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# Assessment of Smallholder Indigenous Poultry Producer Viability After HPAI in Lao PDR

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Mekong Region Report

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## **1. Introduction**

Smallholder indigenous poultry production is ubiquitous in Lao PDR and represents a crucial income generating opportunity for one of the poorest countries in the Greater Mekong Subregion (GMS). Much like other countries in the GMS, highly pathogenic avian influenza (HPAI) outbreaks and the related control measures have adversely affected smallholder production. Despite the importance and prevalence of smallholder poultry production in Lao PDR, there has been little academic work conducted in this sector and information is extremely limited. This information gap creates a serious burden to the effective monitoring and control of HPAI, as a regionally coordinated effort is needed. Furthermore, people's livelihoods are at stake and an in-depth understanding of the smallholder poultry sector is necessary to insure control policies do not adversely affect production.

Survey work conducted in Lao PDR aims to support evidence-based solutions to these problems. Questionnaires consisted of two distinct parts covering the actors in the market chain that supply poultry products and the urban consumers of those goods. Market chain surveys included detailed producer, trader, and vendor surveys that can provide a supply chain audit, linking producers to consumers. Furthermore, these surveys provide detailed data on the total inputs and outputs regarding poultry production and marketing operations, which is instrumental in understanding how future policies or projects may affect cost structures. Additionally market chain surveys can identify the direct and indirect costs and other enterprise effects of culling and related HPAI control measures, financial access and capital constraints within poultry production, the role of contract farming systems, and any other institutional factors limiting smallholder adaptability. The second part of surveys consisted of household consumer surveys. These surveys were intended to assess consumer poultry purchasing habits, preferences, and willingness to pay for certified birds. Survey data can be used to provide recommendations for sustainable market participation by smallholder producers and will strive to increase product quality, safety and revenue across the traditional poultry supply chain.

## 2. Background

### 2.1 Poverty Profile

Despite significant economic progress, Lao PDR still remains a poor country. Although many people have been lifted out of poverty, those that remain face numerous challenges. With a predominately rural population engaged in subsistence agriculture, the contribution of poultry to livelihoods is instrumental.

GDP per capita is among the lowest in the region at \$630 to \$701 in 2007 depending on estimates (World Bank, 2008 and NSC, 2008) and other social indicators are some of the most alarming in East Asia. However, there have been tremendous strides in poverty reduction, and the poverty headcount has fallen significantly since the early 1990s in all major geographical locations (Table 1). While this appears to be welcome news, a closer examination of the data reveals there is still much work to be done.

**Table 1: Poverty in Lao PDR, 1992/3 – 2002/3**

		1992/3	1997/8	2002/3
Mekong Corridor	Number of Poor	745,952	654,067	603,127
	<i>Poverty head-count</i>	55.2	42.4	39.8
Central-South Highlands	Number of Poor	94,346	147,817	154,509
	<i>Poverty head-count</i>	52.1	53.9	49.7
Vientiane Plane	Number of Poor	118,956	54,008	48,547
	<i>Poverty head-count</i>	34.8	13.9	16.6
Northern Highlands	Number of Poor	460,769	522,899	476,065
	<i>Poverty head-count</i>	61.1	53.8	45.4
Northern Lowlands	Number of Poor	358,873	415,073	329,100
	<i>Poverty head-count</i>	50.9	41.0	32.2

**Source:** World Bank, 2006b

Poverty remains highest in the central-southern and northern highlands, which are both characterized by remoteness, mountainous terrain, and generally poor conditions for farming (poor acidic soils in central-southern highlands and steep slopes and high erosion risk in the northern highlands). Poverty is lower in the Mekong corridor and northern lowlands, where agricultural conditions are favorable and irrigation infrastructure is available. Poverty was lowest in the Vientiane plane, owing to the large market opportunity that the Vientiane municipality provides.

Most of the progress in poverty reduction occurred in the first half of the decade, with progress slowing in the second half. Ultimately, only one-third of the total reduction occurred in the last half of the decade. This slowing of poverty reduction also corresponds with a slowing of agricultural growth, which emphasizes the importance of policy efforts to strengthen agricultural sector performance.

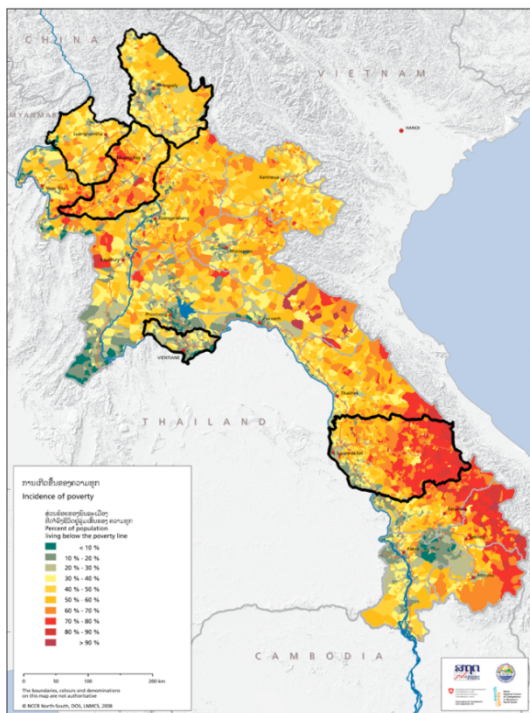
Throughout the 1990s, the majority of rural infrastructure projects such as roads and irrigation infrastructure were primarily directed towards the high potential agricultural areas in the lowlands and along the Mekong corridor. These investments helped transform some of the agricultural production systems from subsistence to a low level of commercialization, which is reflected in the large decrease in poverty headcounts in these regions during the first half of the decade. Starting in the early 2000s, the Government shifted priorities to focus more on the northern and central-southern highlands. Donors soon followed, and this increase in public and foreign investment helped to reduce the poverty in these areas during the second half of the period (World Bank, 2006b).

Perhaps the most striking characteristic of poverty in Lao PDR is its spatial nature, which is best seen geographically. Figure 1 shows that the highest incidences of poverty are concentrated in the mountainous areas, especially those in the south and along the border of Viet Nam. Alternatively, the lowest poverty rates are found in urban areas, on the Bolaven plateau (reflecting the fertile nature of the land) and in the southern part of Xayabury province along the Thai border. The influence of the road network on poverty can also be seen in this map. Most noticeable in the north, there is a green stretch of districts on route 13 between Vientiane and Luang Prabang. In the south, districts along the roads connecting route 13 to the Vietnamese border are also clearly less impoverished. These roads serve as an important channel for trade between the two countries and help demonstrate the importance of market access on poverty rates. This figure effectively demonstrates the general spatial trends within poverty; poverty is lower in cities than rural areas, in areas with roads than those without, along the Thai border than along the Vietnamese border, and in the lowlands than in the uplands (Figure 1).

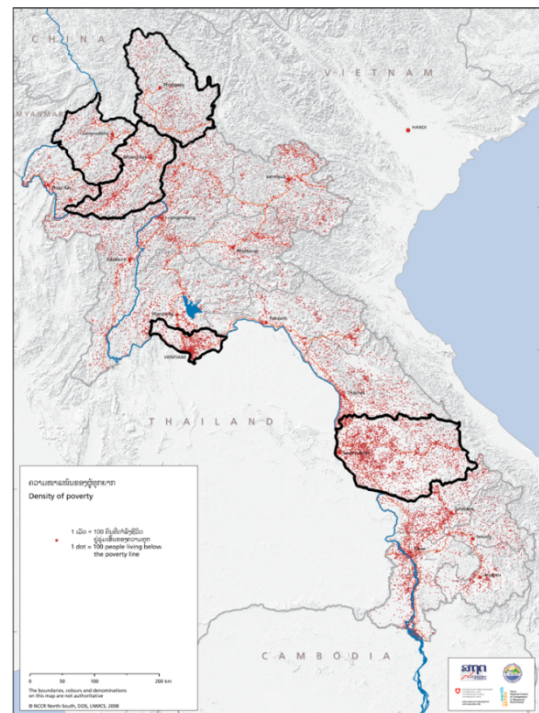
Looking at the density of poverty, the areas identified as the poorest in fact have the fewest poor while the areas identified as the least poor in fact have the highest densities. This apparent paradox is well known in developmental literature, and can be explained by population density and distribution. Generally speaking, less poor areas correspond to areas with high population densities, while the most impoverished areas are sparsely populated. Looking at the density of poverty, it can be seen that largest populations of poor people are in fact closest to the major markets. Thus, improving rates of marketing among poultry producers is one tool that can be used to improve livelihoods (Figure 2).

Poverty rates have continued to fall, albeit at a slower pace, and the most recent national rate is estimated at 34.7% (Messerli et al, 2008). Lifting the remaining third of the population out of poverty remains the biggest challenge yet, as poverty reductions become harder as poverty levels fall.

**Figure 1: Incidence of Poverty**



**Figure 2: Density of Poverty**

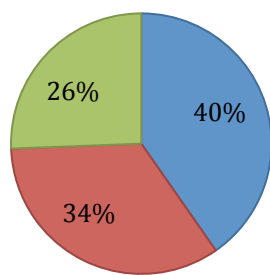


**Source:** Messerli et al, 2008  
(Survey Provinces Outlined)

## 2.2 Poultry Sector

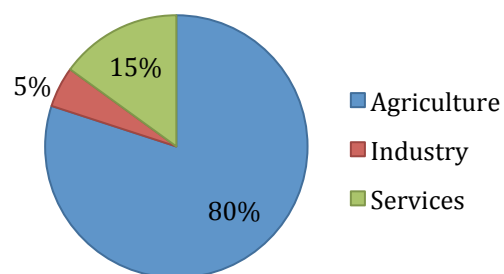
More than 94% of all agricultural output exists in a traditional smallholder system with limited inputs (Wilson 2007b). Despite the prevalence of smallholder production, agriculture remains the largest sector of the economy, representing 40% of GDP and employing 80% of the workforce (Figure 3 and 4). In general, production systems differ based on topography and can be classified under two systems: the lowland rain-fed and/or irrigated farming systems of the Mekong flood planes and its tributaries, and the upland swidden agricultural system.

**Figure 3: Lao PDR GDP by Sector, 2007**



**Source:** World Bank, 2008

**Figure 4: Labor Force by Economic Sectors, 2005**



**Source:** NSC, 2008

Regardless of the topography of the country, poultry production is prevalent and over 90% of households keep at least one species of bird (Wilson 2007a). Smallholder poultry production is so ubiquitous that even in the country's largest and most urban cities, many households still raise birds. Lao PDR had an estimated 20.5 million birds in 2007, but unfortunately the Department of Livestock and Fisheries (DLF) does not have disaggregated statistics by poultry type for the national flock (Table 2). However, the Lao Expenditure and Consumption Survey (LECS), a socio-economic survey conducted every five years, can help shed light on the subject. According to the most recent LECS conducted in 2007/08, approximately 77% of the national poultry flock is comprised of chickens and 22% is comprised of ducks (figure 5). Using the most recent national flock statistics, this corresponds with approximately 16 million chickens and 4.5 million ducks, which is in line with other estimates (Wilson 2007a). Looking at the national poultry flock by type of bird demonstrates that local birds, especially local chickens, represent the



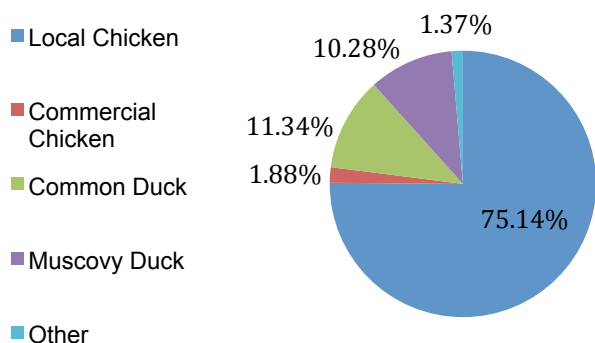
vast majority of birds. However it should be noted that the LECS data under-represents the amount of commercial birds, as the LESC is a household survey and large commercial farmers will not be represented in the data. To gauge the size of the commercial production system we must therefore look at the distribution of the poultry population by production system, which can be seen in figure 6.

**Table 2: Poultry Population and Density by Province, 2007**

	Poultry Population (Thousands of Birds)	% of Total	Poultry Density (Birds per Sq KM)	Birds per Person
<b>Lao PDR</b>	<b>20,453</b>	<b>100%</b>	<b>86.4</b>	<b>3.5</b>
<i>Luang Namtha</i>	324	1.6%	34.7	2.1
<i>Phongsali</i>	532	2.6%	32.7	3.1
<i>Oudomxay</i>	834	4.1%	54.3	3.0
<i>Vientiane Capital</i>	808	4.0%	206.1	1.1
<i>Savannakhet</i>	2,007	9.8%	92.2	2.3

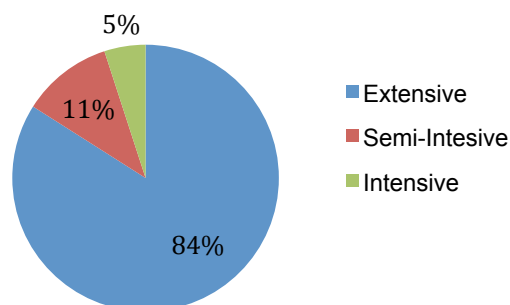
**Source:** MAF, 2008  
(Survey Provinces Listed)

**Figure 5: National Poultry Flock by Type, 2007/08**



**Source:** NSC, 2009

**Figure 6: Poultry Population Distribution by Production System, 2006**



**Source:** Burgos et al, 2008

### 2.3 Poultry Production Systems

Officially, the DLF only separates production between backyard and commercial systems and reports there are some 800,000 birds raised in a commercial system, which represents approximately 3.8% of the national flock (DLF, 2009). However, it is more accurate to disaggregate production systems further into one of the following three

categories: 1) traditional, small-scale, extensive backyard poultry production, 2) semi-intensive, small- to medium-scale, market-oriented, commercial poultry production, and 3) intensive, large-scale, industrially-integrated poultry production. As the DLF lumps semi-intensive production with traditional backyard systems, only estimates are available on the distribution of birds by this classification of production systems, which are found in Figure 6.

