen herd improvement program, development programs on lean crossbred pigs, biosafety poultry and waterfowl livestock production, biosafety livestock breeding, and application of Vietnam Good Agriculture Practise (VietGAP).

Livestock demonstration activities and technology transfers of the Vietnam agricultural extension system in 2009 were diverse. For example, in the sustainable lean pig production program, there were 84 demonstration models established in different places with 697 farmers participating, which attracted 5,518 trainee visits from different training courses and regions. There were 3,761 pigs raised in the demonstration models utilizing high-quality crossbred and exotic pigs (Table 12). Conducting demonstration models is a useful way to disseminate advanced technologies in livestock in general and pig production in particular to farmers because they can show benefits and viability, as well as a step-by-step approach for adopting these technologies. These demonstrations made significant contributions to the development of livestock, especially pig production in last two decades in Vietnam.

(ii) Short training courses for local extension workers and farmers are conducted. Not all new technologies and techniques are demonstrated in the field, therefore training is a means to transfer them quickly to farmers. Training methods include face-to-face training, and training via TV, radio, brochures, CD, VCD, DVD, and via websites (e-learning). Training of trainers (ToT) is also an effective training method to expand the number of skilled extension practitioners. Additionally, the extension system also creates opportunities for some experienced farmers to use advanced technologies from overseas.

Table 12: Results of demonstration activities and technology transfers in livestock, 2009

Type of demonstration model	Scale (no. of head/herds)	Number of demonstration models	Number of participating farmers	Number of trainees visited
Improving ox breeds towards meat production	4,449	54	2,424	5,518
Fattening oxen herd	7,821	62	2,816	6,324
Raising dairy cows	97	6	80	380
Developing breeding oxen	121	3	102	330
Improving the buffalo herd	713	14	512	1,144
Improving the goat and sheep herds	6,966	36	416	2,230
Developing sustainable lean pig production	3,761	84	697	6,105
Biosafety poultry production	472,105	194	1,942	11,346
Honey bee production with high quality	600	5	100	250
Total	496,633	458	9,089	33,627

Source: NCAE (2009)

For the last two decades (1993-2013), the central agricultural extension office has offered printed reference materials and a wide range of DVDs, TV channels, and internet pages. There have been 6,000 training courses conducted with 210,000 participants and many domestic and international visits for approximately 900 participants.

(iii) Science and technology forums and specific festivals and exhibitions are organised so that farmers can exchange directly with scientists and see examples of successful application of new technologies.

The advanced technologies used in demonstration models and training are products of research institutions, universities, and imports. In order to avoid risks for farmers, those technologies must be recognized/approved by the Scientific Council at the Ministry level (applied on a national scale) or at the provincial level (applied on a regional scale).

Besides the responsibility for transferring technologies and training, the extension system also takes responsibility for disseminating new policies related to agriculture, farmers, rural areas, and markets. Meanwhile, extension workers receive feedback on weaknesses and constraints of proposed new technologies or policies.

Current extension policies and programs are mainly focused on the government extension system where extension services are provided for free. This does not create a motivation to expand activities beyond the reach of the public sector, and does not promote participation by other organizations. The links among extension, research, and education are not yet well developed.

4. The role of private firms in the governance of the sector

a. Genetics: main firms and types of contract

The public sector is the dominant player in pig breeding R&D in Vietnam. The private sector (mainly the foreign-owned feed companies) also contributes to the development of pig breeding and genetic conservation. However, there is currently still very limited information on the contribution of the private sector to the development and improvement of pig genetics in Vietnam.

Breeding programs

In Vietnam, systematic breeding is carried out only in nucleus herds and breeding farms. Straight breeding is used for purebreds, keeping in grand grandparent (GGP) and grandparent (GP) herds and is employed mainly for exotic breeds. The breeding objective in that system is referred to as “leanization” to improve product quality. On the other hand, unstructured breeding is commonly used in households and extensive systems. In both production systems, the breeding objective is to increase the proportion of lean meat in the pigs. Quality and quantity traits are of main interest in all breeding systems, while disease resistance and lifetime productivity traits are not yet considered. There are 10 breeding centres with nucleus herds, mainly exotic herds. The breeding programs use artificial insemination (AI). There are 100 breeding farms which serve as multiplication herds, with an average of 200 sows and 10 breeding boars. Ten percent of exotic sows are used for pure breeding, and 90% are used for crossing. There are four boar-testing stations, two in the North and two in the South, however, only 30% of the current testing capacity is used. The majority of boars used on small farms for either AI or natural service were purebred indigenous or exotic breeds. Up to 60% of the national pig herd used AI. In each province there is one or more AI stations (FAO, 2003).

