

CHARACTERISATION OF SWINE PRODUCTION SYSTEMS IN THE CAMBODIAN MEKONG LOWLAND REGION



Characterisation of Swine production systems in the Cambodian Mekong lowland region

Author: Barbara Tornimbene (DVM, MA)

btornimbene@rvc.ac.uk

Co-Author: Prof. Trevor Drew (PhD) – Head of Virology, AHVLA

t.drew@ahvla.gsi.gov.uk

Animal Health and Veterinary Laboratory Agency, DEFRA, Weybridge, UK

National Veterinary Research Institute, DAHP, MAFF, Phnom Penh, Cambodia

Royal Veterinary College, London, UK

The project was funded by Boehringer Ingelheim GmbH

May 2012

Table of Contents

1	INTRODUCTION	4
2	AREA DESCRIPTION	7
3	STUDY DESCRIPTION	9
4	SWINE PRODUCTION SYSTEM	11
4.1	DEMOGRAPHY	11
4.2	FARMING SYSTEM	12
4.2.1	<i>Commercial</i>	12
4.2.2	<i>Semi-commercial</i>	13
4.2.3	<i>Backyard</i>	15
4.3	FEEDING SYSTEMS	17
4.4	BREEDING SYSTEMS	18
5	HEALTH	20
5.1	DISEASES	20
5.2	VACCINATIONS	20
5.3	VETERINARY SERVICE	21
6	TRADE AND MOVEMENT	24
7	SLAUGHTER	28
8	MARKET	29

1 Introduction

Smallholders and mixed farming practices (animals-crop) are considered the backbone of the Cambodian agriculture system. On a global scale, a large proportion of animals are still kept in traditional small and backyard settings and these small farms are characterized by a complex integrated relationship between animals, crops and farming families (Devendra 2007; Dietze 2011). They often involve small land properties and require a minimum resource of labour and capital from which farmers may or may not be able to derive a regular and adequate supply of food or an acceptable income and standard of living (Devendra 2007; Devendra 2007).

Rice is the principal commodity of the Cambodian agriculture sector; the country has two rice crops each year, a monsoon-season crop (long-cycle) and a dry-season crop; the long-cycle crop is planted in late May through July, when the first rains of the monsoon season come to inundate the rice fields. Rice shoots are transplanted from late June through September. The main harvest is usually picked in December. The dry-season crop (short-cycle) is smaller, and it takes only three months to grow. It is planted in November and it is harvested in January or February; it seldom exceeds 15% of the total annual production (FAO).

Due to unfavourable climate condition, between February and late May most famers have to stop cultivating the land (Chhim, 2011, personal observation); livestock production then becomes an essential source of nutrients and alleviates the seasonal food variability and availability typical of single lowland rice crop systems; it also allows famers to better deal with crop failures or natural disasters. Then, during the wet season, animals contribute to land cultivation, supplying drought power and natural fertilizer.

Families that generate extra profit by land farming often fuel that cash into animal husbandry in order to guarantee an alternative source of income for the household; animals frequently act as cash buffer or capital reserve, reducing economic risks, particularly for poorer people (Devendra 2002; Devendra and Thomas 2002; Thomas, Zerbini et al. 2002).

Finally, livestock forms an integral part of the social, cultural and religious traditions that are embedded within village communities. Animals often share the same living space as the families, sleeping and eating under the same roof, consuming often the same food. This contributes to the creation of a complex and heavy interlinked human-animal relationship (Fig. 1), which needs to be taken into careful consideration when studying livestock production systems and animal diseases and their control in Cambodia.



Figure 1 - Human / Animal interaction

Despite this essential contribution to efficient farming and human welfare, the Cambodian livestock sector it is still characterized by a very low level of production. This is largely due to minimal input, poor understanding of nutritional requirements, difficulties with the supply of special feed, lack of knowledge in animal husbandry and poor veterinary services (Samkol P. 2006). As result, food insecurity and malnutrition are still widespread in every part of country; World Bank 2007 indicators show that 34.7% of the rural population was still living under the poverty line (WorldBank 2011). Cambodian farmers struggle every day with a vast number of health problems, animal diseases, climate change, economic insecurity, and receive very marginal support from government policies.

The continuous growth in the national human population is quickly leading to a higher demand for meat. In recent years, also as result of avian influenza epidemics and control campaigns, which often require stamping out of entire flocks of ducks or chickens, pork has become one of the main protein source for many consumers (Huynh 2006; Samkol P. 2006). But despite this opportunity, low agricultural productivity, caused by poor prospects for using improved technologies and poor marketing infrastructure, has jeopardized the development of the pork meat industry (Samkol P. 2006). Less than 1% of pig producers operate on a commercial level and even if these commercial farms continuously increase in production size, they still cannot keep pace with the increase in demand for pigmeat (FAO 2005). The country has started importing live pigs and pork since 2002, and hundreds of thousands of fatteners are illegally imported annually from either the coastal border with Thailand or through Nek Leung, a province along the border adjacent to Viet Nam (Samkol P. 2006). This not only is a threat for the potential introduction of new undetected diseases, but it negatively impacts on the national farmers output in their struggle to be competitive.

2 Area description

Situated in the heart of South East Asia, Cambodia encompasses a territory of 181,035 km². To the west, it is bounded to the North by Thailand and Laos; to the east by Viet Nam; and to the south by the Gulf of Thailand (Fig. 2).



Figure 2 – Cambodia

The agricultural land covers 31.5% of the entire country but only 0.9% is permanent cropland, with high variability between wet season, during rice harvest, and the dry season (WorldBank 2011).