### **2.3.1 Extensive Production**

Traditional backyard systems are the primary production method and account for approximately 84% of the national poultry flock. This production method is common throughout the country in both urban and rural areas, and it is especially favored amongst the poor due to its low inputs. In this system, birds scavenge for food during the day and sleep at night in trees, underneath houses, in natural sheds, or in rudimentary enclosures. Therefore the costs of inputs are extremely low and are often only the small cash expense for day old chicks (DOCs). However, once birds become mature there is no need to purchase DOCs because they can be self-supplied through hatchlings and thus the system is self-replacing. Flock sizes are typically small (under 100 birds), and different bird species are raised in conjunction with each other. The majority of smallscale poultry production is intended for household consumption and only after satisfying family nutrition requirements are birds sold or given as gifts. When sales do occur, producers face a variety of options. First, they can simply sell their product themselves in affect acting as a vendor. This commonly occurs if the producer regularly operates as a vendor or if they sell products to neighbors. Secondly, a producer may sell their products to vendors directly in the market. This often requires a pre-established relationship or agreement with the vendor, although in some cases producers may bring birds to the market with no pre-arranged sale in place. Finally, a producer can sell their products to a trader or aggregator. Aggregators rely on networks within different villages and buy birds from numerous farmers and then transport the birds to the market where they are either sold directly to consumers or to vendors.

### **2.3.2 Semi-intensive Production**

Semi-intensive production systems are often lumped into traditional backyard systems, but with flock sizes of 50 to 1,000 birds and intensive qualities it should be considered a

unique production system. Semi-intensive production accounts for an estimated 11% of Lao PDR's poultry population. Housing is provided for birds either in permanent or makeshift enclosures, with both feed and water being provided in plates, trays, and/or bowls. The level of intensiveness can vary widely and often gardens, backyards, or vacant pieces of land are fenced-in to house birds at night after scavenging for feed during the day. Bio-security measures, albeit limited, represent another key difference between traditional backyard systems as sanitation, treatment, and management are given more priority to limit disease outbreaks. Birds are more frequently sourced from external channels, although the majority of restocking remains self-replacing from the flock. Production is usually focused on poultry meat or eggs. Compared to traditional backyard production systems, these outputs have higher rates of marketing and more formal marketing channels.

### **2.3.3 Intensive Production**

While the lines are often blurred between traditional and semi-intensive production, intensive production demonstrates a clear divide between poultry production systems. Intensive production operations generally have flocks of 1,000 to 10,000 birds and account for approximately 5% of the national poultry population. These operations are characterized by advanced production infrastructures designed for commercialization that includes elaborate housing, feeding and drinking systems. Many of these farms have contracts with CP, a large Thai conglomerate, and source energy dense commercial feed and replacement chicks directly from Thailand. Furthermore, infrastructure and technical knowledge is also sourced from Thailand, and these farms operate very similarly to CP contract farms in Thailand. CP is by far the strongest branded commercial poultry product, even with unique Lao packaging. CP products are commonly found in traditional wet markets amongst vendors of indigenous products. In total, the DLF reports there are 193 commercial farms split between broiler chickens (4), layer chickens (112), layer ducks (52), and quail (25). Most of these operations are found in or around the large urban areas of Lao PDR, with the majority (61%) located in the Vientiane Capital (DLF, 2009).

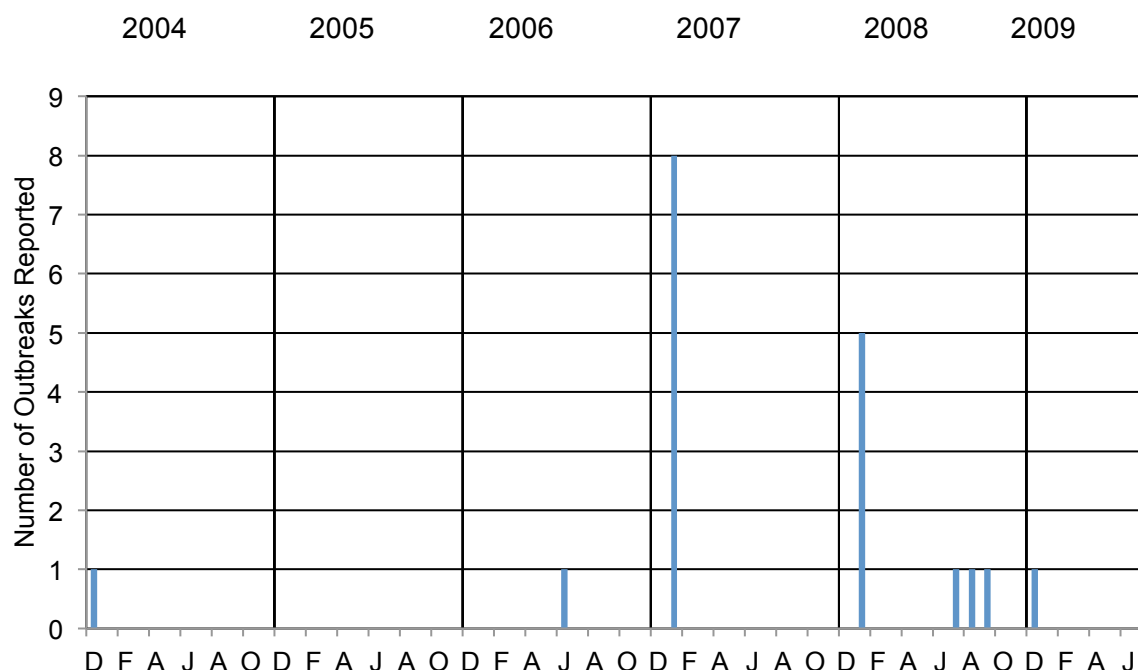
## **2.4 HPAI in Lao PDR**

The HPAI epidemic in Lao PDR was extremely limited relative to other countries in the GMS due to a variety of factors. First, the poultry sector is far less developed and poultry populations are small compared to neighboring countries. Furthermore, the general remoteness of many villages in the country means that trade and interaction between poultry is restricted. Finally, national veterinary services are poorly funded resulting in low monitoring and awareness levels. As a result, HPAI is not perceived as a risky disease for birds and humans and there is a wide acceptance of high seasonal poultry deaths (Barennes et al. 2007). These facts have likely masked the real number and geographical extent of outbreaks that took place.

The first recorded outbreak of HPAI was officially reported to the World Organization for Animal Health (OIE) on January 27, 2004. The primary outbreak occurred in a commercial chicken layer farm just outside Vientiane, with 3,000 birds susceptible. This was Lao PDR's only official outbreak in 2004, which is in stark contrast to the major epidemics found in neighboring Thailand and Viet Nam.

The next outbreak did not occur until July 2006, when another commercial chicken farm just outside Vientiane became infected. In 2007, there were 8 reported outbreaks during the month of February. The first four infections were located in Vientiane again, although this time two backyard farms were infected in addition to commercial operations. Later in the month, official outbreaks were reported outside of Vientiane for the first time, occurring in the Champasak and Savannakhet provinces. The outbreak in Savannakhet was the largest to date with up to 35,000 birds susceptible across 25 villages.

The disease reappeared in 2008, with 5 separate outbreaks in the Northern Province of Luang Namtha in February. There were no more occurrences until August, September, and October when the disease appeared for the first time in Luang Prabang, Oudomxay, and Xayabury. There has only been one reported outbreak of HPAI since, affecting village poultry in Phongsali in January 2009 (Figure 7 and Table 3).

**Figure 7: Temporal Pattern of HPAI Outbreaks, 2004 – 2009**

**Source:** OIE World Animal Health Information Database (WAHID), 2009

**Table 3: Reported HPAI Outbreaks in Poultry, 2004 – 2009**

Year	Month	Location		Epidemiological Unit	Bird Type(s)	No. of birds susceptible
		Province	District/Village			
2004	Jan	Vientiane Capital	Nonsavang	Commercial Farm	Laying Hens	3,000
2006	Jul	Vientiane	Dong Bang	Commercial Farm	Chickens	6,000
2007	Feb	Vientiane Capital	Sisattanak	Backyard Farm	Chickens, Ducks, Geese, Pigeons	54
2007	Feb	Vientiane Capital	Sisattanak	Farm	Layer Ducks	1,380
2007	Feb	Vientiane Capital	Sisattanak	Village	Chickens, Ducks, Pigeons	62
2007	Feb	Vientiane Capital	Sisattanak	Farm	Layer Ducks	600
2007	Feb	Champasak	Bachiengchleunsuk	Village	Chickens, Ducks	3,201
2007	Feb	Vientiane	Phonhong	Village	Scavenging Ducks	700
2007	Feb	Vientiane	Thoulakhom	Village	Scavenging Ducks	500
2007	Feb	Savannakhet	Various	Village	Chickens, Ducks	35,000
2008	Feb	Luang Namtha	Long	Village	Chickens	1,317
2008	Feb	Luang Namtha	Sing	Village	Chickens, Ducks, Turkeys	2,355
2008	Feb	Luang Namtha	Namtha	Village	N/A	535
2008	Feb	Luang Namtha	Namtha	Village	N/A	1,008
2008	Feb	Luang Namtha	Namtha	Village	N/A	1,412
2008	Aug	Luang Prabang	Nambak	Backyard Farm	Ducks	5,422
2008	Sep	Oudomxay	Xay	Village	Ducks	1,170
2008	Oct	Xayabury	Xayabury	Village	Chickens, Ducks	155
2009	Jan	Phongsali	Khoua	Village	N/A	3,314

**Source:** OIE World Animal Health Information Database (WAHID), 2009

In depth, quantitative data on the total numbers of poultry lost or culled during HPAI outbreaks is limited, but most accounts show that total losses are far below those incurred in Viet Nam or Thailand. For example, during the first outbreak in 2004 only 155,000 birds died from the disease or culling efforts (Boltz et al, 2006). As this was the first incidence of the disease, responses were likely the most heavy-handed of the outbreaks.

In terms of human cases, infections have been minimal. There have only been two confirmed cases as reported by the World Health Organization, both of which were fatal. The two cases occurred during February – March 2007 in the Vientiane Capital and Vientiane Province, which was a period of numerous outbreaks as shown above. The two infected women were reported to have been in direct contact with sick birds while giving care or during the preparation of food (WHO, 2009).

Looking at the outbreak data, the temporal nature of the virus is clearly illustrated. In total, 79% of the recorded HPAI outbreaks have occurred in the months of January and February. This time of year corresponds with high poultry sales and movements for the Vietnamese Tet and Chinese New Year celebrations.

The Vientiane Capital and Province were the most common sites of the HPAI outbreaks with 8 of the reported 19 events. This should come as no surprise, as the Vientiane province has large amounts of poultry (and commercial operations) and reporting in the area is likely much better given the close proximity to the central government. Commercial farms were initially the most frequent to report infections and resulted in significant stock losses. In total, commercial producers lost as much as 20% of the national layer flock and almost 40% of the layer flock in the Vientiane province alone. Commercial quail producers were also badly impacted, losing just over a third of the national flock (FAO 2008, as quoted by Burgos et al, 2008).

However, since 2008 the majority of outbreaks have occurred in the far north of Lao PDR in the provinces of Luang Namtha, Oudomxay, and Phongsali. The fact that HPAI has been appearing in the north of Lao PDR is of particular interest because it brings up the issue of transboundary risk.

### **2.4.1 Transboundary Risk**

Luang Namtha and Phongsali are sparsely populated with small poultry populations and densities and it is suspicious that the disease would appear here (Table 2). Although Oudomxay has a more developed poultry sector (albeit still relatively small), the fact that it is the trade hub of northern Lao PDR is of greater interest. The Chinese presence is immediately noticeable in town as many businesses are owned and operated by Chinese. In the markets, many vendors are Chinese as well and Mandarin is commonly heard. Clearly there are strong linkages with China in the north, and it appears likely that cross-border trade of poultry products between the two countries can explain the high incidence of HPAI in this region.

Eggs, chicks, and ducklings from China can be imported legally to Lao PDR while imports of adult birds (either live or slaughtered) are illegal. Eggs must be inspected and are taxed at the border, and as a result most are smuggled illegally. This is commonly done across smaller borders and rarely through the main crossing at Boten in Luang Namtha. Eggs typically come on small trucks, often with other smuggled goods. The networks typically consist of Chinese nationals bringing the eggs to the border, where a Lao-Chinese will buy them and then take them further into Lao PDR. Eggs are also commonly smuggled hidden amongst legal imports, such as clothes or other durable goods (MAF 2010).

The official policies for Chinese chick and duckling imports are as follows. DOCs are only allowed to cross the border with a certificate from China claiming they are inspected and vaccinated. At the border they are visually inspected as well. Once the birds arrive to their final destination they must be held separately from the rest of the flock for 7 days and 1-2 samples (either birds or blood) are sent to Vientiane for inspection. DOCs from China can only be sold to approved farms, and sales to other farms are strictly forbidden. These farms are owned and operated by Chinese nationals living in Lao PDR and are staffed with Lao employees. All birds are to be raised and sold domestically, and never back to China (MAF 2010).

During the course of survey implementation in northern Lao PDR, several large farms were visited that sourced birds directly from China. The largest was a commercial

chicken layer farm that in full capacity could accommodate 6,000 birds. The owner of the farm was a Chinese woman living in Lao PDR that spoke no Lao, nor attempted to do so. She sources her birds from a large commercial hatchery in Kunming. The DOCs are flown from Kunming to the border, where she arranges a truck to pick them up and deliver them to her farm. If she buys more than 1,000 heads, the Chinese company will fly the birds for free. At the border the birds come with a certificate from the hatchery saying they are inspected and healthy. She must pay a tax on the birds at the border, but they are not inspected other than presenting the certificate from the Chinese company and she does not send samples to Vientiane for further inspection. This procedure is contrast to the official rules required by the MAF, but they do not appear to be strictly enforced as we were with MAF employees when the information was revealed.

The Chinese presence was also apparent at markets in Oudomxay. The prevalence of Chinese eggs was especially remarkable. Nearly every egg vendor had eggs from China, some even stamped with Chinese characters. Many vendors themselves were Chinese, and spoke little to no Lao. Early observational evidence from surveys further confirms this. One of the questions asks about the commonness of Chinese poultry products in markets and villages and a majority of the questionnaires showed that Chinese eggs were widespread. Live Chinese birds were less common, but near the market there was a man with a small flock of commercial birds from China. He had about 20 birds, including Silkie, a breed of Chinese origin.