MARD and NIAS have put a lot of effort into pig breeding. During 1995-2000, an ACIAR project, Pig Breeding and Feeding in Australia and Vietnam, was implemented with participation by the Institute of Agricultural Science of South Vietnam (IAS), the Animal Research Institute of the Department of Primary Industry–Queensland (ARI), key agricultural universities, and NAEC. The improved pig breeds, which were imported from Australia, were evaluated for adaptation to Vietnamese conditions. It was evaluated as a successful project targeting enhanced benefits to the poor in Vietnam.

Breeding practices

Along with the growth of the livestock sector in recent years, use of artificial insemination (AI) has been increasing. In 2008, there were 549 facilities breeding boars and carrying out artificial insemination, with 456,000 male pigs and production capacity of about 5.77 million doses of semen per year. There were 105 facilities belonging to state-owned and shareholding companies with 205,000 boars and the ability to produce about 3.48 million doses of semen per year. There are 444 privately owned farms with about 25,000 boars and the ability to produce 2.3 million doses of semen per year. About 4.56 million doses of semen were used, which inseminated approximately 30% of the sow herd in the country (DLP, 2009).

The number of AI swine facilities increased from 282 in 2000 to 549 in 2008, with an average growth rate of 10% per year. A boar can breed an average of 325-400 sows/year using AI, while it can only

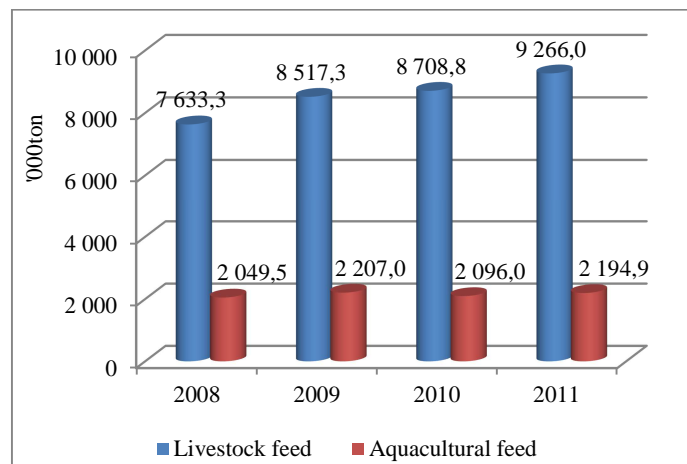
directly breed for 30-32 sows/year. Thus, the AI method made significant contributions to quality improvement of the national pig herd, pig productivity, and efficiency of the pig sector. Understanding the important role of AI, there are many provinces that have preferential policies to support and encourage the development of the AI method in pig production (Hang, 2008).

b. Feed: main firms and types of contracts

In recent years, industrial feed prices have been increasing in Vietnam as a result of rising import prices of key feed ingredients; a substantial percentage (20-30%) of raw materials for feed is imported from other countries. An increasing number of foreign and domestic companies are entering Vietnam to capture potentially high profits that could be generated from feed production and sales. In addition, multinational feed companies such as Cargill, C.P., Proconco, and Japfa have established feed production facilities in Vietnam as a result of government reform policies as well as foreign and domestic investment incentives available to feed industry investors.

The livestock feed processing industry in Vietnam has developed rapidly since the 1990s with the growth of the livestock and fishery sectors. According to GSO, total industrial feed for livestock production was estimated at around 9.3 million tonnes in 2011 and approximately 2.2 million tonnes of aquaculture feed was produced in the same year. The average annual growth rate of total industrial feed production for livestock and fishery during 2008-2011 reached almost 7% and more than 2%, respectively (Figure 19).