With a total GDP of US\$11.34 million, Cambodia only reaches a human development index of 0.523, ranking 139th among the country that have been evaluated (Tab.1)(UNDP 2011; WorldBank 2011).

The rural population represents 77% of the total and agriculture dominates the Cambodian economy, with an added value of 35% to the GDP (UNDP 2011). Livestock and poultry production plays a significant role, accounting for 15.8% of agricultural GDP, or approximately 5% of total GDP (Chetra S. 2009).

	Cambodia	Medium human development	East Asia and the Pacific	World
Human Development Index 2011	0.523	0.630	0.671	0.682
Health				
Expenditure on health, public (% of GDP) (%)	1.7			
Under-five mortality rate (per 1,000 live births)	88			
Life expectancy at birth (years)	63.1			
Health index	0.68			
Income				
GDP per capita in PPP terms (constant 2005 international \$)	1739			
GNI per capita in PPP terms (constant 2005 international \$)	1848			
Income index	0.418			
Poverty				
MPI: Multidimensional poverty index ($k \geq 3$) (%)	0.251			
MPI: Intensity of deprivation	48.4			
MPI: Headcount ($k \geq 3$), % pop. in poverty	52			
MPI: Population living below \$1.25 PPP per day (%)	28.3			
Demography				
Population, total both sexes (thousands)	14305.2			
Population, urban (%) (% of population)	20.4			
Population, female (thousands)	7302.54			
Population, male (thousands)	7002.65			

Table 1 – Cambodia: Human development indicators, UNDP 2011

3 Study description

The objective of this study was to collect descriptive data on the Cambodian pig farming system, the attitude of farmers to bio-security, the main issues pig farmers face and the characteristics of the diseases affecting their pigs.

The following document analyses the pig production systems in six southeastern Cambodian provinces (Fig. 3): Kampong Cham, Svay Rieng, Prey Veng, Kandal, Takeo and Kampot. Information from published literature on animal production systems in Asia was collated with personal field observations.



Figure 3- Area of study

The choice of these six provinces was based on the following criteria; first, the relatively high pig density and the importance of the region for pig production (Fig.4)(Chetra S. 2009); second, their location within the Mekong region, so representing that larger ecosystem; third, the coexistence of different production system. Geographically, vast plains of rice fields and scattered hills characterize the area.

4 Swine production system

4.1 Demography

Pig production has recently become more developed, with the twin objectives of rearing piglets for sale, and fattening. In 2011 the government survey counted a total of 2,099,322 pigs in the whole country, the provinces with the highest animal density being Prey Veng and Kampong Cham (Tab. 2)(MAFF 2012).

Year	Pig Production, Head
2000	1,933,930.00
2001	2,114,524.00
2002	2,105,435.00
2003	2,304,248.00
2004	2,428,566.00
2005	2,688,612.00
2006	2,760,029.00
2007	2,389,389.00
2008	2,215,641.00
2009	2,126,304.00
2010	2,057,431.00
2011	2,099,332.00

Table 2 - Pig population MAFF 2012

Before 1997, most non-indigenous pig breeds were imported directly from Thailand and Viet Nam. Since then, pig farms in provinces adjacent to those countries, such as Banteay Mean Chey, Battambang, Prey Veng, Svay Reing and Kampong Cham have taken on an increasingly important role in the supply of improved pig breeds within Cambodia (Chetra S. 2009). Most of commercial and semi-commercial farms are located in Takeo and Kampong Speu, while Svay Rieng, Prey Veng and Kampot are characterized by a more traditional subsistence farming system.

About 2 million pigs are sold countrywide each year (MeatTradeNewsDaily 2010). A few commercial piggeries are located near Phnom Penh City, in Kandal province, to cater for the high urban demand for pork and other pig products. The capital requires about 2,000 pigs per day to meet demand, and according to Mong Reththy, one of the few commercial farms, only in 2010, 730,000 pigs, worth a combined US\$182.5 million, were required to support Phnom Penh market alone (ThePigSite 2009).

It is important to observe that the drastic decline in pigs' number that Cambodia experiences both in 2007 and 2010 (Tab.2) was probably due to epidemics. Since 2006, reports from China and Viet Nam have alerted the world to a new Asian highly pathogenic variant of PRRSV (HP-PRRS), (Metwally,

“CP Group” contracts farmers and supply them with weaners to complete the finishing process (Fig. 5). Pigs normally remain on farm for 3 months to be sold by “CP Group” directly to Phnom Penh markets for around \$7.50 each, at the time of writing. Food, maintenance, transportation and the veterinary service are provided by the company, which retains all the profit from the sale of the pigs. “CP Group” is also one of the main producers of commercial food, which can buy easily purchased in local markets.



Figure 5 - CP farm



4.2.2 *Semi-commercial*

In 2008 NaVRI reports the existence of 1,367 semi-commercial farms in Kandal, Takeo, Kampot, Svay Rieng, Prey Veng and Kampong Chang. Farmers generate a good part of the household income from pig production: aside they generally run different businesses (restaurants, retail, etc.) and they might or might not harvest rice, either for consumption or trade. Semi-commercial farms held an average of ten to thirty pigs at a time and they are mainly indoor single site herds. They generally comprise three to five pens, which are most likely to be closed by solid walls of concrete or bricks, have cemented floors with no bedding, and sheet metal roof (Fig 6). Free ranging is not practiced, unless to isolate sick pigs from the herd.