Chinese poultry trade networks are by no means limited to Oudomxay, and can also be found in adjoining provinces. For example, Chinese poultry products were also confirmed in Muang Khua, the largest town on route 2E, which connects Oudomxay to the Dien Bien Phu province in Viet Nam. Muang Khau is small, but has a thriving trade industry and many stores stock Chinese goods. There is only one market in town and the majority of households raise poultry and thus poultry product vendors are limited. However, Chinese eggs were located in the town and it was confirmed that live Chinese commercial birds were common until HPAI struck the town in January 2009. Chinese eggs were also found in Muang Mai, which is over five hours away from Oudomxay and less than 40 kilometers from the Vietnamese border.



Adding further relevance to the transboundary risk issue is that the Dien Bien Phu province in Viet Nam has been home to numerous HPAI outbreaks including recent events in November 2009 and January 2010. Dien Bien Phu is adjacent to Lao PDR and the city center is only 36 kilometers from the border, which has tremendous implications for Lao PDR. The isolation of Dien Bien Phu and far proximity to other outbreak areas has fueled suspicion that cross-border poultry trade may be responsible for the high HPAI activity. It appears possible that trade from China, through Lao PDR and into Viet Nam may explain the abnormal levels of HPAI activity in the province.

Direct observational evidence supports that cross-border trade cannot be ruled out as a possible source of HPAI infection. Chinese poultry products are ubiquitous throughout northern Lao PDR, and eggs were located only 35 kilometers from the Vietnamese border. In Dien Bien Phu it became clear that it is very common for people to informally walk across the border to visit relatives in Lao PDR and we spoke with one person who explicitly confirmed bringing birds across the border. Thus we know that Chinese marketing networks extend to distant Lao PDR villages along the Vietnamese border, and that there is a large amount of informal flows of animals, products, and people across the border.

### **3. Survey Methodology**

Questionnaires were implemented in the northern, central, and southern parts of the country, spanning three distinct geographical regions. Survey implementation began in the central part of the country in the Vientiane Capital province. Next, questionnaires were conducted in the north in the Oudomxay, Luang Namtha, and Phongsali provinces. Finally, the project was concluded in the south with surveys conducted in the Savannakhet province.

#### **3.1 Vientiane Capital Sample Design**

In the Vientiane Capital province the most logical way to design the sample was to split it between urban and rural areas. The Vientiane capital metropolis is predominately spread along the Mekong River and south-central part of the province, spanning five districts. The surrounding four districts represent large areas of rural agriculture land that are used to provide agro-food products to the urban center. Thus by separating between rural and urban, we created natural categories to capture the rural producers that supply the urban vendors and consumers. Therefore producer surveys were predominately conducted in rural areas, while household and vendor surveys were only conducted in urban areas.

Granted, there are rural households that purchase poultry. However, the purpose of the consumer survey is to better understand the poultry purchasing preferences of households that acquire poultry products through markets (and subsequently do not raise birds). As rural households are much more likely to raise poultry, they were excluded from the consumption questionnaires. Consequently, only urban markets were surveyed as we intend to link the household questionnaires to the markets where respondents purchase goods.

Under the government classification scheme, villages are classified as urban, rural, or rural without roads. Both urban and rural villages were included in the sample, but rural villages without roads were not. This decision was made based on the fact that we are concerned with poultry market chain analysis. We assumed that villages without road access do not contribute to the greater poultry supply chain and operate in a closed

market system. Thus these villages have little relevance to our study and were not included. Furthermore, only urban villages in the five districts<sup>1</sup> containing the Vientiane Capital metropolis were included in the consumer sample. Although the remaining districts<sup>2</sup> have government classified urban areas, these are more likely to be peri-urban where poultry purchasing will be limited, making a random sample difficult to implement.

In total we targeted 1,250 market chain observations and 750 consumer observations. Traditionally this project has had targets of 500 market chain observations and 500 consumer observations, but survey work in Vientiane was conducted in conjunction with Phingseng Changkham at the National University of Lao PDR, allowing us to combine resources to create a large sample size.

Our sample was drawn from a combination of the households surveyed in the 2007/08 Lao Expenditure and Consumption Survey (LECS IV) and households selected from our own random sample. Re-sampling the households from the LECS IV is desirable because it allows us to match our data to a variety of other socio-economic indicators. In total, the LECS IV covered 48 villages in the Vientiane Capital province split between 32 urban and 16 rural villages. Only 16 households in each village were surveyed and thus only resurveying the LECS IV households would not cover our ideal sample size. Therefore, to reach our target goal we had to include an additional 30 urban and 50 rural villages which were selected randomly using a probability proportional to size (PPS) methodology. This was done using the PPS.do command in STATA, which is published by the World Bank.<sup>3</sup> Villages were drawn from the most recently updated village lists from the National Department of Statistics.

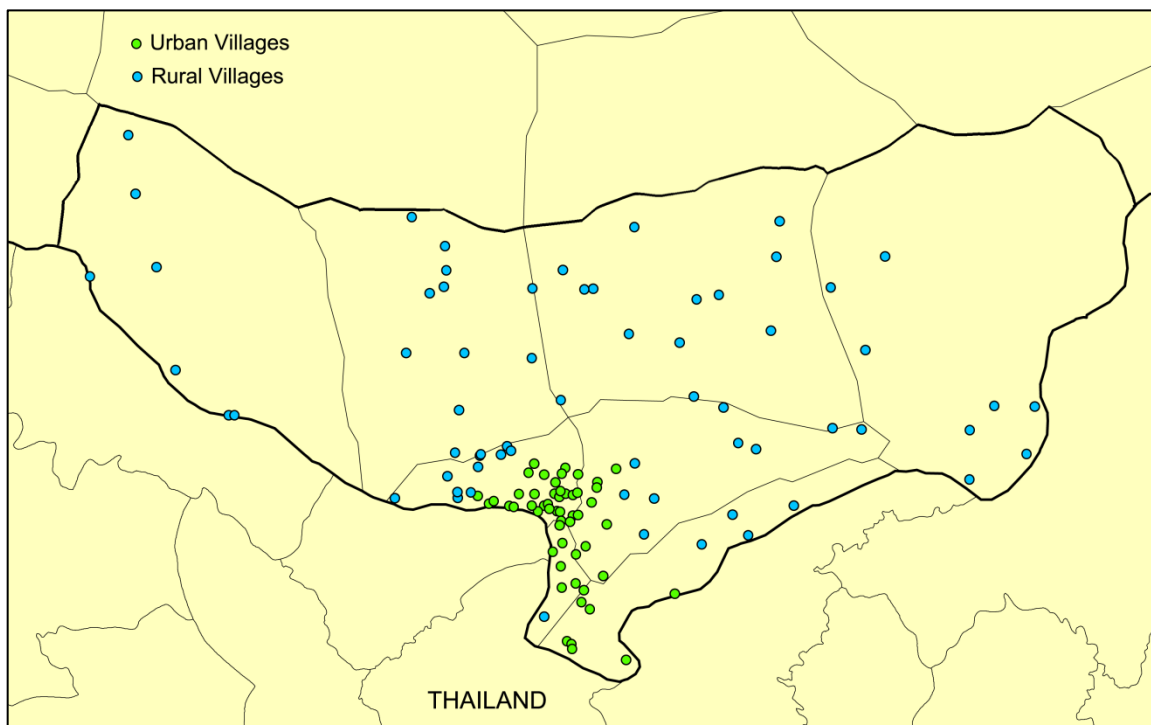
**Table 4: Number of Vientiane Capital Sample Villages**

	Urban		Rural		Total
	LECS IV	Own Sample	LECS IV	Own Sample	
Vientiane Capital	16	30	32	50	128

<sup>1</sup> Chanthabouli (01), Sikhottabong (02), Xaisettha (03), Sisattanak (04) and Haxayfong (07)

<sup>2</sup> Naxaythong (05), Xaithani (06), Sangthong (08) and Pakngum (09)

<sup>3</sup> PPS.do file & documentation can be found online: <http://www.worldbank.org/html/prdph/lrms/manage/pps.html>

**Figure 8: Map of Vientiane Capital Province Survey Locations**

### 3.2 Northern Lao PDR Sample Design

The Northern Lao PDR sample was shaped by the additional motivation for surveys to track poultry trade flows between China, Lao PDR and Viet Nam. Due to this motivation, three provinces were selected for inclusion based on their proximity and close ties to China and Viet Nam: Oudomxay, Luang Namtha, and Phongsali. Districts from each province were further selected based on the inclusion of the main roads that connect Lao PDR to China and Viet Nam (route 13N and 2E respectively). This included 3 districts from Oudomxay, 2 for Phongsali and 1 for Luang Namtha<sup>4</sup>

Just like Vientiane the sample was split between urban and rural villages. The original plan was to only sample urban villages in the Xay (M. Xay) district, Oudomxay, home to the largest city in northern Lao PDR. However, it became clear on arrival that M. Xay was semi-urban with many traditional Lao thatched wooden homes in the urban center and widespread smallholder poultry production. This meant that M. Xay was not distinctly different than other urban centers in different districts and provinces, and thus

<sup>4</sup> Oudomxay: Xay, La, and Namor. Phongsali: Khua, and Mai. Luang Namtha: Luang Namtha

the original intention of only including M. Xay for our urban sample no longer seemed valid. Furthermore, there are only 22 urban classified villages in M. Xay, requiring more observations per village than would be ideal. Thus after arriving in M. Xay it was decided to include urban villages from other districts and provinces in our sample. This is further justified by the fact that all the urban areas in the adjacent provinces and districts lie on route 13N and 2E, except for Luang Namtha. Luang Namtha has many urban villages in its provincial capital, but this was not included because it does not lie on Route 13N.

Thus, 48 villages were eligible for inclusion from the urban areas in the selected districts in Oudomxay and Phongsali, and from the one urban village on Route 13N in Luang Namtha. However, to keep parameters consistent with the Vientiane Capital surveys, only 14 consumer observations per village were recorded. With a target of 500 consumer observations, the complete coverage of the 48 villages was too large and a sample had to be developed. Like the Vientiane implementation, sampling was conducted in two methods. First, villages were self-selected based on certain characteristics. Again, villages from the LECS IV were re-sampled and this included 5 villages from the possible 48 urban villages. Additionally, any urban village that had a permanent market was self-selected in our sample as well. This was decided based on our interest in households that buy directly from a market, and also the need to obtain market vendor observations. In total, 13 villages were self-selected leaving a remaining 35 villages to draw our remaining sample from. The remaining sample was conducted using the PPS methodology, and an additional 27 villages were selected creating a total of 40 urban villages in the sample.

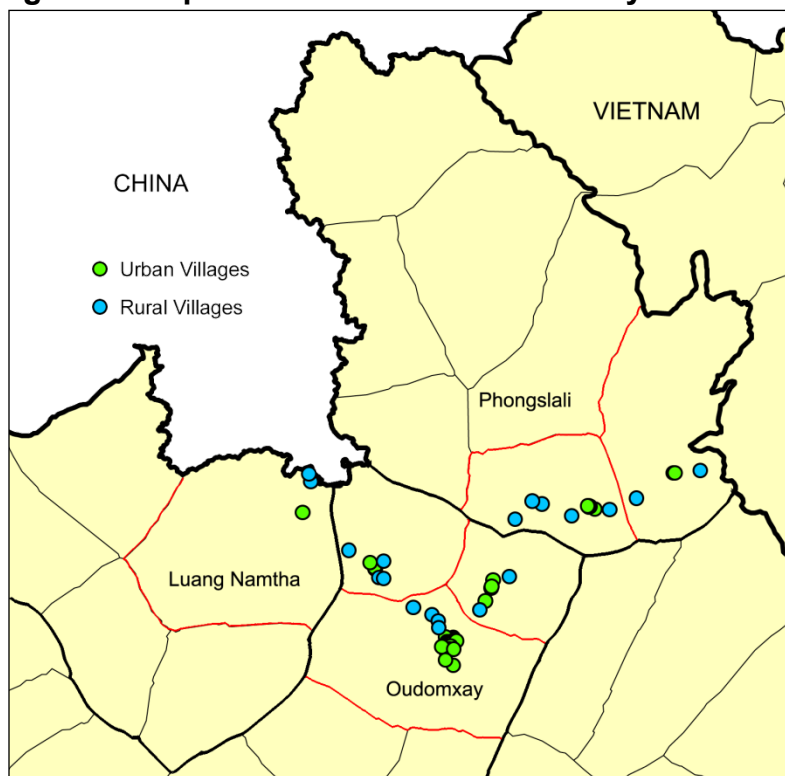
Developing the rural sample was more complicated due to the fact that rural villages in the three selected provinces are ethnically diverse (presenting language barriers) and remote (creating accessibility/feasibility issues). Thus it was decided to only include rural villages in our sample that were on or near (less than 5 KM) Route 13N and Route 2E. This decision can be justified on many levels. Primarily, it makes the logistics of implementation much easier, as any villages on these roads are relatively accessible. Given our resources it would not be feasible to do a true random sample of rural villages in the three provinces because they cover a large, unforgiving, sparsely populated

terrain. Furthermore, looking at the additional motivation for northern survey work, it can be justified to focus on these villages only as they will have the closest ties to China and Viet Nam, given the limited alternative road networks and border crossings.

Using district maps, village lists and local knowledge, 44 rural villages were found to be on or near Route 13N and 2E in the selected provinces and districts. However, this was too large of a sample for our desired number of observations and again a smaller sample had to be developed. This was conducted in two methods using a mixture of self- and random selection. 2 of the 44 rural villages were also in the LECS IV survey and were included in the sample. Additionally, Boten, which shares its border with China, was decided to be included given its political importance. The remaining 17 villages were drawn using PPS, creating a rural sample size of 20 villages.