Figure 19: Livestock and aquaculture feed production in Vietnam, 2008-2011



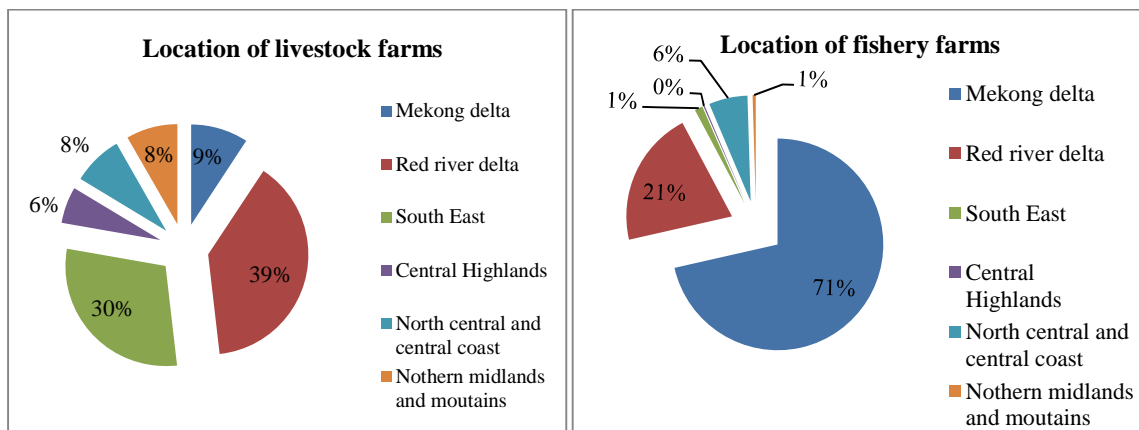
Source: GSO (2012d)

According to MARD data, there were 225 registered livestock feed mills (42 foreign, 12 joint ventures, and 171 domestic) and 89 aquaculture feed mills in Vietnam in 2010. All of the biggest feed manufacturing corporations in the world have established businesses in Vietnam. Currently, foreign feed companies hold a market share of 65-70%. There are a number of domestic feed enterprises that have been successfully developed such as Golden Pig. However, the feed technologies used by domestic feed

companies are not as modern when compared to those of foreign companies. Although there was high investment and support from the government, state-owned feed enterprises cannot compete with private and foreign feed companies. The big challenge for domestic feed enterprises is a lack of premix technology, which is owned by the foreign companies. The foreign companies have no competitors in producing premix feed in Vietnam, hence they can sell their products to Vietnamese feed companies at a very high price.

To reduce transportation and transaction costs, the feed production facilities are located in eight regions of Vietnam. Industrial feed mills are located mainly in the Red River Delta, South East, and Mekong River Delta, where livestock and fishery farms are highly concentrated. The smallest feed producing region is the Central Highlands, where the livestock and fishery sectors are less developed due to unfavorable natural conditions (Figure 20).

Figure 20: Location of livestock and fishery farms in Vietnam, 2011



Source: GSO (2012d)

The feed industry is classified as large-, medium-, and small-scale (Table 13). There are different strategies used to buy raw materials and sell products among the feed companies. In general, the larger the scale of feed production, the higher the percentage sold to wholesalers and traders, with a smaller share sold to small household livestock producers. The larger the feed business, a higher percentage of raw materials is bought from private processing businesses/state-owned enterprises and traders, with a lower share coming from farmers.