Figure 6 - Semi Commercial farms



These medium scale farms are mostly farrow-to-finish or finisher farms. Farrow-to-finish farmers generally own from one to three sows; owning more than one sow allows the farmer to alternate pregnancies and guarantee the simultaneous presence of more than one age group in the farm, so to secure a production flow. Sows usually bear three litters every 18 months and are rarely placed in cages during farrowing. After weaning, pigs are moved to a single pen where they remain until they reach slaughter weight. Replacement gilts are always bred in situ. Few big farrow-to-finish farms sell weaners locally, depending on litters sizes and market prices for piglets.

Finishers restock their farms with piglets (1 month old) two to three times a year, purchasing them from different breeders, either locally or from big commercial farms. They too rear more than one age group at time so to maintain production flow, but the number of piglets purchased might vary in relation to crop seasonality and it is therefore linked to cash availability.

Bio-security in farms is generally lacking. Disinfection is only ever applied, if at all, to finisher pens when the pigs leave for the slaughterhouse. The most used product is TH4+ (Sogeval, France), a bactericidal, viricidal and fungicidal disinfectant, but sufficient quantities are often not affordable.

Although pigs are reared in different age group, pens are generally located in one single shed with only a short wall separation. No ventilation system is present. Quarantine is never applied and sick pigs are not always isolated. Drainage is built-in and connected to every pen in the shed, but water exit are often situated within farm, offering an easy source of contamination for roaming chickens, ducks and dogs. Waste is often used as fertilizer, or generally discharged into the fields. During the wet season, flooding events might increase the chance of water and field contamination. Staff, family friends, traders, VAHWs and veterinarians generally have free admittance to the animal sheds. Neither they nor owners use boots or protective clothing while working with the pigs. Boots tips are not in use, nor disinfectant basins. Traders, veterinarians and middlemen vehicles have free access to the farms and disinfection is not applied to wheels and vehicles interiors. Veterinarians or VAHW have the tendency to use same needles and instruments in different farms without sterilisation or disinfection, and farmers often swap syringes for vaccines and drugs, enhancing the possibility of disease spreading through fomites.

4.2.3 Backyard

Backyard farming varies in relation to the region, customs, period of the year and the farmers' cash availability; these farmers generate most of their income from rice cultivation, and aside have few animals to contribute to household food demand. Pig raising is also practiced as form of money savings plan (literally a "piggy bank"), it often doesn't generate any profit but compensates for the fact that farmers don't have access to bank accounts and live in communities where it is difficult to safeguard their cash savings.

Backyards farms are single outdoor or indoor herds, rearing one to a maximum of six pigs at time. We distinguished three main distinct backyard-farming systems: pens keeping, tethering and free-range, seasonal and not seasonal.

1. Pen keeping - Pens can vary from very rudimental to quite well structured (Fig. 7). A family will have one, maximum two pens. Dimensions are variable, generally from 2x2m to 4x3m. The floor is made of mud, cement or concrete, and bedding is generally not used, except possibly some sparse straw. The walls can be made with any available materials, wooden fences, bricks, stones or concrete. The roof is normally made of palm leaves. Generally they house one to a maximum of six adults pigs. Sow and piglets are kept together until weaning. Dung is collected manually once a day and pens are cleaned by throwing water and brushing the floor. Often, sick pigs are separated from the healthy ones in the pen and left free ranging until full recovery or death.



Figure 7 - Backyard Pen keeping

2. Tethering - The pig is kept in the farm tethered to a tree in the front or back yard or underneath the house where the family lives (Fig. 8). Faeces are not removed and are mixed with water, to create soft and fresh bedding for the animal. This type of rearing system is particularly used by breeders: sows are always kept tethered, piglets instead are kept below bamboo baskets during the first week of age and then left free ranging until they get sold.



Figure 8- Tethering

3. Free ranging - Adult pigs but more often sows and unweaned piglets are left loose in the village to facilitate scavenging (Fig. 11). It is considered seasonal when the pigs are let free during the dry season and kept in pens during the wet season. This is done when the farmer are growing vegetables to avoid pigs destroying crop. In the non-seasonal system pigs are kept free all year long. The animals generally eat kitchen scraps left around the farm or the village, roots or other vegetables they can find on the border of the streets and in the gardens, and drink in ponds or rice fields, when flooded.



Figure 9 – Free ranging

Backyards can also be distinguished by production system: Farrow to Finish, Finishers and Breeders. In the same village these production systems can coexist, so that the movement of the pigs is restricted and the extra cost of the trader is avoided, although some area has got a high concentration of breeders only.

Most of farrow-to-finish farms have one sow and keep the pigs until they reach 50 to 70 Kg. Fatteners buy piglets twice a year in order to rear a single age group per time, which they grow until slaughter, before replacing them with the new batch of pigs. The age of the pigs at slaughter can vary in relation to the type of diet and the resource that the farmers put into the rearing practice. In some backyard farm, due to farmers' limited resources and access to feed, pigs can take up to 13 or 15 months in order to reach the ideal weight for slaughter.

Breeders generally own a single sow, and sell the piglets locally, most of the time in within the commune. If they can afford to buy feed, they try and keep the pigs until post weaning, in order to make more money from the sale of the pigs.

Backyard farmers rarely maintain the same production type through the years, instead they often vary the system in order to better adapt to seasonal variation, financial availability, pig added value, pork meat demand and animal health constraints.

Lack of bio-security characterizes the backyard system even more than the semi-commercial one. These farmers have a limited knowledge of husbandry techniques and very poor understanding of animal diseases and their control. Use of disinfectant is very rare, pigs and personnel move freely to and from the farms; vaccines are seldom or wrongly administered.