**Table 5: Number of Northern Lao PDR Sample Villages**

	Urban		Rural		Total
	LECS IV	Own Sample	LECS IV	Own Sample	
Northern Lao PDR	5	35	2	18	60

**Figure 9: Map of Northern Lao PDR Survey Locations**

### 3.3 Savannakhet Sample Design

Due to the large geographical area that the Savannakhet province covers, first districts had to be selected for the sample inclusion. This presented two options; either select the districts randomly or strategically. Ultimately it was decided to select the districts strategically, as this could better suit the needs of our project. Since we are interested in smallholder poultry marketing, strategically selecting districts allowed us to include districts where higher levels of marketing were expected. Road networks and urban density were used as a proxy for high levels of poultry marketing and districts were eligible for inclusion if they contained either of the two major road networks that run through Savannakhet. These roads are Route 9 and 13, and are the province's major trade and transportation networks. Route 13 is also appealing because survey work was conducted specifically along this road in the northern section of this project. Working along the same road in the south will enable us to compare the effects of this road in different geographical regions of the country. Route 9 is also very important to Savannakhet because it connects the province to Thailand and Viet Nam. Furthermore it is part of the Asian Development Bank's "East-West Economic Corridor," which has been lauded as a driver of trade and development.

Including all 8 districts that route 9 and 13 passes through would have been ideal, but this still covers a large area and additional districts had to be dropped to ensure observations could be collected in a timely and cost effective manner. A random sample could have been used to select the desired number of districts, but given that districts were already selected strategically this did not seem to be logical. Furthermore, this would not make the logistics any easier as distant and non-adjacent districts may be selected.

Thus it was decided to self-select districts again for sample inclusion. One attractive option was to include all districts which route 9 passes through. This approach would allow us to closely work to the Vietnamese border, where we may find interesting results about cross-border trade. However this plan would span a distance of over 250 km and the difficulty and cost-effectiveness of this approach outweighed the apparent benefits. Ultimately it was decided to include 6 districts for sample inclusion leaving out the two most eastern districts near the Vietnamese border. This was decided for numerous reasons. First, enumerators were recruited in the provincial capital of Savannakhet, Savan, which is the westernmost area of the province directly across the border from Thailand. Sending enumerators 250 km to visit a handful of villages would be extremely expensive. Secondly, and more importantly, the selected districts are arguably a better sample as it contains districts which route 13 passes through as well.

The Outhoomphone district, east of Savan, can be considered the center of our sample, which is where route 9 and 13 cross. The remaining sample includes 5 adjacent districts to the north, south, east and west of the Outhoomphone district, following the road networks in every direction. Furthermore this sample captures all the adjacent districts to the provincial capital district and includes 3 of the 4 districts along the Thai border.

Once districts were selected, a village sample was then developed using a similar methodology to previous survey work. For urban villages, all 31 urban villages in the provincial capital district were included as this is the major city in the Savannakhet province. Of these 31 villages, 5 were from the LECS IV. However, 31 villages were too small of a sample to meet the desired number of consumer observations and additional villages had to be selected. Additional urban villages were drawn from the

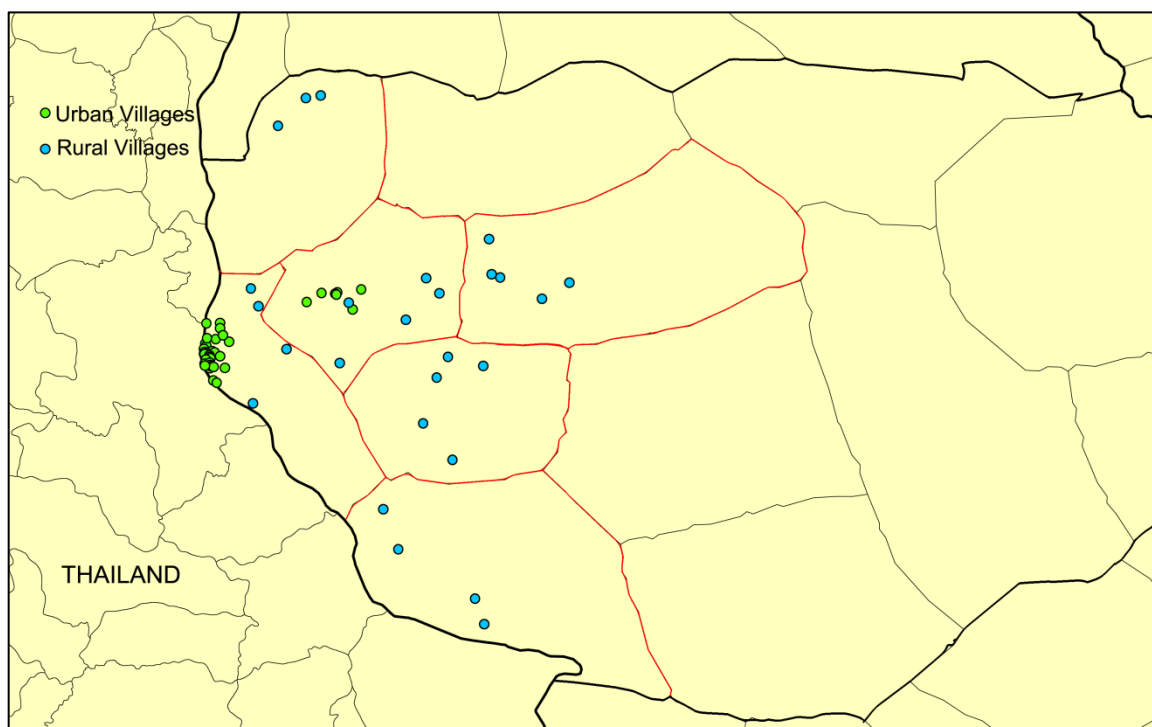


Outhoomphone district from the urban area where route 9 and 13 cross, called Seno. First, villages in Seno were identified and then 7 additional villages were selected using a PPS methodology. Although other sample districts have government classified urban villages to draw from, they are in fact peri-urban and likely meet the bare minimum for urban classification. Thus it was decided to not sample from these villages, as poultry consumption is likely to be low.

For rural villages, the majority of the sample was drawn from the LECS IV. In our 6 sample districts there were 20 rural LECS IV villages, which would have been enough to meet the desired number of producer observations. However, most of these villages are not located on route 9 and 13, and it was decided to include additional rural villages along these roads. This will allow us to compare levels of marketing between rural villages located on the major road systems, versus those off them. Additional villages were selected by first identifying which villages were on route 9 and 13 and then selecting 6 villages using the PPS methodology. 3 of the 6 selected villages are actually classified as urban, but they are peri-urban and have high levels of smallholder poultry production.

**Table 6: Number of Savannakhet Sample Villages**

	Urban		Rural		Total
	LECS IV	Own Sample	LECS IV	Own Sample	
Savannakhet	5	33	20	6	64

**Figure 10: Map of Savannakhet Survey Locations**

### 3.4 Poultry Farmer Surveys

#### 3.4.1 Motivation:

Poultry farmer surveys are intended to better understand farming cost structure, the contribution of poultry production to income and livelihoods, resource utilization, and assess the adjustment of poultry production in response to HPAI control measures. The surveys assessed these issues by focusing questions on evaluating farmer inputs and outputs, access to markets, barriers to expansion, HPAI experience, financial access and capital constraints, and trading relationships.

Poultry farmer surveys consist of three distinct questionnaires: a smallholder chicken and duck producer questionnaire, a largescale chicken producer questionnaire, and a largescale duck questionnaire. The largescale questionnaires are intended for households that raise more than 100 birds and are applicable for both meat and egg producers.

Poultry farmer questionnaires in the north had an additional section that aims to capture the existence and extent of poultry trade flows between Lao PDR, China, and Viet Nam.

Since this is a controversial topic (and answers may be untruthful), questionnaires also aim to assess the commonness of Chinese poultry in sample villages and the extent of family networks across borders.

### 3.4.2 Implementation:

Producer survey implementation was done using a combination of direct and random targeting. Implementation was also split between urban and rural areas. In urban LECS IV villages, producers were directly targeted using data from the LECS IV. Any household that was found to be raising poultry when the survey was conducted was re-surveyed with a producer questionnaire. In urban villages drawn from our own sample, producer observations were capped at 2 per village due to the prevalence of smallholder urban poultry production. Thus a 2-stage random sample was feasible, and enumerators visited every 4<sup>th</sup> household and targeted them either as a consumer or producer until 2 producer observations were recorded.

In rural LECS IV villages, households were also directly targeted using data from the LECS IV. Enumerators would visit all 16 households interviewed in the LECS IV and give producer surveys if the household raised birds. If not every household raised birds or a household could not be located, additionally producer observations were recorded as needed by visiting every 4<sup>th</sup> household at random until 16 producer observations were recorded. In rural villages drawn from our own sample, producers were found using a random selection process. Enumerators randomly selected a household in a village and then visited every 4<sup>th</sup> until 16 observations were recorded.

In both urban and rural areas, largescale producers in sample villages were directly targeted due to their limited numbers. Largescale producers were located by talking to village chiefs or other farmers in the selected villages and enumeration teams were instructed to actively seek out all largescale farmers during smallholder surveys. This was actually conducted first to ensure all largescale producers would be covered.

**Table 7: Poultry Farmer Observations**

	Smallscale	Large Chicken	Large Duck	Total
Vientiane Capital	1,047	81	29	1,157
Northern Lao PDR	421	9	3	433
Savannakhet	508	28	3	539

### **3.5 Aggregator Surveys**

#### **3.5.1 Motivation:**

Aggregator surveys are intended to improve our understanding of the poultry marketing network and trading relationships between different actors. Also information on pricing, disease considerations, resource utilization and operation costs was collected. The survey aims to include traders of all poultry products including chickens and ducks for meat, eggs, and chicks/ducklings for sourcing production.

Northern surveys had additional questions similar to those on producer questionnaires and seek to discover the role trader's play in cross-border flows of poultry. Questions will assess if traders buy or sell poultry products from neighboring countries, monitor the extent of Chinese products in the markets or villages they work in, and determine the network of relatives in China or Viet Nam.

#### **3.5.2 Implementation:**

Aggregators are by far the most difficult group to interview given their nature of work. Additional motivation was given to enumerators by making aggregator questionnaires worth the most, despite being shorter than other surveys. Aggregators were searched for in both urban and rural areas and were located by any means possible. Primarily, this was done by speaking with farmers, village chiefs, and market vendors and using this information to locate traders. Enumerators would also obtain contact information and attempt to contact aggregators directly. Aggregators were also occasionally located directly at markets, households, or farms and interviews were conducted upon site. Aggregator survey forms were eligible for every village and market from our sample, and did not count towards the 16 observations per village limit. Ideally, we hoped to collect as many aggregator observations as possible, and thus imposing a limit was illogical. This is in contrast to Vientiane, where aggregator observations counted towards the total number of observations per village. However, this limit was created under the assumption that one aggregator per village could be found, which turned out to be inaccurate.

**Table 8: Aggregator Observations**

Location	Observations
Vientiane Capital	27
Northern Lao PDR	41
Savannakhet	36

### **3.6 Market Vendors**

#### **3.6.1 Motivation:**

The purpose of the market vendor survey is to better understand the sources of poultry sold in urban markets as well as to collect price and breed data. Furthermore, data from the market is intended to provide a direct link between consumers and the market chain.

Northern surveys had questions asking vendors if they purchase any of their products from neighboring countries and the importance of different attributes in making this decision. Again less sensitive questions about the existence of family networks and commonness of Chinese poultry products at the market were asked as well.

#### **3.6.2 Implementation:**

Market surveys were conducted in the markets that serve the urban villages where consumer surveys were implemented. Markets were found in two ways in Vientiane. First, we obtained a list of registered markets in the Vientiane municipality, which listed all of the major markets. Additionally we relied on enumerators for local knowledge to visit any remaining markets in the Vientiane metropolis that were not on the official government list. In total this resulted in 21 markets being visited.

In northern Lao PDR, villages that had permanent markets were self-selected for our sample using government data. Furthermore, our sample for M. Xay contained every urban village in the district, and thus even if any markets were not officially listed with the government, the enumerators were able to capture them during data collection. Additionally market vendor observations were encouraged in rural villages or urban villages without permanent fresh markets, as egg vendors are still common. Egg vendors typically sell their products along with dry/processed goods and thus they are still common in areas without “wet” markets. In fact, these vendors are so common we had to establish a limit of only 1 egg vendor observation per village as some villages

can have several dozen-egg vendors alone. Chinese eggs are the most common form of foreign poultry products sold in northern Lao PDR, and thus these vendors are especially important to the project. This marks a difference from the Vientiane and Savannakhet implementation, as vendor surveys were only conducted at permanent fresh markets and no rural observations were recorded.

The Enumerator's strategy was identical throughout the different provinces. Enumerators visited markets during off-peak hours and attempted to interview every vendor that sold poultry meat. Enumerators also asked vendors if there were other vendors missing that were normally there so that a complete coverage of all vendors could be conducted. Enumerators revisited the same market several times in order to speak to all the vendors there.

**Table 9: Market Vendor Observations**

Location	Observations
Vientiane Capital	99
Northern Lao PDR	45
Savannakhet	45

### **3.7 Consumer Surveys**

#### **3.7.1 Motivation:**

The purpose of the Consumer Survey is to better understand poultry purchasing habits of households that acquire their poultry products through markets (i.e., do not raise their own poultry). A detailed survey was conducted revolving around household tastes, price sensitivity, breed preference, and other aspects of shopping habits. In addition, this survey will be used to assess interest in paying extra for certified poultry.

Northern surveys ask whether consumer's purchase poultry products from neighboring countries and the importance of different attributes in making that decision. Questions regarding family networks across borders and the commonness of Chinese poultry products in respondent's villages were also asked.

### 3.7.2 Implementation:

Consumer surveys were only implemented in urban villages and were separated between LECS IV villages and villages from our sample. Households in the LECS IV villages that did not raise poultry when the LECS IV was conducted were targeted directly as consumers. If an urban LECS IV household could not be located, or had previously raised birds but no longer did so, than replacement observations were needed. Enumerators would either re-survey the household that no longer raises birds or find another household at random for replacement observations.

For villages from our sample, households were selected at random. Enumerators would first select a household in the sample village at random, and then visit every 4<sup>th</sup> household until 14 observations per village were recorded. In total, 1806 consumer observations were recorded.

**Table 10: Consumer Totals**

Location	Observations
Vientiane Capital	782
Northern Lao PDR	520
Savannakhet	502

### 3.8 Project Totals

In total, 4,266 observations were recorded. Slightly under half of these come from Vientiane where a larger amount of smallscale and consumer observations were recorded. The other two regions account for approximately 1,000 observations each split between 500 market chain and 500 consumer observations.