Table 13: Characteristics of small- and medium-scale feed enterprises

Scale of feed business	Sources of raw materials	Type of customers
Large	Private processing business	Wholesale agents/traders
	State-owned enterprises	
Medium	Private processing business	Wholesale agents/traders
	Traders	Retail agents
	Famers	Commercial farms and small households
Small	Famers	Retail agents
	Traders	Wholesale agents/traders
	Private processing business	Commercial farms and small households

Source: CAP-IPSARD (2011)

The availability of local inputs for feed, particularly protein-rich ingredients, are limited compared to local demand for feed. Vietnam is an agricultural country, but the industry does not have enough raw materials for feed production because there is a shortage of suitable land to grow these crops, as well as limited processing capability. This imbalance of supply and demand increases feed prices in domestic markets. Every year the feed processing industry in Vietnam produces nearly 6 million tonnes of feed for livestock and poultry and 2.4 million tonnes for aquaculture . Of the estimated 8.5 million tonnes of feed, processing factories have to import 3.7 million tonnes of raw materials each year. Although Vietnam is one of the largest exporters of agricultural products in the world, there is still a high percentage of raw materials imported for domestic feed production. This is a major constraint for development of the domestic feed industry. Prices of commercial animal feed produced domestically are 15-20% higher than commercial feed produced in neighboring countries in the region based on recent statistics (MARD, 3/2010).

The high dependence of the domestic feed industry on imports such as maize, soybean meal, and premixes also creates volatility in feed markets and exposes farmers, particularly, small-scale producers, to market risks. After joining the WTO, the government set tariffs for feed ingredients to zero, thereby allowing the market to accommodate a free flow of imported feed ingredients with the anticipated desired price effects in the feed sector. However, the domestic feed manufacturing sector and feed markets are not effectively organized in a structure that allows appropriate supply responses to these new trade policies that will likely benefit a majority of stakeholders. Feed prices in Vietnam, therefore, are much higher compared to other countries in the region, leading to high pig production costs and reduced competitiveness. This suggests the need for a long-term strategy to develop the feed industry towards less dependence on imports (maize, soybean meal, and other feed ingredients) and more effective and transparent management of government trade policies on feeds. R&D on feed technologies that will enable cost-effective rations will enhance feed-cost efficiency across all types of pig production.

c. Health, sanitary control, quality of meat

Private veterinary practice and private veterinary medicine sales are regulated in Vietnam. Except for veterinary drug imports and production, there is no national database of private veterinary activities. Thus planning to support and control the private veterinary network is impossible. Each province usually has a list of licensed drug shops, and sometimes of veterinary practitioners. While drug shops may seem to be regularly registered (easy to see and locate), it is likely that a significant number of veterinary practitioners are not registered (perhaps half of the para-professionals and a third of the veterinarians). Private veterinarians could number around 1,600 and private veterinary para-professionals around 30,000. The number of veterinary pharmacies and drug shops might be as high as 20 per district, but usually only one in remote areas. They could number several thousands (estimated at 3,000) (Fermet-Quinet et al., 2007).

Private clinics are usually located in most big cities and in some provinces for pets and for animal production (mainly in the lowlands for poultry and pigs). They are usually owned by veterinarians who work with veterinary para-professionals. Their facilities are rather basic but adequate (e.g., computers, diagnostic table, small equipment, and the usual drugs). These veterinarians and their staff are registered with local governments (Fermet-Quinet et al., 2007).

It is almost only in the big cities where drug shops are owned by private graduate veterinarians, many of whom also run a small animal clinic from the same premises. The huge majority of drug shops are held by veterinary para-professionals of non-specific qualification levels. Very often the seller is not a qualified person. Apart from direct sales to farmers, they seem to have little direct contact with farm livestock due to limited time to practice their profession because selling drugs brings much higher returns (Fermet-Quinet et al., 2007).

Very large investments in veterinary services have been made by both the Vietnamese government and international donors, particularly in response to ongoing outbreaks of HPAI H5N1 in poultry. Such funding has flowed from national and international political pressure and improved planning output of the government, including the generation of medium- to long-term planning. It also has created significant improvements in physical resources and some aspects of technical capacity building at the central level, including much improved laboratory diagnosis and risk analysis capacity. At the field level, resources have poured into building offices and quarantine stations, purchasing vaccine (for FMD and especially HPAI), and creating an entirely new level of veterinary services with funding from the government, and the network of commune veterinary para-professionals at the field level. These steps obviously had some positive impact on veterinary services field coverage and activity (Fermet-Quinet et al., 2010).