4.3 Feeding Systems

In semi-commercial farms water is supplied to the pigs using nipples or water troughs, while feed is provided using dispensers or feed troughs; backyard farms use rudimental metal bowls or cut car tyres and feed is often mixed with water.

Pigs can be fed with kitchen scraps, rice bran or rice by-products, beer by-products, or purchased commercial feed. Semi-commercial farm normally use a mixture of rice, commercial food and vegetables. Commercial feed has started appearing in backyard farms too, when the cost of food is sustainable in view of a quicker and better growth of the pigs; however feeding pigs kitchen scraps,

which often contain blood, meat or fish and bones, mixed with rice and vegetables is still the most common practice.

Commercial feed is provided both by Cambodian's and foreign companies, with high slices of the market hold by CP, the Vietnamese "GreenFeed" and the Thai "BetAgro"; feed bags are easily available though veterinaries, VAHW or other traders. Some farmers use medicated feed or growing feed, raising the problem of residues in pork meet. Water is not filtered and generally comes from nearby private wells in the dry season, and from rain tanks or ponds in wet season for pigs maintained in pens or tethered.

4.4 Breeding Systems

The pure local breed has almost disappeared in the south of the country, though it is still possible to see some local breed pigs free ranging in small villages. They are characterized by the shape of the back, with is heavily rounded, and a very dark and hairy skin. The local breed is thought to be more resistant but tends to grow slower and the meat is less valuable, being quite fat. A previous work from Saroeun at al indicates the Kandol, Hinam and Domrey as the most common local breeds present in the area (Saroeun 2007). Crossbreeding among local and exotic breeds is being practiced widely. The most common exotic breeds are Hampshire, Landrace, Yorkshire, and Duroc.

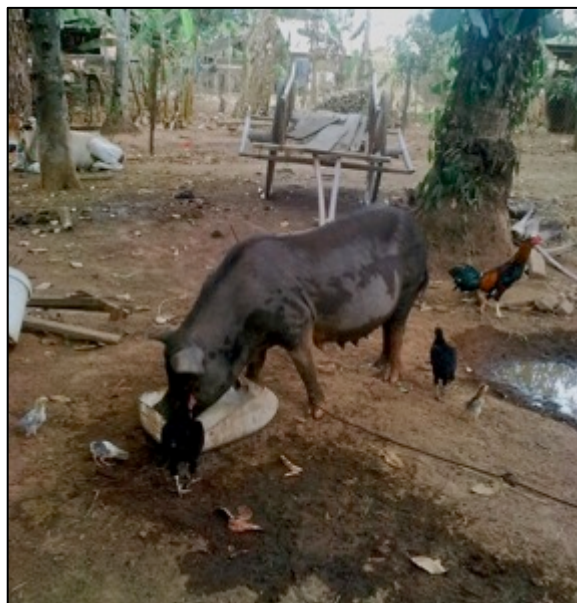


Figure 7 - Local Breed

Sows are always covered in situ and only very few farmers keep males, so boars need to travel to the farms. In fact, a particular production category applies to boar owners: these can ether be famers

engaged in other type of production systems, crop cultivation mainly, which own one or two males and manage to make a small profit from the cover, or big farrow-to-finish semi-commercial farms that use their own boars to serve other local farms. The boar is generally taken into the farms using a very rudimental motorbike carrier (Fig. 10), and its movement is often limited to the district.



Figure 10 - Serving Boar

Very few farmers are using artificial insemination; in the past commercial breeders (“CP” and “GreenFeed”) have supplied famers with free semen samples in order to create a demand, but farmers haven’t been positively responding to the trial, partly because of the low reliability of the technique (the cold chain, indispensable to maintain the semen fertile, is often unavailable) and partly due to costs. A new governmental artificial insemination (AI) centre has been recently (2010) put in place in Takeo province with the support of the EU-Cambodia Livestock Project, in order to supply farms with low cost semen, but it has encountered a number of health issues, which have delayed its full launch. In it also important to mention that at today no measures have been enforced by the veterinary authority to ensure preliminary testing for serving boars.

5 Health

5.1 Diseases

Common agents as Classic Swine Fever virus (CSFV), Porcine Circovirus (PCV2V), Foot and Mouth Disease virus (FMDV), Aujeszky's virus and Mycoplasmas are currently circulating (data not yet published)(Sarooun 2007; Wallberg 2011). In 2010 an outbreak of PRRSV highly pathogenic strain has also devastated the pig population in the southern part of the country (Dietze 2011; Theary R 2011). Despite the negative impact of swine diseases on productivity and farmers' livelihood, no substantial studies have been carried out to investigate the health status of the swine population in the country. There is a general lack of understanding of pathogenesis of the diseases and a complete absence of epidemiological data. Unrestrained transport of infected animals and smuggling from bordering countries are often the causes of disease spreading, and a weak national disease surveillance system results in frequent and widespread epidemics (Sovann 2002; ThePigSite 2010).

5.2 Vaccinations

Most farms are vaccinated for Classical Swine Fever, but other vaccines are administered accordingly to VAHW training, availability and cost of the vaccine, or district veterinarian experience. *Pasteurella*, *Salmonella*, Aujeszky, FMD, Hemorrhagic Septicaemia, *Mycoplasmas* and *Erysipelas* vaccines are often used in semi-commercial farms (data not yet published). Vaccines are readily available in markets or from the VAHW or salesmen who come into the village and sell them directly to the farmer.