**Table 11: Project Totals**

	Smallscale	Large Chicken	Large Duck	Aggregator	Market Vendor	Consumer Household	Total
Vientiane	1,047	81	29	27	99	782	2,065
North	421	9	3	41	45	520	1,039
Savannakhet	508	28	3	36	45	502	1,112
Total	1,976	118	35	104	189	1,804	4,226

## 4. Market Chain Survey Findings

### 4.1 Smallscale Farmer Surveys

To better understand how poultry products are produced and marketed, we begin our discussion on the market chain survey findings with smallscale farmers. Smallscale producer surveys form the largest section of our market chain observations, with nearly 2,000 households interviewed.

**Table 12: Smallscale Farmer Sample Size**

	Vientiane	North	Savannakhet	Total
Observations	1,047	421	508	1,976

#### 4.1.1 Smallscale Farmer Household Characteristics

The gender of respondents varied significantly from different regions. In Vientiane, we find that the majority of our respondents were female, while in Northern Lao PDR and Savannakhet most respondents were male. Although women tend to have a larger role in smallscale poultry production, men are typically the head of household and social customs dictate that enumerators speak with them.

**Table 13: Gender of Survey Respondents**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Male	459	44.1	303	73.0	352	69.3
Female	582	55.9	112	27.0	156	30.7

In regards to education, we find that respondents in the North were the best educated, with only 3.8% having no education. Overall, the most common level of education among smallscale producers is completion of primary school, and most lack higher education.

**Table 14: Education of Survey Respondents**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
None	158	15.1	16	3.8	112	22.1
Primary	416	39.8	154	36.6	192	37.8
Lower Secondary	223	21.3	138	32.8	103	20.3
Upper Secondary	132	12.6	80	19.0	63	12.4
Vocational	87	8.3	28	6.7	29	5.7
University	29	2.8	5	1.2	9	1.8



Households range in size from an average of 5.6 people in Vientiane to 6.6 people in Savannakhet. Households on average have slightly more men than women. Most households encountered had electricity, but running water was much less common. Households in the North were the most likely to have running water, but also had the lowest percentage of electricity.

**Table 15: Household Characteristics**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Electricity	1,044	99.7	302	71.7	505	99.4
Running Water	138	13.2	115	27.3	96	18.9
Neither	5	0.5	114	27.1	1	0.2

#### 4.1.2 Overview of Agricultural Activities

Looking at background agriculture activities is useful because it demonstrates that poultry production is often done in conjunction with several other agricultural activities. We see that on average, our respondents used 1 to 2 HA of land for their agricultural activities although total land ownership rates range from 1.6 to 6 HA. Total average land size in Vientiane and Savannakhet had large standard deviations, but agriculture land sizes did not. This demonstrates that despite sizeable land holdings for some smallscale producers they are unable to effectively utilize their land to its potential.

**Table 16: Average Household Land Size (HA)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Total Land Size	6.1	66.3	1.6	1.1	4.2	26.8
Agricultural Land	1.2	2.5	0.8	0.6	2.0	2.6

In regards to crops produced, rice is by far the most important commodity; especially in Savannakhet where over 80% of households reported producing rice. Crop production rates are lowest overall in Vientiane, which can be expected as the dynamic economy of the nation's capital presents many opportunities for other economic activities.

**Table 17: Crop Production**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Glutinous Rice	614	58.6	284	67.5	416	81.9
Ordinary Rice	199	19	25	5.9	78	15.4
Vegetables	53	5.06	178	42.3	30	5.9
Fruits	5	0.5	2	0.5	2	0.4
None	383	36.6	87	20.7	83	16.3

Although many households produced rice, few reported that ducks scavenged on their paddies. Farmers in Savannakhet were the most common group to identify that ducks had scavenged on their paddies, and their own ducks were more likely to scavenge on rice paddies than another household's flock. Our data illustrates that migratory duck production systems that occur in other areas of the GMS, are extremely limited in Lao PDR. Savannakhet is one of the largest rice production areas of the country and even here we find that nearly 70% of rice producing had no ducks scavenge on their plots.

**Table 18: Duck Scavenging Activities in Rice Producing Households (Previous 12 Months)**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Own ducks scavenged in rice paddy	36	5.7	34	11.0	104	24.9
Other ducks scavenged in rice paddy	78	12.3	28	9.9	39	9.4
No ducks scavenged in rice paddy	493	77.5	267	86.7	281	67.4

Other livestock production was less common for smallscale producers than crop production. We find clear regional differences between the prevalence of livestock production and the types of livestock produced. Again, Vientiane has the most respondents that reported raising no other animals; although a large number of households raise cattle. This is true as well in Savannakhet with over 60% of households reporting that they raise cattle and it can be seen that rice and cattle production (or pigs in the North) for smallscale farmers are important economic activities, and are likely many household's primary source of income.

**Table 19: Other Livestock Production**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Pig	56	5.4	268	63.7	216	42.5
Cattle	391	37.3	99	23.5	321	63.2
Buffaloes	79	7.6	73	17.3	197	38.8
Goats	56	5.4	24	5.7	45	8.9
Fish	58	5.5	9	2.1	10	2.0
None	524	50.1	132	31.4	103	20.3

#### 4.1.3 Poultry Production Background

Most smallscale producers reported they produce poultry to consume or to consume and sell. Producing poultry for sales only was extremely uncommon outside of the North. Most smallscale producers raise birds for meat or in a mixed system producing meat and eggs. Egg production as a primary system was virtually nonexistent among smallholders.

**Table 20: Primary Purpose of Poultry Production**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
To Sell	13	1.2	82	19.6	4	0.8
To Consume	651	62.2	124	29.7	227	44.7
To Consume and Sell	335	32.0	152	36.6	267	52.6
To consume, but sell in times of emergency	46	4.4	60	14.3	8	1.6
Other	1	0.1	0	0	2	0.4

Flock sizes on average range from 37 to 42 birds, and are largely comprised of chickens, especially in the North. Duck flock sizes were largest overall in Vientiane, and the common duck was the clear preferred breed among smallscale producers. It was much more common from producers to only raise chickens than to only raise ducks and over 40% of households in the North and Savannakhet reported they only had chickens in their flock. Sole duck production was rare with only 2.6 to 3% of producers having no chickens. We can therefore conclude that in general, chickens are the preferred species and some smallscale producers may raise ducks as well, but often in much small quantities.

**Table 21: Average Flock Sizes**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Chicken	26.7	19.1	37.0	19.6	27.7	25.3
Common Duck	10.5	13.8	4.3	9.5	8.3	14.0
Muscovy	0.4	2.4	0.3	2.6	0.6	4.5
Other	1.2	31.2	0.1	1.5	0.1	1.1
Total	38.6	41.5	41.7	22.1	36.7	30.3

Flock sizes are not static and over the course of typical month they will change. Births are the largest overall change and flocks add anywhere from 9.5 to 18.8 new chicks or ducklings per month on average. Sales varied from 4.3 to 10.8 birds sold over the previous month, however there are large standard deviations for these means because many producers did not sell any birds at all, while the producers who did sell often sold in quantities larger than the mean. The same is true for births, as many producers had no births in the previous month.

**Table 22: Change in Flock Size over Previous Month**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Bought	+0.8	4.9	+0.3	3.4	+0.3	1.7
Gift	+0.3	1.3	+0.0	0.5	+0.2	1.3
Birth	+9.5	13.3	+18.8	19.4	+11.1	14.4
Sold	-4.3	10.9	-10.8	14.9	-6.3	38.6
Died	-2	6.2	-6.2	12.0	-5.6	12.5
Eaten	-2.1	4.2	-3.4	3.1	-2.1	4.0
Gift	-0.2	1.5	-0.2	1.4	-0.1	1.0

Egg production and use reveals that the majority of eggs are fertilized and hatched rather than eaten or consumed. Thus, the primary purpose of laying birds is to reproduce rather than lay eggs for consumption or sales. Monthly egg consumption averages of 2 to 4 eggs suggests that many smallscale farmers must buy eggs despite the fact they produce birds.

**Table 23: Average Egg Production and Use over Previous Month**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Total Eggs Laid	17.8	10.1	35.1	11.5	14.6	11.3
Eggs Consumed	1.9	1.4	3.7	1.6	1.4	2.0
Eggs Sold	0.1	0.4	0.6	1.3	0	0.5
Eggs Gifted	0.2	0.2	0.0	0.1	0	0
Eggs Fertilized	15.3	7.8	28.4	8.4	12.2	6.3
Fertilized Eggs Sold	0.1	0.1	0.1	0	0.1	0
Eggs Hatched	11.7	6.1	22.6	6.4	9.8	4.9
Eggs Spoiled	3.6	1.7	6.0	2.1	2.8	1.3

The most common area to let birds scavenge was in the producer's yard, followed by the village or neighbors yard and Northern producers let their birds scavenge in more places than producers in other regions. Between species there is littler difference in scavenging locations in Vientiane and Savannakhet, but in the North ducks are more likely to scavenge in rice paddies or public water bodies.

**Table 24: Where Birds Scavenge (Percent of Flocks)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Yard	96.4	91.9	99.5	89.5	90.8	86.6
Village/Neighbors Yard	32.4	25.8	86.3	80.5	38.1	28.8
Personal rice paddies	3.6	3.6	12.7	32.3	23.6	27.8
Other people's rice paddies	4.6	5.1	12.2	34.6	1.8	1.8
Public water bodies	1.0	1.2	20.3	38.4	0.3	1.4

#### 4.1.4 Inputs and Costs

As the egg data suggests, most smallscale producer's source birds from their own flock. There is little difference between species, except ducklings are sourced from other farmers slightly more frequently than chicks. Other farmers are the second most common channel and producers in Vientiane source from them more than producers in the other regions.

**Table 25: Source of Chicks/Ducklings (Percent)**

	Vientiane		North		Savannakhet	
	Chicks	Ducklings	Chicks	Ducklings	Chicks	Ducklings
Own Flock	91.1	85.1	98.3	95.7	95.1	91.3
Other Farmers	7.0	13.4	1.5	4.3	3.6	6.6
Market	0.1	0.2	0	0	0.8	1.6
Trader	0	0.1	0	0	0.2	0
Hatchery	0.5	0.9	0.2	0	0.1	0.2
Other	1.3	0.9	0	0	0.2	0.4

Producers in Vientiane are also more likely to purchase adult birds for their flock than farmers in the other regions. However, adding adult birds to flocks is still uncommon and as less than 10% of respondents reporting doing so.

**Table 26: Percent of Producers that Purchase Adult Birds**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
No	942	90.9	404	97.6	470	92.7
Yes	94	9.1	10	2.4	37	7.3

When adult birds are purchased, the most common source is from other farmers. Therefore we see that self-replication and sourcing from other farmers satisfy virtually all the needs for new bird inputs into smallscale flocks. While aggregators play a large role in the marketing of poultry, they are much less important actors in the supply of inputs on smallscale farms.

**Table 27: Source of Adult Birds (Percent)**

	Vientiane		North		Savannakhet	
	Chickens	Ducks	Chickens	Ducks	Chickens	Ducks
Other Farmers	83.9	83.3	94.4	100	74	62.3
Market	2.4	0	5.6	0	8.3	21.8
Trader	5.6	4.2	0	0	9.1	6.8
Other	8.1	12.5	0	0	8.6	9.1

The most common type of housing system for smallscale producers is keeping flocks confined in the yard with a roof. Enclosed units as used in largescale production were very limited for small producers, which is reasonable given the higher costs associated with a closed housing system. Providing no housing for birds was the most common in Savannakhet where nearly 20% of producers reported not having any enclosure.

**Table 28: Types of Housing**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Enclosed Unit	61	6.5	3	0.7	9	1.8
Confined Yard with Roof	804	85.3	285	70.0	326	64.4
Confined Yard (no roof)	55	5.8	8	2.0	58	11.5
Roof only (no fence)	21	2.2	106	26.0	14	2.8
No Enclosure	90	8.7	3	0.8	98	19.4

Although most birds scavenge, they are still provided a variety of feed. There are differences between the types of feed used in different regions, but overall rice and bran (often mixed together) is widely fed to most birds. Commercial feed was most commonly used in Vientiane, followed by the North, but was much less common in Savannakhet. In regards to water, most birds get water supplied by the owner, typically in tires or other rudimentary holding devices.

**Table 29: Types of Feed**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Paddy Rice	423	40.4	377	89.6	197	38.8
Broken Rice	690	65.9	399	94.8	411	80.9
Bran	881	84.2	319	75.8	430	84.7
Corn	.	.	261	62.0	7	1.4
Kitchen Scraps	113	10.8	203	48.2	59	11.6
Commercial Feed	527	50.33	124	29.5	52	10.2
None	3	0.3	1	0.2	1	0.2
Other	31	3.0	0	0	0	0

Smallscale producers most commonly use pharmacies for veterinary services for their flock, if they seek services at all. Village veterinary workers or state veterinary services are utilized heavily in the North, but are rarely used in other places. This is likely a combination of two factors. First, HPAI outbreaks in the North have made smallscale producers more concerned about disease risk and are therefore more likely to seek veterinary services. Second, HPAI activity may have resulted in a larger presence of state veterinary services and village veterinary workers in this region.

**Table 30: Sources of Veterinary Services**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Village Vet. Worker	75	7.2	212	50.4	16	3.2
State Vet. Services	18	1.7	167	39.7	1	0.2
Private Vet.	92	8.8	87	20.7	4	0.8
Friend/ Relative/ Neighbor	69	6.6	195	46.3	51	10.0
Pharmacy	336	32.1	142	33.7	161	31.5
Hatchery Owner	11	1.1	2	0.5	17	3.4
Do not seek services	404	38.6	76	18.1	235	46.3
Do not know how to get services	105	10.0	59	14.0	72	14.2

There are a variety of costs smallscale producers may have, but most producer's primary costs are feed and housing. In the North, more producers have costs associated with animal health which is logical given that northern producers utilize the largest amount of veterinary services.