The most significant limitation within the Vietnamese Veterinary Services is the ongoing lack of effective national coordination that links central veterinary services with the field. Two related efforts are needed to generate such links throughout the different veterinary services levels to stakeholders: (i) an effective chain of command; and (ii) communications and consultation approaches. Having links between the

central veterinary services and lower level veterinary services/stakeholders is of vital importance to efficiently functioning veterinary services. Unfortunately, Vietnam does not have sufficient mechanisms for an effective chain of command, nor regular, formal consultation, and therefore cannot effectively link central to field. Therefore, irrespective of funding levels and resources available, these inadequate links will continue to limit progress (Fermet-Quinet et al., 2010).

In terms of impacts, the relative separation of central from field negatively affected capabilities relating to surveillance and reporting up the line, as well as the ability of policies to be implemented to field level down the line. This was most clearly demonstrated by difficulties in rapidly and efficiently responding to outbreaks, and ultimately their persistence as endemic diseases.

In addition, a lack of standardized knowledge and skills from field veterinarians and veterinary para-professional staff and issues with stakeholder compliance (particularly farmers) also hinders progress. These may be current gaps more easily amenable to targeted funding and dedicated projects, such as those to improve initial and continuing veterinary and para-veterinary education, the establishment of a Veterinary Statutory Body and delivery of more effective animal health communications to stakeholders (Fermet-Quinet et al., 2010).

d. Processing and distribution: main actors

Processing

Vietnamese consumers prefer fresh meat over processed products, so the share of meat for processing is quite low. There are about 28 pork processing factories in Vietnam with products such as ham and sausage (Thanh, 2011). Tung et al. (2010) also noted that processed meat accounts for less than 6% of meat sold, especially in rural areas. This figure is highest in Hanoi and Ho Chi Minh City, at just over 10%. Some trading companies process and export meat.

The key players in the meat processing industry include some of the largest multinational and joint-stock companies such as VISSAN, which is the largest company engaged in food processing in Vietnam. The major processed pork products include paté, ham, and meat loaf type products. The operation of modern market outlets such as Big C and Metro Cash & Carry has encouraged development of modern meat processing. Normally, these big companies have contracts with large pig farms.

Apart from a concentrated modern meat-processing industry, local traditional processing units have existed over the years in Vietnam, and there are traditional villages that produce different traditional products such as grilled chopped pork, fermented pork, and Vietnamese meat loaf. In Northern Vietnam, there are several meat processing villages where many small meat processors operate, such as Uoc Le, Chem, and Dong Huong. Processed meat for urban/semi-urban consumers mostly comes from meat processing areas where many meat processors operate, such as in villages.

In rural areas where demand for processed pork is relatively low, normally there are few or no meat processors in a commune. The scale of operation for these processors is very small, about 3-4 kg of meat processed each day. Many of them do slaughtering, processing, and retailing, e.g., husband slaughters pig, wife does retailing, and both process the meat. For communes near traditional meat processing villages, there may be no meat processors because consumers might buy directly from the villages or through meat retailers at communes.

Processors normally buy meat directly from the slaughterhouse right after slaughtering. Some types of processed products require fresh meat, such as meat loaf. Some processors also make other ready-to-eat food from pork and sell it in the market, for example cooked blood sausages, barbeque, steamed pig's liver, lung, and intestines.

Marketing and distribution

Meat is sold to consumers through various channels, including modern outlets (supermarket, trading centre, food stores), wet markets in communes/towns, temporary meat vendors in villages, or itinerant meat vendors hawking from home to home. In 2011, there were 8,550 (open/wet) markets in the country, 638 supermarkets, and 116 trading centres (Table 14). However, a majority of Vietnamese consumers do not like to buy pork from supermarkets, and prefer to buy fresh pork from traditional market outlets (Lapar et al., 2009), so most meat is available in traditional open/wet markets. In 2011, there was one open market for about every 39 km² in the country. The density is highest in RRD (11.8 km²), followed by MRD (22.8 km²). In rural areas, only 58% of communes have markets (Table 15). The operation of small meat vendors is popular in rural Vietnam.