One of the major issues related the use of vaccines is the almost complete lack of understanding of how they work, by the farmer and often by the veterinarians. Frequently farmers are not even aware of which type of vaccine has been used, either by the breeder, the veterinarians or the VAHW; they often believe that one single shot of a general vaccine can cover their animals against every disease. Drug salesmen can be directly responsible for that, because they purposely give false information about the efficacy of a vaccine in order to sell it at higher price. Unfortunately, when a farm experiences mortality after vaccination, even if the animal was not covered for the specific disease that caused its death, the farmer believe the vaccine to be ineffective and stop using it. Even when the right range of vaccines is used, vaccination plans are barely respected and chances of the animals being protected is quite low;

vaccines can be kept at high temperature for long periods and administered randomly to different age groups, which enormously affects their efficacy.

5.3 Veterinary Service

The Cambodian Veterinary Service is hierarchically well structured but still quite rudimentary. The Department of Animal Production and Health (DAPH) guides and manages the service in the whole country. It is based in Phnom Penh and comprises seven different departments (Tab. 3).

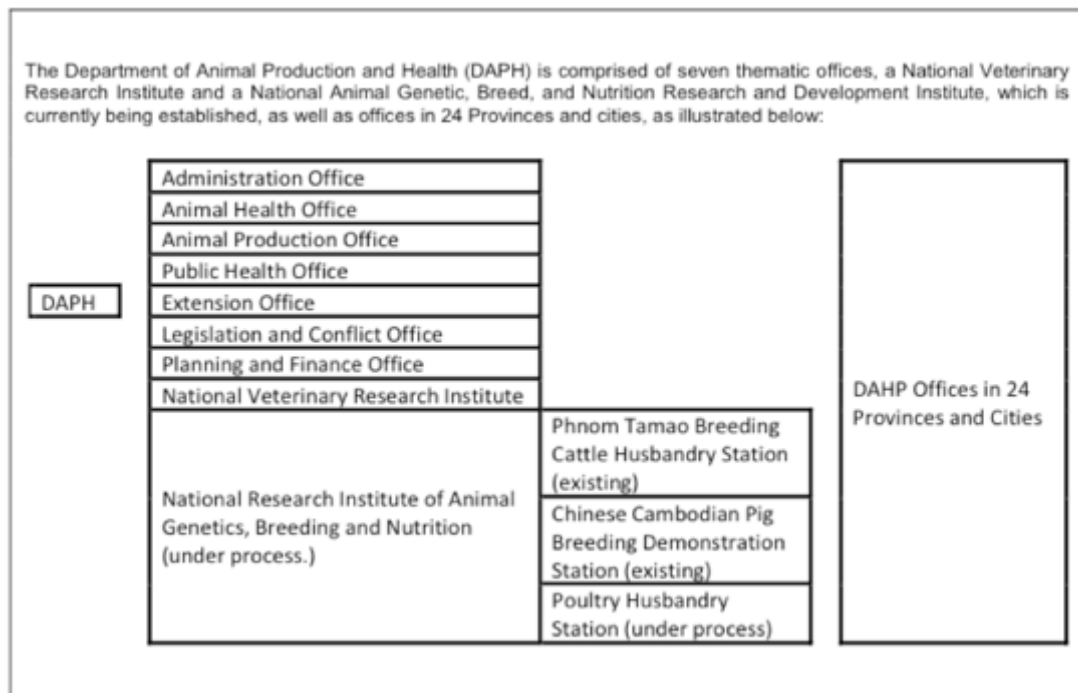


Table 3 – DAHP structure, Chetra 2009

Every province possesses a local DAHP office, administered by the Provincial Veterinarian (PV). Underneath the PV works a pool of District Veterinarians (DV) and Village Animal Health Workers (VAHW). The latter are normally volunteers trained by international organization or NGOs, and they generally treat and vaccinate livestock in their own village or local areas; they are not paid for their service so they usually generate a small income by selling animal drugs or animal feed to farmers.

Apart from avian influenza, only a basic disease surveillance system is in place. Veterinarians often don't have the experience, the logistical assistance and/or the financial support to carry out formal surveys. Reporting lacks structure, and it is mainly done via personal communication (phone) between

the VAHW, DV, PV and the Department. Even if animal samples were to be efficiently collected, NAVRI lacks basic test reagents and kit controls, it is not supported by the central government but mainly involved with foreign projects and lacks of its own autonomy. Disease investigation often depends on funding from international projects, specified by the donor. A major constraint that derives from constantly relying on foreign support is a loss of creative thinking and independence; before applying control strategies or running public awareness campaigns, provincial and district veterinarians wait for the contribution of external partners, both to plan and finance such missions. Furthermore, the measures that are sponsored by big organizations often don't take into account the limitations of the veterinary service capability and the features of local farming.

For all those reasons, disease control in the region is a difficult issue, both at the national scale and at a local level. Smallholders have a poor understanding of diseases, limited funds, and poor access to drugs and other veterinary services. Veterinarians might or might not be fully trained; Cambodian Universities don't offer a complete veterinary medicine degree and young Cambodian veterinarians only graduate from the Agronomy faculty in Animal Health and Production. In fact, at today, fully qualified veterinarians working in the country are either foreign or Cambodian citizens that had the chance to study abroad (Russia, Cuba) during the years in which Cambodia was under the socialist block (1979-1990). Most of the district veterinaries have simply inherited the profession from family members, and are sometimes less knowledgeable than the VAHW. This creates a general lack of basic understanding of animal health science, ignorance towards basic concepts of pathology or clinical medicine, with a consequent heavy repercussion on diseases control and sustainability of farming practices. Farmers are often left alone to deal with the burden of animal disease. The situation is compounded by the huge number of irresponsible – even criminal activities of veterinary drug sellers from Viet Nam and Korea that travel through the villages posing as practitioners, convincing animal owners to buy improbable vaccines or useless medicines.