**Table 31: Producers with Costs Related to Poultry Production**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Feed	1,093	99.2	396	94.1	505	99.4
Water	49	4.7	150	35.6	31	6.1
Employees	0	0	0	0	0	0
Gasoline	17	1.6	43	10.2	1	0.2
Transportation Rental	6	0.6	4	1.0	0	0
Pharmaceuticals	166	15.9	153	36.4	26	5.1
Vaccinations	92	8.8	135	32.1	10	2.0
Veterinary Services	15	1.4	41	9.7	2	0.4
Building an enclosure	604	57.7	410	97.4	338	66.5

Looking at average costs per month, feed is the most expensive cost followed by transportation rental and gasoline for transportation of products. However, only a few smallscale producers use these inputs and therefore transportation rental and gasoline costs are not indicative for majority of smallscale producers. On average, producers spend \$17 USD to \$23 USD on feed per month. Feed costs depend largely on flock size, which is why we see they are highest in the north where the average flock size is largest. Feed costs also have large standard deviations because costs vary widely



depending on flock size. Housing costs are similar between Vientiane and the North, but are cheaper in Savannakhet due to producers having more rudimentary housing for their birds.

**Table 32: Average Cost of Each Input for Respondents Using Inputs (LAK/Month)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Feed	169,837	337,695	188,719	164,810	138,720	199,434
Water	21,911	25,519	34,141	89,770	22,133	26,341
Employees	.	.	.	.	.	.
Gasoline	94,356	143,243	30,138	39,302	.	.
Transportation Rental	110,000	141,421	142,250	194,807	.	.
Pharmaceuticals	13,322	36,916	25,236	35,428	3,183	4,248
Vaccinations	17,111	16,374	24,238	26,194	6,932	8,515
Veterinary Services	7,708	9,647	36,974	26,652	2,917	589
Building an enclosure (Total)	136,855	223,829	132,490	104,994	89,281	171,195

Because costs vary so much with flock size, a more indicative statistic is looking at the average cost per bird. Here we find that on average a producer spends \$0.62 to \$0.74 per bird per month.

**Table 33: Average Cost Per Bird (LAK/Month)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Cost Per Bird	5,122	5,963	6,075	6,776	5,146	6,485

#### 4.1.5 Outputs and Income

Marketing of poultry among smallholders is relatively common overall, although there are large discrepancies between regions. In Vientiane, only 42% of producers reported selling poultry in the previous year, compared to 56% in Savannakhet and 66% in the North. One may assume that these sales discrepancies can be explained by the different proportions of urban and rural households in each sample. For example, in Vientiane only 9% of producers were in urban villages compared to 18% in Savannakhet and 25% in the North. However, we find that in the North and Savannakhet, rural producers sell more than those in urban areas, and thus differences in sales rates are not explained by the sector.

**Table 34: Percent of Producers Who Sold Poultry in Previous Year**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Sales	439	41.9	277	66.4	282	56.0
No Sales	608	58.1	140	33.6	222	44.0

While many producers reported selling birds in the past year, the frequency of sales demonstrates how limited sales actually are as the vast majority of producers reported selling birds less than once a month. Sales are infrequent for several reasons. First, smallholder poultry production is primarily for consumption or a mixture of consumption and sales. Thus, production is subsistence oriented and sales only occur if a household's nutritional requirements are met. Second, limited flock sizes mean that producers only have a small amount of birds that are able to be sold at any given time. Unlike large production where birds are raised in batches so that sales can occur frequently, smallscale producers raise small amounts of birds continuously. Finally, for many smallscale producers marketing channels are limited to aggregators because search costs for buyers are too high. This means that in many cases sales only occur when a farmer is approached by a buyer.

**Table 35: Frequency of Sales (Percent of Producers)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Daily	0	0	0	0	0	0
Weekly	0.3	0.3	0.7	1.5	0	0
Every 2 Weeks	0	0.7	0.7	0	0.4	0
Monthly	9.8	10.7	12.9	4.4	0.7	0
Less Than Once a Month	90.0	88.3	84.9	94.1	98.9	100

When a smallscale producer does sell their products they reported selling them through four different channels: aggregators, market vendors, households and other farmers, or to restaurants and food vendors directly. Enumerators asked respondents to list what percent of birds and were sold through these channels and the averages are listed in Table 36. Smallscale producer data reveals that aggregators represent the single largest group of sales. However, many smallscale producers also arrange a large portion of sales on their own, either selling directly to end-users or to vendors. Sales to other households were highest in Vientiane and for duck sales in North.

**Table 36: Poultry Marketing Channels (Average Percent of Sales)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Aggregator	40.9	44.3	57.8	37.6	59.3	67.7
Market Vendors	20.0	17.8	24.8	31.3	22.1	22.0
Households/ Other Farmers	35.2	33.7	14.6	21.6	17.3	14.9
Restaurants / Food Vendors	0.4	0.2	2.9	10.3	0.1	0.
Other	3.3	3.6	0	0	1.5	1.9

Although most actors in the supply chain outside of Vientiane only use per head prices, we were able to obtain pricing information per kilogram in all regions due to our large number of smallholder observations. Pricing data shows that chicken meat is least expensive in Savannakhet, and most expensive in the North. In Vientiane and the North, duck meat is cheaper than chicken, but more expensive in Savannakhet. Duck eggs are also more expensive than chicken eggs.

**Table 37: Poultry Product Sale Prices (LAK/KG, LAK/Egg)**

	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Chicken Broiler	25,796	27,570	28,182	29,727	21,200	27,786
Chicken Egg	1,163	1,200	1,000	1,000	900	.
Duck Broiler	20,245	22,283	27,500	28,333	27,500	33,750
Duck Egg	1,143	1,1214	1,514	1,550	1,667	2,167

Despite limited sales, birds represent a solid investment. Assuming it takes 3 months for birds to reach maturity than the average cost of producing a bird is approximately 15,000 to 18,000 kip. Producers sell birds for 23,000 to 34,000 kip per head and can therefore earn up to \$2.30 USD in profit for each bird sold.

**Table 38: Poultry Product Sale Prices (LAK/Head)**

	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Chicken Broiler	34,045	34,750	26,755	31,548	22,678	24,842
Duck Broiler	34,714	38,571	38,226	43,107	37,453	40,677

On average producers earn between approximately \$6.14 USD to \$7.80 USD per month from poultry sales. This does not represent true monthly income from poultry sales as essentially no producer's sell birds monthly, but can be used as an estimate to see how much income smallholders derive from poultry sales. Poultry income in Vientiane represented the largest percent of total income despite being the smallest amount of kip, while poultry income for producers in Savannakhet is the smallest percent of total income yet they earn the most. However averages do take into account producers who do not sell any birds, and therefore it is logical that Vientiane has the lowest average as it has the largest percentage of producers who do not sell birds.

**Table 39: Average Household Income from Poultry Sales (LAK/Month)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Income	50,380	191,175	58,973	100,066	64,017	244,829
% of Total Income	7.0	15.4	6.2	10.5	5.5	8.2

Poultry derived income is used for a variety of activities, but spending on essential consumption is the most common response across all regions. Producers in the North use their income in a largest variety of ways.

**Table 40: How Poultry Derived Income is Used**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Save for use in emergencies	185	17.7	208	49.4	121	23.8
Spend on school fees	114	10.9	156	37.1	50	9.8
Spend on essential consumption	287	27.4	228	54.2	248	48.8
Spend on non-essential consumption	111	10.6	137	32.6	7	5.3
Invest in other activities	57	5.4	98	23.3	22	4.3
Do not have	490	46.8	135	32.1	197	38.8
Do not know	32	3.1	6	1.4	2	0.4
Other	29	2.8	2	0.5	6	1.2

#### 4.1.6 Biosecurity and HPAI Disease Experience

Smallscale producers are responsible in disposing of birds that have died from disease and over 90% of producer reported burying them. Only 3 producers in the entire sample sold birds that had died and only 2% gave birds away.

The most common biosecurity measure was to clean bird enclosures regularly. Producers in Savannakhet reported they were most likely to keep birds separate from other flocks despite the fact they had the most basic housing of the respondents. Vaccination use was highest in the north, but overall regional differences were minimal.

**Table 41: Biosecurity Measures**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Keep Birds in an Enclosure	288	27.5	107	25.4	48	9.5
Clean Enclosure regularly	801	76.5	334	79.3	334	65.8
Use Gloves, boots, and/or masks when handling birds	123	11.8	48	11.4	33	6.5
Keep birds over cement	20	1.9	56	13.3	14	2.8
Keep flock separate from other birds	122	11.7	111	26.4	244	48.0
Use vaccinations	91	8.7	144	34.2	22	4.3

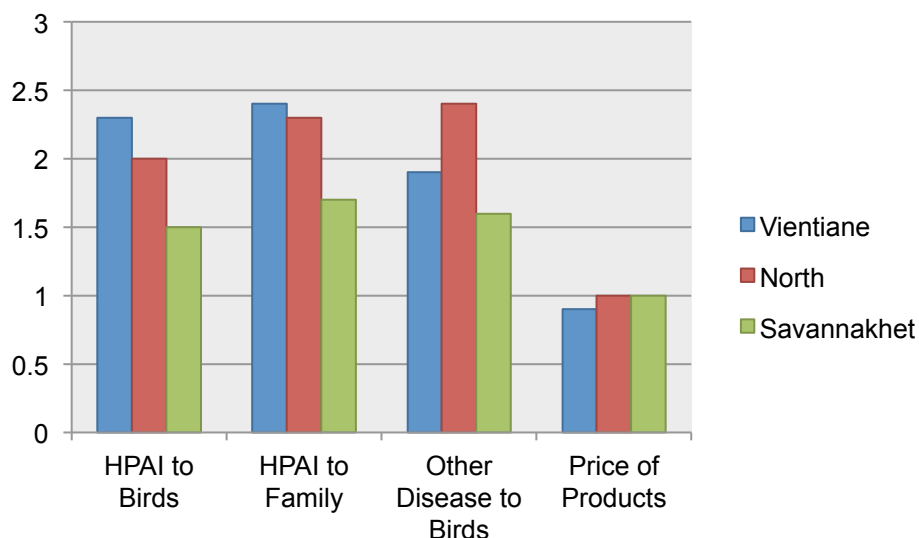
Vientiane and the North were home to the most farmers that had birds culled in response to HPAI outbreaks with 14.9% and 13.2% of farmers having birds culled respectively. In Savannakhet only 2.6% of farmers had losses from culling. Producers in Vientiane lost a higher percentage of their flock and more birds than producers in the North. However, Vientiane producers received less compensation than producers in the North.

**Table 42: Summary Statistics of Farmers with Culled Birds**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
% of Flock Lost	92.2	23.6	69.1	39.3	.	.
Number of Birds	40.8	161.1	22.0	9.3	.	.
Compensation (LAK/KG)	8,274	15,653	9,681	5,255	.	.

In regards to disease concerns, all farmers were more concerned about HPAI affecting their family than affecting their flock while producers in the north were most concerned about other disease. The price of products is used as a comparison to see how important marketing is compared to disease concerns, and we see that all smallscale farmers are more worried about disease than the price of birds.

**Figure 11: Smallscale Farmer Disease Concerns**



#### 4.1.7 Transboundary Risk

Chinese poultry products are widespread throughout Northern Lao PDR and 44% of smallscale producers reported buying Chinese eggs. No producers purchased chicks, but adult birds were bought by 2.1% of producers. Vietnamese products were much less common with 8.1% of respondents buying Vietnamese eggs.

**Table 43: What Products are Bought (Percent of Producers)**

	North			
	China		Viet Nam	
	Freq.	Percent	Freq.	Percent
Eggs	187	44.4	34	8.1
Chicks	0	0	0	0
Adult Birds	9	2.1	0	0
Feed	18	4.3	2	0.9
None	207	49.1	387	91.9

There is a large stigma attached with purchasing Chinese products and therefore a less probing question was asked to ascertain the extent of Chinese products. Data shows

that only 2.2% of respondents had never seen Chinese poultry products in their village, and the majority (57.4%) said Chinese poultry products are very common.

**Table 44: Prevalence of Chinese Poultry Products**

	North	
	Freq.	Percent
Chinese poultry products are very common in the village	238	57.4
Chinese poultry products are occasionally in the village	125	30.1
Chinese poultry products are rarely in the village	43	10.4
Never seen Chinese poultry products in the village	9	2.2

Of producers that have seen Chinese poultry products, eggs are by far the most common type of product and were encountered by 96% of these respondents. Birds, live or slaughtered, were much less common but were still found by over 10% of respondents that saw Chinese poultry products.

**Table 45: Types of Chinese Poultry Products Seen**

	North	
	Freq.	Percent
Live Birds	48	11.7
Slaughtered Birds	49	11.9
Eggs	395	95.9

## 4.2 Largescale Farmer Surveys

Largescale production is extremely limited in Lao PDR as demonstrated by our limited largescale producer sample sizes. Enumerators were instructed to locate and interview all large producers in our sample frame and thus these observations represent the total coverage of large production in our selected villages. We find that large chicken production is much more common than large duck production, and Vientiane has the most large producers overall.

**Table 46: Largescale Farmer Sample Size**

	Vientiane	North	Savannakhet	Total
Large Chicken	81	9	28	118
Large Duck	29	3	3	35

### 4.2.1 Overview of Agricultural Activities

Large producers on average hold less land than smallscale producers, although a larger percentage of their land is used for agriculture purposes, signaling large producers are better able to utilize the land they have. In general we see that, crop production and livestock production is less important for large producers than small producers, as large farmers dedicate more of their time towards chicken production, while smallscale producers engage in a myriad of agriculture activities.

**Table 47: Average Household Land Size (HA)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Total Land Size	3.2	2.8	1.7	2	7.5	3.3
Agricultural Land	1.8	1.3	1.1	1.3	2.3	1.7

In regards to crop production, rice is the most common crop for large producers, especially duck producers. We find that chicken producers in Vientiane are the group that is the most likely to not raise crops (as well as other livestock). This demonstrates that largescale chicken production in Vientiane is closer to an industrial model whereas larger farmers in other parts of the country still have other agricultural activities.

**Table 48: Crop Production (% of Producers)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Glutinous Rice	42.0	58.6	66.7	66.7	64.3	66.7
Ordinary Rice	14.8	20.7	0	0	10.7	33.3
Vegetables	3.7	10.3	44.4	66.7	7.1	0
Fruits	1.23	0	0	0	0	0
None	48.2	24.1	22.2	33.3	35.7	33.3

For other livestock production data further strengthens the statement that chicken production in Vientiane is the most intensive model. Conversely we find that large duck producers are more likely to raise other animals in conjunction with poultry production, indicating it is not their main economic activity.