Table 14: Number of vendors and market density in Vietnam, by region, 2011

Region	No. of (wet) markets	No. of supermarkets	No. of trading centres	Area to have one market (km ²)	Population supposed to be served/market (person)
Country	8,550	638	116	38.7	10,274
RRD	1,782	165	38	11.8	11,223
NMMA	1,423	63	7	66.9	7,934
NCCCA	2,427	144	22	39.5	7,848
CH	370	24	1	147.7	14,276
SE	766	186	44	30.8	19,440
MRD	1,782	56	4	22.8	9,726

Source: Computed from GSO data

Table 15: Presence of markets in communes in Vietnam, 2011

Indicator	2006	2011
Total number of communes	9,073	9,071
Total number of communes having a market	5,336	5,239
Communes having a market as percentage of total communes	58.8	57.8

Source: GSO (2011)

Almost all meat retailers are female and operate at a range of scale, depending on demand and supply capacity in the market place. They might specialize in fresh meat, processed/cooked meat, or combine with other foods such as eggs, tofu, and vegetables. Normally meat retailers who register in markets specialize in only meat, partly because it is regulated by the market management board. Meat retailers in villages or temporary market places normally sell meat plus several other types of foods. The former might sell up to several pig carcasses per day in urban/semi-urban areas, while the latter trades a much smaller quantity, as low as 5 kg/day (RIA, 2013). Many meat retailers in village or temporary markets in rural areas have multiple functions such as slaughtering and processing (traditional meat loaf and grilled chopped pork).

5. Conclusion: issues and prospects for sustainability

a. Issues for pig value chain development

Development of the pig value chain that benefits the poor will need strong support and involvement of the government. MARD has played a key role in designing pro-poor policies and rural poverty alleviation in Vietnam. It has implemented a number of policies to support, invest in, and promote the livestock industry and pig value chain specifically. However, there are still gaps that need to be considered, especially the fact that MARD strongly emphasizes the production side with little attention paid to product marketing and the accompanying issues of supply vs. demand, distribution, and prices.

In production, MARD has issued a number of policies for livestock sector development, the most important being the Livestock Development Strategy to 2020 that has recently been updated to reflect the government's policy directions to 2030. The main challenge has been the weakness of the policies themselves (not strongly grounded on relevance and context of the country and its systems) as well as in the implementation (mismatch between targets and resources).

Recent projections suggest that the Vietnam pig sector will remain predominantly household based over the next decade. While there is a slowly growing share of modern pig sector composed of big farms linked with food and feed processing functions, it is unlikely that this will radically shift Vietnamese pork consumption towards processed pork products. Modern pork products will not likely be a significant share of consumer pork consumption. The modern pork sector will grow about 4% in the next 10 years

even if there is no technological growth in the traditional pig sector. Therefore, domestic pork production will likely remain and keep a dominant share in total pork supply in the country, suggesting potential for the development and expansion of small- and medium-scale pig production. Changes in the composition of pork demand will not squeeze out small- and medium-scale pig producers within the next decade and beyond (Minot et al., 2010). Also, a growth in market share of modern pork products could be cost-effectively produced from imported cheap frozen/chilled pork (Minot et al., 2010). While movement towards larger-scale commercial production of pigs is apparent — as bolstered by supportive government policies for development of a modern industrial livestock sector — sector model projections suggest that the large, modern pig sector will not be a dominant player in Vietnam’s pig industry within the next decade. MARD has recently highlighted the important contribution of small-scale livestock (pig) production, and the need for supportive policies to this particular group in the sector. The latest policy on restructuring the livestock sector in Vietnam also focuses attention on pigs as one of the key livestock species with important economic contributions to the country’s overall growth.

A number of issues that pose significant constraints to the development of a pro-poor and well-functioning pig value chain can be categorized as breeding, animal health, feed prices, market and output prices, food safety, and environmental pollution.

Breeding

While farmers have been traditionally more active in supplying piglets for themselves through on-farm production, many still depend on outside sourcing, especially good quality breeds and especially during/after disease outbreaks. MARD has introduced a state law on animal breeding, however, but implementation is not effective (WS, 2013). Farmers are unable to test/check for quality of piglets sourced from markets or traders, which are also likely sources of disease outbreaks. Hence, better state control/management of piglet quality and supply in markets is an urgent task.