The few private veterinary groups present in the country, some of which are affiliated to big western pharmaceutical companies, also act more as drug and food sellers and rarely offer a complete veterinary service. They too may provide misleading information to famers in order to sell a particular vaccine or drug.

The fact that farmers can't rely on a proper veterinary service often results in high pig mortality rates and heavily impacts farmer welfare, with families often forced to give up animal production or go into massive debt to cover the losses. The Ministry of Agriculture, Food and Fishery (MAFF) has drafted a new veterinary legislation, planned to be put in place by January 2012, which hopefully will bring some clear guidelines to follow, both in terms of education and standards of practice.

6 Trade and movement

The sale-purchase system is quite complex and varies in relation to the provenance of the stock and the age of the pig sold, i.e. 1-month-old weaners or fatteners to slaughter (Fig)

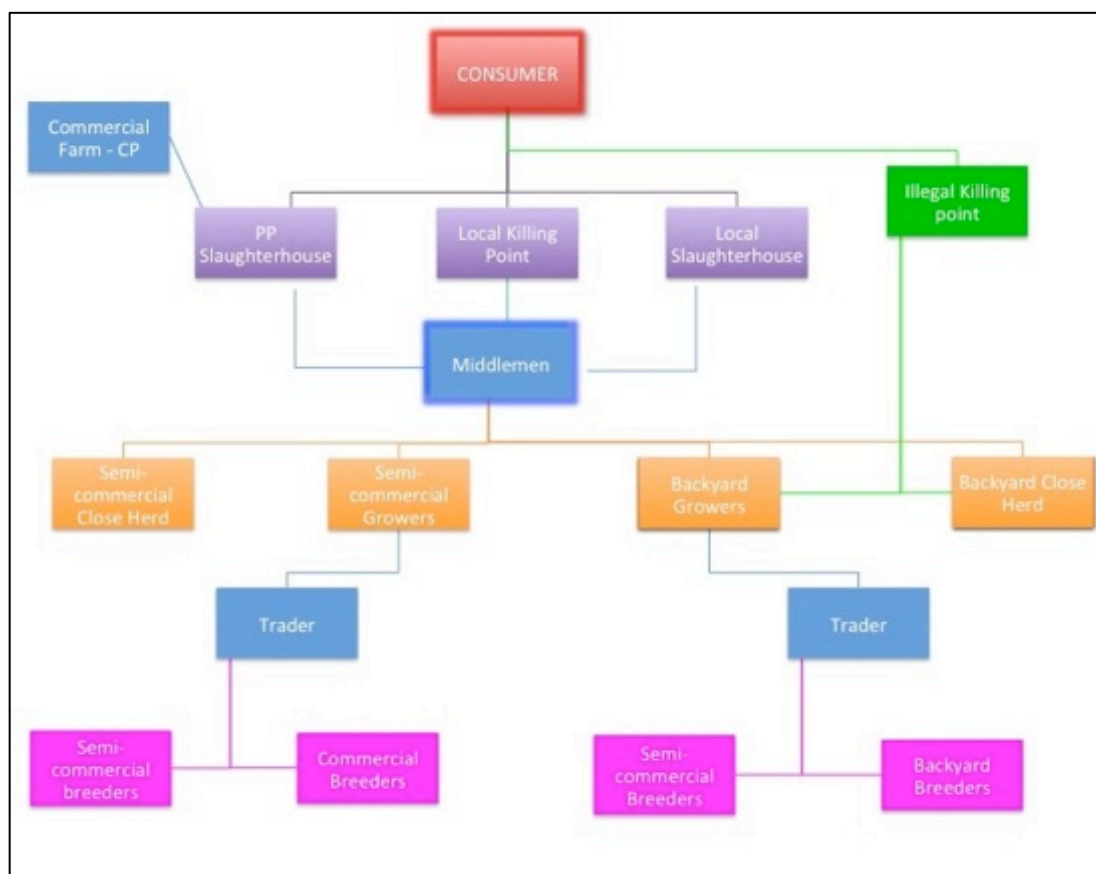


Figure 8 - Pig movement diagram

Weaners are bought by traders in breeders' farms and sold directly to fatteners, generally within the province. Traders can also sell pigs in villages central markets during prefixed days of the month, which are known by pig producers in the area. In areas close to Viet Nam and Thailand, farmers might cross the border to buy piglets; the direction of the trade will depend on the relative market prices of pigs in the two countries. This type of trade is mostly illegal, therefore no control from the veterinary authorities or imposed quarantine are applied.

A single trader buys from 10 to 50 piglets at time, from one or more farmers, depending on the scale of their business, and transports them using a moped, a small trailer or a van. Daily live pig markets are not very common; weaner's sellers generally travel between towns to sell at communal markets during established day of the week. A particular exception is Mesang district market in Prey Veng province. This market is in a region renowned for the quality of its pigs. Traders gather in the main square of the

village with their moped armed with small bamboo cages that can hold 8-12 piglets. Those are sold to traders that come from every part of Cambodia and piglets can travel for 200 or 300 Km to their final destination.



Figure 9 - Mesang market

Once fatteners reach 5 or 7 months, or approximately 70-100 Kg, they are bought by middlemen and taken to slaughterhouses or they can be taken to local killing points, directly by farmers or butchers. Semi-commercial farms, which send from 5 to 20 pigs to slaughter at time, tend to rely on middlemen for trade, while backyard farmers, who might slaughter 1 or 2 pigs per half season, are more likely to take their animals to close-by killing points or have them picked up by the butcher. Few big semi-commercial farmers own vans and take pigs to Phnom Penh to sell them directly to the four city slaughterhouses.