**Table 49: Other Livestock Production (% of Producers)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Ducks/Chickens	21.0	55.2	22.2	0	71.4	0
Pig	16.1	31.0	33.3	66.7	42.9	33.3
Cattle	35.6	44.8	0	66.7	71.4	66.7
Buffaloes	4.9	13.8	0	0	39.3	33.3
Goats	4.9	10.3	0	0	17.9	66.7
Fish	14.8	34.4	11.1	0	7.1	66.7
None	42.0	6.9	33.3	33.3	3.6	0

#### 4.2.2 Poultry Production Background

It is important to separate largescale producers by production systems, because farm characteristics can vary widely. We find that the production is typically split between egg, meat, and a mixture of both. Only one chicken and duck farm reported operating as a hatchery. Egg production is most common in Vientiane, and outside of a few large chicken egg producers in the North, no other large farmers reported that eggs were their primary production system.

**Table 50: Primary Production System (% of Producers)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Egg Production	38.3	20.7	11.1	0	0	0
Meat Production	38.3	44.8	66.7	100	7.1	100
Mixed	22.2	31.0	11.1	0	92.9	0
Hatchery	0	3.5	11.1	0	0	0
Other	1.2	0	0	0	0	0

For egg producers, flock sizes are larger than other forms of production so that a marketable quantity of eggs can be attained, and flock sizes of a few thousand birds were common. Flocks are dominated by layers, (or chicks for replacement flocks), and other birds have little importance in these systems. We find a large standard deviation of flock sizes due to several large industrial farms with flock sizes up to 52,000 birds.

**Table 51: Average Flock Sizes (Egg Production)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Layers	4,699.9	7,754	5,000	.	.	.
Males	65.5	50	0	.	.	.
Broilers	0	0	0	.	.	.
Chicks	0	0	5,000	.	.	.
Total	4,764.4	7,794	10,000	.	.	.

For meat production, we see that the flock sizes are much more dispersed. In these systems, there are a parent flock of layers and males to produce chicks that are then raised into broilers for sale. Thus we see that chick sizes are the largest amongst this segment of production, followed by broilers. Standard deviations among this group are much lower as no large industrial broiler operations were encountered.

**Table 52: Average Flock Sizes (Meat Production)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Layers	19.6	24	15.7	15	37.5	38.3
Males	12.8	11.8	14.3	7.3	14	19.7
Broilers	21.7	27.5	29.8	3.3	340	76.7
Chicks	58.8	86.7	87.5	58.3	388.5	71.7
Total	112.9	150	147.3	84	780	206.3

In mixed production systems, flock sizes are similar to meat production only with a larger number of layers, because these birds must produce eggs to sell and produce chicks for broiler production. These systems have high standard deviations for layers as some farms operate with a couple thousand birds.

**Table 53: Average Flock Sizes (Mixed Production)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Layers	1340.8	26.9	57	.	488.2	.
Males	6.1	4.7	23	.	15.2	.
Broilers	16.3	29.8	5	.	30.8	.
Chicks	36.3	49.2	150	.	48.6	.
Total	1,399.6	110.6	235	.	582.8	.

Looking at how flock sizes change over the course of a month, there are large differences between different production groups. For egg producers, the largest changes in flock size come from purchases and sales when spent layers are sold off and need to be replaced. For this production system we see large changes in these categories due to egg producer's larger flock sizes. Therefore when sales and replacement purchases are made, these changes are much larger than other groups.

**Table 54: Change in Flock Size over Previous Month (Egg Production)**

	Vientiane		North		Savannakhet		Total	
	Chicken	Duck	Chicken	Duck	Chicken	Duck	Chicken	Duck
Bought	+164.5	+0	+5,000	.	.	.		
Gift	+0	+0	+0	.	.	.		
Birth	+32.3	+0	+0	.	.	.		
Sold	-230.6	-6.7	-0	.	.	.		
Died	-3.8	-1.7	-0	.	.	.		
Eaten	-0.3	-1.7	-0	.	.	.		
Gift	-0.2	-0	-0	.	.	.		

For meat producers, the largest changes in flock sizes come from sales of meat and births. This is because broilers are often raised from chicks born from the parent stock, rather than purchased. Thus, birth of new chicks is high for this group.

**Table 55: Change in Flock Size over Previous Month (Meat Production)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Bought	+1.0	+8.9	+0	+0	+0	+0
Gift	+0.6	+0.5	+0	+0	+0	+0
Birth	+31.8	+44.1	+59.3	+51.7	+245.5	+43.3
Sold	-26.4	-20.2	-53.5	-191.7	-125	-30
Died	-3.2	-1.3	-18.3	-1.7	-0	-0
Eaten	-4.3	-2.4	-6.7	-3	-5	-3.7
Gift	-0.5	-0.6	0	-0	-0	-0

Mixed represents characteristics from both egg and meat production systems. Therefore there can be large quantities of sales when spent layer batches are sold, but purchases are smaller, and instead the flock may restock through births.

**Table 56: Change in Flock Size over Previous Month (Mixed Production)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Bought	+0	+0	+0	.	+115.4	.
Gift	+0.3	+0.2	+0	.	+0.3	.
Birth	+13.1	+14.3	+130	.	+21.2	.
Sold	-635.8	-18.3	-58	.	-169.9	.
Died	-4.5	-0.1	-30	.	-14.6	.
Eaten	-0.2	-1	-7	.	-1.4	.
Gift	-6.1	-0.4	-0	.	-0.8	.

The production and use of eggs further reveals the differences between production systems. For egg producers we see that on average, a much larger amount of eggs per

week are produced. Of the eggs produced, virtually of them are sold, which is in contrast to mixed production systems where producers both sell and hatch eggs.

**Table 57: Average Egg Production and Use over Previous Month (Egg Producer)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Total Eggs Laid	26,138.6	16,175	17,670	.	.	.
Eggs Consumed	89.5	25	0	.	.	.
Eggs Sold	26,535.5	16,150	17,670	.	.	.
Eggs Gifted	15.2	0	0	.	.	.
Eggs Fertilized	0	0	0	.	.	.
Fertilized Eggs Sold	0	0	0	.	.	.
Eggs Hatched	0	0	0	.	.	.
Eggs Spoiled	12.3	0	0	.	.	.

**Table 58: Average Egg Production and Use over Previous Month (Mixed Producer)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Total Eggs Laid	11,976.9	290.5	120	.	3,473.8	14,820.8
Eggs Consumed	12.5	12.4	20	.	1	4.2
Eggs Sold	11,923.9	203.6	35	.	3,450	14,826.5
Eggs Gifted	0	1.1	0	.	0	0
Eggs Fertilized	48.1	73.4	65	.	22.8	27.0
Fertilized Eggs Sold	3.8	0	0	.	0	0
Eggs Hatched	33.1	69.4	50	.	21.2	25.5
Eggs Spoiled	8.5	4	15	.	1.6	2.3

#### 4.2.3 Inputs and Costs

Most producers source birds from their own flock, with the second most common categories being hatcheries or companies. Producers who source from hatcheries or companies are mostly egg producers that restock after selling spent layer batches, while mixed producers and meat producers more frequently source from their own flock.

**Table 59: Source of Chicks/Ducklings (Percentage of Respondents Purchasing from the Source)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Own Flock	67.5	69.7	88.9	53.7	85.7	73.3
Other Farmers	2.8	12.8	0	0	3.9	3.3
Market	0.2	0	0	0	3.6	0
Trader	3.1	0	0	0	0	0
Hatchery	15.4	10.7	11.1	46.3	.	.
Company	8.8	3.4	0	0	3.6	23.3
Other	2.3	0	0	0	0	0

The most common source of housing was a confined enclosure with a roof. Completely enclosed units where birds are kept in indoor facilities, were less frequent but not completely uncommon. These housing systems are used for large industrial operations, typically egg producers and were most common in Vientiane and chicken producers in the North.

**Table 60: Types of Housing (Percent of Producers)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Enclosed Unit	16.9	24.1	22.2	0	7.1	0
Confined w/ Roof	70.8	55.2	66.7	66.7	78.6	100
Confined w/o Roof	10.1	17.2	0	0	14.3	0
Unconfined	2.2	3.4	11.1	33.3	0	0

For types of feed used there are large regional differences. Commercially feed was most commonly used in Vientiane and the North, but was less common in Savannakhet. Instead these farmers feed their chickens a mixture of bran and broken rice, which is more indicative of a smallscale system.

**Table 61: Types of Feed**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Paddy Rice	34.6	34.5	44.4	100	25.0	33.3
Broken Rice	42.0	58.6	66.7	100	50.0	33.3
Bran	55.6	75.9	66.7	100	89.3	66.7
Corn	.	.	33.3	66.7	0	0
Kitchen Scraps	3.7	10.3	0	100	7.1	33.3
Commercial Feed	75.3	89.7	55.6	100	17.9	0
Other	8.6	6.9	22.2	0	21.4	33.3

Water sources come from a variety of different channels and there are clear differences between the regions and species produced. For Vientiane, wells or personal water is the most common source of water for flocks, while in the North public water is more commonly used for chickens. In Savannakhet, standing or rain water is the most common which is again indicative of a smallscale, less intensive system. For ducks, several large producers reported their birds had daily access to bodies of water, with ponds and rice paddies being the most common.

**Table 62: Source of Water**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Standing / Rain Water	12.3	17.2	11.1	0	57.1	66.7
Well / Personal Water	64.2	62.1	22.2	33.3	3.6	0
Pipes / Public Water System	3.7	10.3	44.4	0	25	0
Closed Housing Unit	12.4	3.5	33.3	0	7.1	0
Water Body	.	13.8	.	66.7	.	0
Other	13.6	20.7	11.1	33.3	7.1	33.3

Largescale producers in general seek veterinary services more frequently than small producers. This is logical given their larger flock sizes and commercially oriented production, as they can afford services and loss from disease is more damaging to livelihoods. For large producers we even see the use of private veterinary services which are beyond the means of most smallscale producers. We also find a large reliance on village veterinary workers and state veterinary services in the North, which may signal the wider availability of these sources due to recent HPAI activity.

**Table 63: Sources of Veterinary Services**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Village Vet. Worker	8.6	0	44.4	100	0	0
State Vet. Services	3.7	0	44.4	100	0	0
Private Vet.	13.6	31.0	33.3	0	3.6	0
Friend/ Relative/ Neighbor	6.2	6.9	33.3	100	0	0
Pharmacy	39.5	41.4	44.4	0	82.1	66.7
Hatchery Owner	9.9	3.5	11.1	0	0	0
Company	11.1	0	0	0	7.1	0
Do not seek services	19.8	24.1	11.1	0	3.6	33.3

While smallscale producer's only costs are typically food and housing, large producers have a variety of costs. Costs such as electricity (for housing and incubation), employees, and veterinary related services are more frequent among large producers, particularly in Vientiane and the North. Again, the large producers that were encountered in Savannakhet appear to operate more similarly to smallscale producers. The costs are particular indicative of this as only one producer reported having costs

besides housing and feed. It appears that although the large producers in Savannakhet have flock sizes above 100 birds, they still utilize an extensive production model.

**Table 64: Producers with Costs Related to Poultry Production**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Feed	100	100	100	100	100	100
Water	4.9	100	66.7	0	3.6	0
Electricity	39.5	10.4	44.4	33.3	3.6	0
Employees	9.9	3.5	22.2	0	3.6	0
Gasoline	12.4	3.5	55.6	0	3.6	0
Transportation Rental	2.5	0	22.2	0	0	0
Pharmaceuticals	38.3	37.9	55.6	0	3.6	0
Vaccinations	16.1	10.3	33.3	66.7	0	0
Veterinary Services	8.6	3.5	0	0	0	0
Building an enclosure	77.8	72.4	100	100	89.3	100

Monthly average cost structures for largescale chicken producers are useful in demonstrating how much large producers spend producing their flocks and the large discrepancy in costs between different production systems.<sup>5</sup> When looking at the average costs we separate by flock size because producers with over 500 birds tend to have more industrial operation qualities and thus have significantly higher costs. For producers with flock sizes under 500 birds, feed is the largest monthly cost followed by transportation of products and bird health related costs.

<sup>5</sup> Largescale chicken data is used due to the larger number of observations. For largescale duck data please refer to the annex.

**Table 65: Average Cost of Each Input for Chicken Producers Using Inputs (LAK/Month) (Flock Size <500)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Feed	754,625	1,162,443	782,000	626,100	430,800	276,434
Water	55,000	.	44,500	70,737	.	.
Electricity	35,833	42,710.2	50,000	.	.	.
Employees	.	.	.	.	.	.
Gasoline	.	.	204,000	226,321	.	.
Transportation Rental	240,000	.	.	.	.	.
Pharmaceuticals	21,844	50,029	43,333	55,960	.	.
Vaccinations	6,983	5,987	125,000	106,066	.	.
Veterinary Services	16,233	28,970	.	.	.	.
Building an enclosure	633,367	1,164,615	464,286	684,175	205,000	421,739

Producers with over 500 birds, have both a larger variety of costs and significantly higher costs. This group captures producers with flock sizes of several thousand birds including industrial CP farms, and therefore costs range widely. Again, feed remains the largest monthly cost ranging from approximately \$3,050 USD to \$12,075 USD per month. While no farmers with flock sizes under 500 had employees, these producers do, and it represents a large source of costs as well. Housing costs are especially large for this group as well due to the industrial housing systems.

**Table 66: Average Cost of Each Input for Chicken Producers Using Inputs (LAK/Month) (Flock Size >500)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Feed	33,700,000	56,400,000	25,000,000	24,000,000	99,000,000	88,500,000
Water	150,000	.	1,626,000	1,944,544	3,000,000	.
Electricity	424,166	1,192,921	1,610,000	1,965,757	5,000,000	.
Employees	1,222,500	1,776,487	1,400,000	848,528	16,400,000	.
Gasoline	631,000	609,611	5,400,000	.	2,700,000	.
Transportation Rental	600,000	.	3,250,000	3,889,087	.	.
Pharmaceuticals	794,884	1,513,077	500,000	.	126,000	.
Vaccinations	2,096,667	3,553,313	1,300,000	.	.	.
Veterinary Services	100,000	.	.	.	.	.
Building an enclosure	70,800,000	72,800,000	156,000,000	136,000,000	542,000,000	563,000,000



A more descriptive statistic is looking at the average cost per bird. Here we find that on average producers spend approximately \$0.75 USD/month per bird. For chickens, per bird costs are highest in the north and cheapest in Savannakhet, and for ducks costs are highest in Vientiane and lowest in the North.