Breed quality is also a recurring concern among producers. While most high quality pig breeds in the world are now available in Vietnam, their productivity remains low compared to those in other countries. The deterioration of indigenous breeds is now of increasing concern due to a strong push by the government for widespread dissemination and use of exotic breeds.

Animal health

In Vietnam, the production, distribution, and application of veterinary practices, medicine, and other veterinary inputs are not properly regulated nor are the markets for veterinary services and products adequately monitored for compliance with appropriate standards. This subsequently leads to a proliferation of low-quality veterinary drugs and low effectiveness of treatment, resulting in higher risks in pig production and the veterinary and human health. Cases such as these predominantly occur among small-scale farmers in the middle regions and mountainous areas that are less served and difficult to reach by public veterinary services. While training in animal health service has been organized for farmers, including the creation of a para-professional cadre of veterinary staff at the local level, many of these para-professionals have weak skills in diagnosis and treatment of animal diseases let alone “new and emerging diseases”.

Many farmers think animal health is affected by climate change (RIA, 2013). In case of disease outbreaks, MARD always has been prepared with emergency solutions to manage the situation, but the implementation of these programs at the local level has been less than desirable and not effective at controlling diseases and curtailing transmission and the accompanying economic losses. The programs have not been able to elicit appropriate responses by farmers for risk reduction, and in fact have encouraged risky practices such as farmers selling diseased pigs or dumping them in public places, especially ponds and rivers.

Feed and feed prices

The feed market is concentrated with a small number of large manufacturers capturing high market shares (most are FDIs, e.g., Cargill, C.P.). This market structure limits smallholders' ability to significantly affect feed markets, particularly prices. The high dependence of the domestic feed industry on imports such as maize, soybean meal, and premixes also creates volatility in feed markets and exposes farmers, particularly smallholders, to market risks. After joining the WTO, the government set tariffs for feed ingredients to zero, thereby allowing the market to accommodate a free flow of imported feed ingredients, with anticipated desired price effects. However, the domestic feed manufacturing sector and feed markets are not effectively organized in a structure that allows appropriate supply responses to these new trade policies that would likely benefit a majority of industry stakeholders. There is a perception that these policies only exposed unfair treatment and unbalanced access to preferable government incentives to a few key players with clout in the sector, leaving the majority of industry players at a disadvantage. This suggests the need for a long-term strategy to develop a feed industry less dependent on imports and more effective and transparent management of government trade policies on feeds.

Feed ingredients imported from China are perceived to be of dubious quality and do not meet strict quality control standards, and might contain substances that promote animal growth that harm consumers. There is a need for more research on feed technologies for farmers, particularly those technologies that they could produce at home and utilize low-cost feed ingredients.

Prices of pig and pork products

Tariff reductions in meat among WTO member countries and other AFTA countries obviously expose Vietnamese pig farmers to strong market competition with important implications for domestic pork markets. Cheap imports of meat and edible offal flowing into the domestic market likely dampen local liveweight prices in the short to medium term. In the context of small and scattered pig production, these price effects are likely to put small producers at great market risk, especially if they are faced with prices that barely allow them to cover production costs. From a broader sector perspective, the Vietnam government will need to consider how recent trade policies on tariffs for meat and meat products will likely impact domestic supply and prices. There is a concern that application of some non-tariff measures to protect domestic producers is an appropriate strategy to shield Vietnamese consumers from proliferation of cheap but low-quality meat imports. Absent strong and compelling

evidence, this will need further investigation to ensure policy recommendations are based on a rational examination of facts.

State management and food safety

Aside from issues of policy design and implementation mentioned earlier, state management in some nodes of the value chain still creates inconsistency and difficulties. One notable example is food safety management, where several government agencies are involved — Ministry of Health, Ministry of Agriculture and Rural Development, Ministry of Industry and Commerce, Ministry of Natural Resources and Environment, Ministry of Public Security, and Ministry of Finance. These create a mix of functions and responsibilities among ministries (especially food safety), especially with slow and poor cooperation among ministries, and create difficulties for actors in the pig value chain.