Middlemen transport pigs to the slaughterhouse and then collect and sell the carcasses to the market. The number of pigs that a middleman buys from a farmer matches the meat demand in the market. When pigs are slaughtered in killing points, the butchers themselves sell the meat to a local market. For fatteners, movement is mostly local and middlemen transport one or two pigs at one time, making more than one trip to the slaughterhouse if necessary. However when more than five fatteners are moved,

very likely through two or more provinces, a tracking system is put in place and middlemen are required to apply for an official transport certificate. To do so, they have to pay an “animal movement” tax to the Ministry of Agriculture, which will then issue the formal certificate. The tax amount varies in relation to the number of units (pigs) that the certificate permits; middlemen can request certificates for 100 or 200 units, and they can use the same certificate throughout a period of time, ticking off numbers of units in relation to the pigs moved.

Once a farmer decides to proceed with the sale of his stock, he/she contacts a middleman directly. When the pick up date is agreed, the middleman arranges with the VAHW responsible for the area where the pigs originate, to meet at the relevant farm at that specific day. Once at the farm, the VAHW visit the pigs and produces a permit letter for the middleman, certifying the provenance and health status of the animals; both the letter and the transport certificate need to be authorised and stamped by the district veterinarian and the local office of Agriculture. When all the requirements are met, the documentation can be taken to the veterinary provincial office for the final signatures, and the middleman can then proceed with the movement of the pigs.

It is important to describe how disease outbreaks can radically change the movement pattern described above. When farmers suspect the circulation of a disease, via information gathered from other farmers or traders (literally through “word of mouth”), they try offloading their stock very quickly, particularly those pigs that are not showing clinical signs yet, in order to still guarantee a good profit from trade. This might happen within a time window of ten days to two weeks, before the veterinary authority formally reports the disease. Once the outbreak is reported and becomes general knowledge, pork consumption drastically decreases, often due to misleading campaigns of zoonotic diseases and confusing, often alarmist media reports. Pork meat prices fall and slaughterhouse owners start refusing to buy pigs. Swine producers are then forced to either keep the sick pigs in the hope of a recovery, or slaughter them on the farm and sell the meat directly to markets, or to travel to poorer villages and trying selling under-priced sick animals. This behaviour greatly enhances the chances of disease spread and badly erodes the effectiveness of any control strategies that the government might try to put in place. The tendency of farmers to evade regulations is driven not only by their concerns about lower prices from the sale of the pigs, but it is also fuelled by government policies which incur huge costs to farmers (e.g. AI surveillance schemes), by large-scale slaughter without compensation. As a

consequence, farmers are afraid of involving the veterinary authorities when diseases appear, leading to underreporting and poor co-operation during epidemics.

7 Slaughter

A new law in 2008 introduced a number of regulations concerning the Cambodian slaughterhouse system. Every district has, or is working towards having, a Government slaughterhouse. However, poorer farmers still tend to use a small killing point for slaughter, generally because the official slaughterhouse is located too far from the farms and they can't afford the cost of the transportation, or because the provincial veterinarian office asks an extra "compensation" to use the public slaughterhouses.

Home slaughter is very rare; farmer might slaughter few pigs for ceremonies or weddings, or during outbreak events, when traders or slaughterhouse owners refuse to buy sick pigs.

The stock is brought to the slaughterhouse (Fig. 13), or the killing point (Fig. 14) during the day; pigs are separated and marked by the owner. Because of lack of cold chain facilities, slaughter takes place around 2 or 3am, to guarantee the delivery of fresh meat to markets. Pigs are killed by a direct cut in the neck, and they might be previously stunned using a bat. As soon as the animal is dead, carcasses are eviscerated, either on the floor or on stone tables, and blood from the jugular vein is collected into bowls. Organs are put aside, and bodies are quickly burned to remove hair and then cut. Veterinary inspectors are sometimes present in big slaughterhouses in order to check carcasses for the presence of parasites or lesions in muscles and organs. Rarely the whole carcass is eliminated, most often only the affected organ or part of the carcass is put aside.



Figure 10 - Slaughterhouse



Figure 11 - Killing Point

8 Market

Pork meat price per Kg can vary in relation to the season, the quality of the meat and the market demand. A farmer can earn from 5000 to 7000 Riel (1.25USD to 1.75USD) per Kg of meat, depending on the breed and the characteristic of the meat; local breed for example has much fatter meat and is generally sold at lower value. During disease outbreaks the price of the meat can drop to 3000 (0.75USD) Riel per Kg, hugely affecting farmers' economic status.

Cambodia relies on imports to support 60% of the country pork demand; local producers currently produce about 2,000 pigs a day, though actual demand is closer to 4,000 animals (PhnomPenhPost 2011). In 2008 the Ministry of Agriculture licensed five domestic firms to import 800 pigs per day from Thailand to support Phnom Penh market demand (MeatTradeNewsDaily 2010). Domestically produced animals sell to slaughterhouses for 200 Riels (about 0.05 USD) per kilogram less than imported pigs, impacting negatively on the national production rate. Pigs imported illegally from Viet Nam are priced at just over 6,000 Riel (about 1.42 USD) per Kg, about 3,000 Riel cheaper than pigs raised in Cambodia. Even though the market in the country lacks about 700 to 800 pigs per day, farmers are discouraged to raise pigs because of those imported ones from neighbouring countries. USAID estimates a loss of about 45 million US dollars a year to Cambodian farmers due to the million pigs imported from Thailand (MeatTradeNewsDaily 2010).