The government's role in the management of food safety is important. This is a problem in Vietnam, however, when agencies involved in this task are not well coordinated and cooperation is weak. The recently established Food Safety Law is a case in point. With weak coordination among responsible agencies, the law is not effectively implemented. There is a perception among stakeholders that the food safety law has not improved food safety, particularly in developing consumer trust in food quality. Developing a credible and transparent food safety system is especially critical in meat and meat products where quality and safety attributes could not be observed visually. Absent this credible and well-functioning quality and safety assurance system, food safety scares will continue to persist and create undesirable consequences, hindering the development of a well-functioning pork value chain that benefits consumers, while ensuring an equitable distribution of returns to all value chain actors and thereby sustaining effective participation by smallholders.

To improve the food safety situation in the pig value chain, coordination among farmers with other upstream actors should be established and developed. Transaction costs for designing and implementing agreements among them are usually high (ILRI-HUA-IFPRI, 2007; McDermott et al., 2010; Lapar and Tiongco, 2011), so proactive policies and investments can help ensure the inclusion rather than the exclusion of the poor pig farmers who produce and sell on a small scale.

Environmental externality

Pollution caused by pig production is now an issue in rural areas and more seriously in suburban areas where population density is high and the number of pig raisers has not significantly declined as desired by the government. This has two-fold implications — increasing risks for both animal health and human health, and aggravating social issues (conflict) in the community. MARD has encouraged farmers to move animals (such as pigs) out of residential areas, however, the policy has not been successfully implemented due to limitations of land and farmer hesitance to locate pig production to areas not near their homes. There is a need to explore technical solutions to the environmental issues from waste and odour generated from pig production. Research on technologies that reduce environmental pollution caused by animal production will help develop feasible and viable approaches. One technology that has been developed and undergone some limited on-station testing is the biology mattress for small pig farmers developed by researchers from Hanoi University of Agriculture with support from international and government partners. This technology is applied in small-scale settings and has shown promising

results. If shown to be widely acceptable, it could potentially contribute to solving one of the important environmental issues in the pig sector.

b. Areas for future research

Knowledge and updated accurate information on pig value chains are very important for their development. At present, some key information and knowledge gaps have been identified which are crucial to supporting development of the pig value chain that will benefit the poor:

- Production and its logistics
- Cost and efficiency of feed production
 - ✓ Feed market structure, conduct, and performance;
 - ✓ Updated information on economic performance of pig production in different systems, scale, and breeding;
 - ✓ Pig producer's behavior and dynamics during transition period in Vietnam, e.g., a more market-oriented focus;
 - ✓ Breeding capacity and strategies to improve breed quality of pigs;
 - ✓ Climate change and its relationship to animal health (pigs);
 - ✓ Production and market risks in pig production;
 - ✓ Contract farming and other forms of vertical and horizontal coordination in pig production;
 - ✓ Effectiveness and efficiency of delivery of animal health services.
- Slaughtering, processing, transporting, meat trading, and meat retailing
 - ✓ Economic performance of animal slaughtering houses;
 - ✓ Economic performance of the meat processing sector;
 - ✓ Structure and dynamics of the meat retail market in Vietnam;
 - ✓ Movement/trading of diseased pigs/sick pigs, use and disposal;
 - ✓ Food safety issues and incidence of food safety risks along the chain; and
 - ✓ Examples of a new and emerging pork value chains for safe meat in cities and assessment of performance to manage food safety risks.
- Consumption
 - ✓ Characteristics and levels of meat/pork consumption (including away-from-home consumption, processed meat) and dynamics of consumer behaviour; and
 - ✓ Characteristics of and demand for meat and pork by institutional meat consumers.
- Policy/state management and R&D
 - ✓ Evaluation of policies, programs in pig value chain, especially for small-scale pig farmers;
 - ✓ Evaluation of state management along pig value chain (input, production, output, food safety, marketing, labelling);
 - ✓ Roles played by various agencies/institutions in livestock development and their effectiveness; and
 - ✓ The state of R&D in the pig sector, especially the emerging role of the private sector.

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