From the end of 2010 and during the first six months of 2011 the price of pork meat has seen large gains, increasing 25.37% to 21,800 Riel a Kg in Phnom Penh markets. The sharp raise in prices is due to decrease of pork availability, due to a decline of imports from Thailand and Viet Nam, which are both facing a pig shortage (PhnomPenhPost 2011). The growth of pork prices is beneficial for pig farmers but it is problematic for buyers with lower incomes – for them, pork prices are too high. Recently the Mong Reththy Group, one of the few commercial farms on the territory, announced an ambitious plan to breed up to one million pigs by 2015 to boost local production and cut dependence on foreign sources. Part of this US\$5 million plan is the importation of 600 Yorkshire breeding pigs from a farm in northern England (ThePigSite 2009).

Hopefully more input will come from the Cambodian industry to try and create a self-sufficient sector, which will safeguard the interest of the farmers and will protect them from excessive losses due to

market price shifts, but will also allow those less well-off to afford an adequate protein intake for their families.

References

- Chetra S., B. D. (2009). Review of Animal Production in Cambodia Environmental Animal Health Management Initiative for Enhanced Smallholder Production in South East Asia. M. C. FAO.
- Devendra, C. (2002). "Crop-animal systems in Asia: implications for research." Agricultural Systems **71**(1-2): 169-177.
- Devendra, C. (2007). "Perspectives on animal production systems in Asia." Livestock Science **106**(1): 1-18.
- Devendra, C. (2007). "Small farm systems to feed hungry Asia." Outlook on Agriculture **36**(1): 7-20.
- Devendra, C. and D. Thomas (2002). "Smallholder farming systems in Asia." Agricultural Systems **71**(1-2): 17-25.
- Dietze, K., Pinto, J., Wainwright, S., Hamilton, C., Khomenko, S. (2011). Porcine reproductive and respiratory syndrome (PRRS). Focus on. FAO. **5**.
- FAO. "Cambodia - Country Information." Retrieved 6th Jan 2012, from <http://coin.fao.org/cms/world/cambodia/CountryInformation.html>.
- FAO (2005). Livestock Sector Brief - Cambodia. AGAL.
- Huynh, T. T. T., Aarnink, A.J.A., Drucker, A., Verstegen, M.W.A. (2006). "Pig production in Cambodia, Laos, Philippines, and Vietnam: a review." Asian Journal of Agriculture and Development **4**(1).
- MAFF (2012). "Statistic on Pig Production." from http://www.stats.maff.gov.kh/en/index.php?page=stat&mode=pig&option=com_content&Itemid=91.
- MeatTradeNewsDaily (2010). "Cambodia - The pig Industry." Meat Trade News Daily. from http://www.meatradenewsdaily.co.uk/news/060310/cambodia_the_pig_industry_a_spx.
- Metwally, S., F. Mohamed, et al. (2010). "Pathogenicity and molecular characterization of emerging porcine reproductive and respiratory syndrome virus in Vietnam in 2007." Transbound Emerg Dis **57**(5): 315-329.
- PhnomPenhPost (2011, 4th July). "More money for meat." Phnom Penh Post. from <http://cambodia-business.blogspot.com/2011/07/more-money-for-meat.html>.
- PhnomPenhPost (2011, 1st July). "Pig Production Priority." Phnom Penh Post from <http://cambodia-business.blogspot.com/2011/07/pig-production-priority.html>.
- Samkol P., B. K., Sovann S. (2006). "Pig systems in Southeast Asia—The case of Cambodia ". from http://www.ilri.org/Infoserv/webpub/fulldocs/Pig_Systems_proceeding/CH_04_Borin_Sovann.pdf.
- Saroeun, K., Sokerya, S., Samkol, P., Ty, C., Theara, S., Sunnara, S., Soveasna, M., Borin, K. (2007). Assessment of pig production, feed and feeding practices in three main agro-ecological zones of Cambodia. MEKARN Regional Conference 2007: Matching Livestock Systems with Available Resources. C. f. I. a. A. D. (CelAgrid). Halong Bay, Vietnam.

Sovann, S., Sorn, S. (2002). Pig Production in Cambodia, in *Priorities for Pig Research in Southeast Asia and the Pacific to 2010*. ACIAR: 22-27.

Theary R, T., N., Inui, K., Sorn, S. (2011). Molecular Epidemiology of Higly Pathogenic PRRS (HP-PRRS) in Cambodia. APVS, Pattaya, Thailand.

ThePigSite (2009). "Cambodia: Moving from Imports to Exports." from <http://www.thepigsite.com/swinenews/20082/cambodia-moving-from-imports-to-exports>.

ThePigSite (2010). "Cambodia allarmed at Illegal Import of Pigs." The PigSite.com. from <http://www.thepigsite.com/swinenews/24376/cambodia-alarmed-at-illegal-import-of-pigs>.

Thomas, D., E. Zerbini, et al. (2002). "Increasing animal productivity on small mixed farms in South Asia: a systems perspective." Agricultural Systems **71**(1-2): 41-57.

UNDP (2011). "Human Development Report - Cambodia." from <http://hdrstats.undp.org/en/countries/profiles/KHM.html>.

Wallberg, E. (2011). Small scale pig production in Takeo province in a rural area of Cambodia. Department of Animal and Nutrition Managment. Uppsala, Swidish University of Agricultural Sciences. **Veterianary Medicine and Animal Science**.

WorldBank (2011). "Indicators." from <http://data.worldbank.org/indicator>.

Zhou, L. and H. Yang (2010). "Porcine reproductive and respiratory syndrome in China." Virus Res **154**(1-2): 31-37.