**Table 67: Average Cost Per Bird (LAK/Month)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Cost Per Bird	5,997	7,670.5	6,202	4,644	5,840	5,387

#### 4.2.4 Outputs and Income

In regards to sales, the majority of all sales (both meat and eggs) go through aggregators providing further evidence of the prevalence they have in the poultry supply chain. Egg producers utilized aggregators more than meat producers. For Vientiane and the North, meat sales to households are a common channel, but are virtually non-existent in Savannakhet. Conversely, we find that little egg producers sell eggs to households in Vientiane and the North, whereas producers in Savannakhet do.

This variation can likely be explained by several factors. First the larger prevalence of smallholder production in Savannakhet means that many households are unlikely to buy meat (this is further confirmed by household consumer data which shows that over 20% of households never purchase meat). Second, our observations for egg producers all come from mixed systems and have more extensive qualities than industrial production specifically designed for egg production. This means that many of the large egg producers are less likely to rely on formal marketing channels and instead sell eggs to households.

**Table 68: Marketing Channels of Largescale Chicken Producers (Average Percent of Sales)**

	Vientiane		North		Savannakhet	
	Meat	Eggs	Meat	Eggs	Meat	Eggs
Aggregator	58.2	67.9	51.1	60	61.7	70
Market Vendors	19.6	19.8	35	35	37.7	16.6
Households/ Other Farmers	19.7	3.1	11.7	5	0.6	13.3
Restaurants / Food Vendors	0.4	3.8	2.2	0	0	0
Hatchery	0	2.4	0	0	.	.
Company	0	0	0	0	0	0
Other	2.1	2.9	0	0	0	0

Duck producers rely less on aggregators than chicken producers except in the North. We also find that both meat and egg sales to households is the second most common channel in Vientiane.

**Table 69: Marketing Channels of Largescale Duck Producers (Average Percent of Sales)**

	Vientiane		North		Savannakhet	
	Meat	Eggs	Meat	Eggs	Meat	Eggs
Aggregator	49.7	53.8	83.3	.	53.3	.
Market Vendors	20.7	20	16.7	.	23.3	.
Households/ Other Farmers	24.9	26.2	0	.	0	.
Restaurants / Food Vendors	4.8	0	0	.	0	.
Hatchery	0	0	0	.	.	.
Company	0	0	0	.	23.3	.
Other	0	0	0	.	0	.

In regards to sale quantities there is a great variation in sales between months for meat. This is because birds are raised in batches, and therefore are sold in large, infrequent quantities. While some large meat producer's raise several batches in different stages of production, this is still quite uncommon and therefore we see these large variations in the data. In addition there is a strong seasonality of poultry meat sales and producers sell more in months with important holidays, especially in April, November, December, and February. Variation in egg sales is from how many active layers are currently in the flock and the rates of production of those birds. For example in the North there are a few months where the large egg producer's produced no eggs because their new batch of layers were not producing eggs yet.

**Table 70: Average Monthly Sales Quantities**

	Vientiane		North		Savannakhet	
	Low	High	Low Season	High Season	Low Season	High Season
Chickens	138	372	2	728	2	81
Chicken Eggs	27,890	46,009	0	17,676	5,750	8,520
Duck	8.3	27.3	0	66.7	16.7	101.7
Duck Eggs	4,105	4,264	.	.	.	.

Prices in the North and Savannakhet were given per head, while Vientiane prices were quoted per kilogram. There is a strong regional difference in how products are priced and virtually no actors in the supply chain could be found who price their products in kilograms outside of Vientiane. However, we can still compare data across the regional areas. Meat prices in Savannakhet are the cheapest from our sample as whole birds can be bought for less than the price of 1 kilogram in Vientiane. We also see that birds are more expensive in the North than Savannakhet. Sale prices also reveal that there is little difference between product types. For example, in Vientiane sale prices of an active layer and broiler are nearly identical, while spent layers and males previously used for breeding are only slightly smaller. We later find that as birds move further down the supply chain these differences become even smaller and by the time birds enter the market, their costs are nearly identical.

**Table 71: Chicken Product Sale Prices (LAK/Head<sup>6</sup>, LAK/Egg)**

	Vientiane		North		Savannakhet		Total	
	Low Season	High Season	Low Season	High Season	Low Season	High Season	Low Season	High Season
Broiler	26,310	28,862	30,429	37,167	26,000	27,00		
Layers	26,091	28,727	38,333	39,000	26,480	27,080		
Spent Layers	23,429	25,538	31,250	31,750	26,761	27,048		
Males	24,875	29,778	38,750	38,000	33,880	34,480		
Egg	687	705	833	667	911	1,078		

Duck data reinforces the evidence from the chicken pricing data. Again, prices in Savannakhet and the North were given per head, while Vientiane was given per kilogram. On average, duck meat is cheaper than chicken meat but eggs are more expensive (ducks typically weigh more which explains why they are more expensive per head).

<sup>6</sup> Vientiane: (LAK/KG)

**Table 72: Duck Product Sale Prices (LAK/Head<sup>7</sup>, LAK/Egg)**

	Vientiane		North		Savannakhet		Total	
	Low Season	High Season	Low Season	High Season	Low Season	High Season	Low Season	High Season
Broiler	21,824	23,313	31,667	40,000	43,333	45,000		
Layers	24,000	26,000	.	.	40,000	40,000		
Spent Layers	22,250	23,333	.	.	40,000	40,000		
Males	22,333	24,000	.	.	50,000	50,000		
Egg	1,012	1,023	.	.	.			

Due to the large variation in flock sizes we find there a great deal of variation in the average income from poultry sales and the standard deviations are large. Income from poultry is highest for chicken producers in Vientiane where large producers earned approximately \$965 USD per month. Duck producers on average make less than chicken producers in every region, yet as a percentage of total income it represents a higher share in Vientiane and Savannakhet. This signals that large chicken producers are likely better off than the large duck producers, although the appearance of large industrial chicken observations in the data certainly has an affect on the averages.

**Table 73: Average Income from Poultry Sales (LAK/Month)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Income	7,595,870	2,190,023	5,952,556	850,000	4,091,786	2,176,667
% of Total Income	50.6	53.0	42.6	31.3	22.3	43.3

#### 4.2.5 Biosecurity and HPAI Disease Experience

Large producers are responsible about the disposal of birds that die from disease and only 2 reported selling birds that had died. Most producers bury their dead birds or burn the birds.

Large producers take more biosecurity measures than small producers. Producers in Vientiane and the North take the most steps, while producers in Savannakhet mostly clean bird enclosures regularly and keep flocks separate from other birds. Overall, producers in the North take the most biosecurity measures.

<sup>7</sup> Vientiane: LAK/KG

**Table 74: Biosecurity Measures**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Keep Birds in an Enclosure at All Times	59.3	58.6	66.7	100	7.1	33.3
Clean Enclosure regularly	86.4	89.7	77.8	100	96.4	100
Use Gloves, boots, and/or masks when handling birds	39.5	20.7	44.4	33.3	0	0
Keep birds over cement	6.2	3.5	33.3	33.3	3.6	0
Keep flock separate from other birds	30.9	24.1	22.2	100	89.3	100
Use vaccinations	38.3	20.7	55.6	0	3.6	0

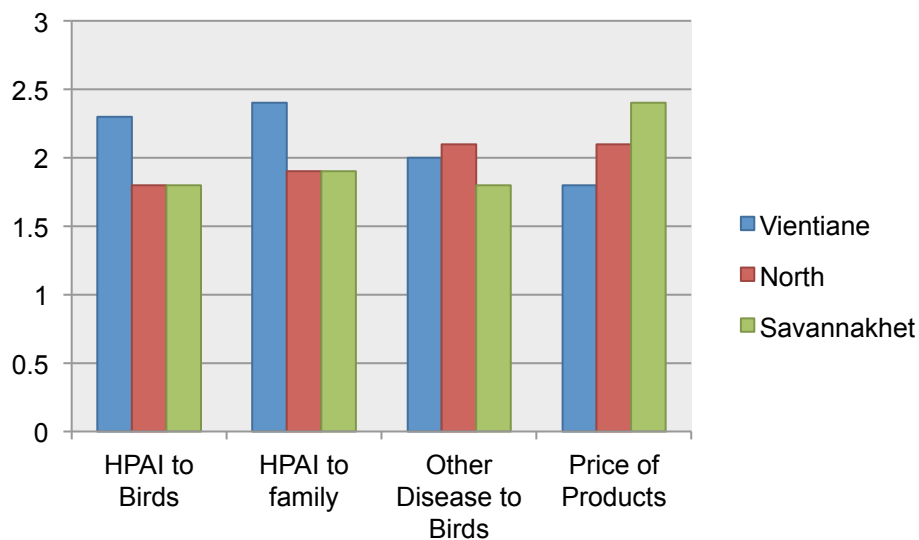
In Vientiane, 10% of chicken producers and 17.2% of duck producers had their flocks culled in response to HPAI outbreaks. In the North, no chicken producers and 1 duck farmer reported having culled flocks. In Savannakhet, 1 chicken farmer had their flock culled while duck farmers had no losses. In Vientiane producers only received approximately \$0.75 USD per kilogram compared to \$2.05 USD per kilogram in Savannakhet and \$1.80 in the North.

**Table 75: Summary Statistics of Farmers with Culled Birds**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
% of Flock Lost	100	100	.	20	85	.
Number of Birds	1,757	162	.	20	13,000	.
Compensation (LAK/KG)	6,000	5,200	.	15,000	16,800	.

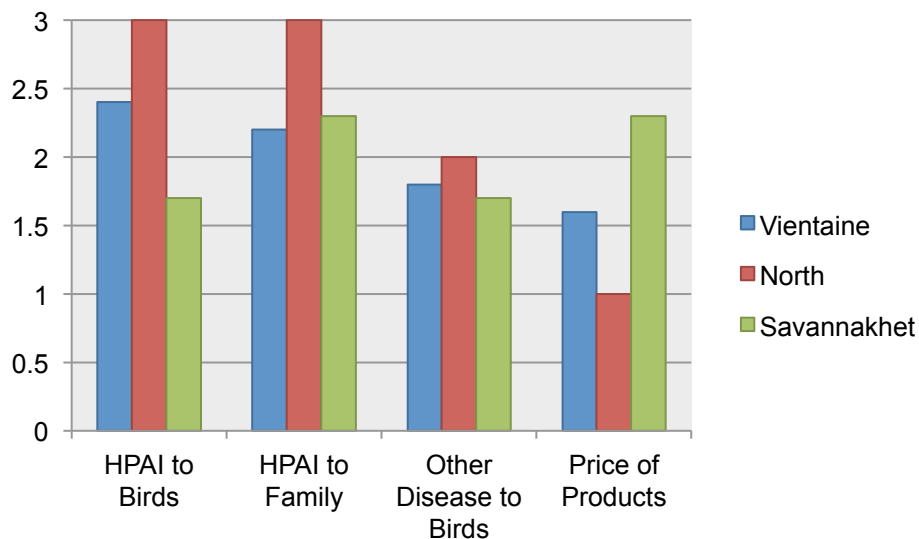
In regards to disease concerns, all chicken producers are more worried about HPAI affecting their family than they are about it affecting their flock. In Vientiane and the North, producers are more worried about other diseases than HPAI. In Savannakhet, producers were most concerned with the price of their products, which was unique amongst the regions.

**Figure 12: Largescale Chicken Farmer Disease Concerns**



For duck producers, respondents in the North were most concerned about HPAI, either affecting their birds or their families. In Vientiane, HPAI concerns were higher than all others, and HPAI to birds was considered a larger risk. In Savannakhet, duck producers were most concerned with the price of their products, followed by HPAI affecting their family.

**Figure 13: Largescale Duck Farmer Disease Concerns**



#### 4.2.6 Transboundary Risk

In Northern Lao PDR, 33% of chicken producers reported buying and/or selling poultry products from neighboring countries. All 3 of these producers said that they had

purchased eggs, from China, while one said they had purchased an adult live bird. For duck producers, 100% reported buying products, buying eggs from either China or Vietnam.

**Table 76: What Products are Bought (Percent of Producers)**

	North			
	China		Viet Nam	
	Chicken	Duck	Chicken	Duck
Eggs	33.3	66.7	0	33.3
Chicks	0	0	0	0
Adult Birds	11.1	0	0	0
Feed	22.2	0	0	0
None	66.7	33.3	100	66.7

More surprisingly, producers also reported selling products to China with one producer claiming they sold eggs and another claiming they sold live birds.

**Table 77: What Products are Sold (Percent of Producers)**

	North			
	China		Viet Nam	
	Chicken	Duck	Chicken	Duck
Eggs	11.1	0	0	0
Chicks	0	0	0	0
Adult Birds	11.1	0	0	0
Slaughtered Birds	0	0	0	0
None	88.9	100	100	100

While only 33% of producers admitted to purchasing Chinese poultry products, all producers said that Chinese poultry products could be found in their village, with 78% of chicken producers reporting they are very common. Eggs were reported as the most common product type followed by live birds.

**Table 78: Types of Chinese Poultry Products Seen (Percent of Producers)**

	North	
	Freq.	Percent
Live Birds	3	25.0
Slaughtered Birds	1	8.3
Eggs	9	75.0

### 4.3 Aggregators

In total, 104 aggregator observations were recorded. The most observations came from the North as enumerators were pushed hard to find as many aggregators as possible to ascertain the role they play in the transboundary risk issue.

**Table 79: Aggregator Sample Size**

	Vientiane	North	Savannakhet	Total
Observations	27	41	36	104

#### 4.3.1 Poultry Trading Background

Local birds, specifically chicken, were the most commonly traded product by aggregators and in general, chickens are traded more frequently than ducks. Commercial birds were traded most commonly in Vientiane and the North, but were much less common in Savannakhet. However, aggregators in Savannakhet were the only ones who traded commercial chicks and ducklings. As producer data showed, common ducks are the preferred breed, and Muscovy ducks were only heavily traded in the North. Aggregators who sold eggs were only found in the North; however these aggregators certainly do exist in other regions, but unfortunately could not be located.

**Table 80: Poultry Products Traded**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Commercial Birds	22.2%	11.1%	12.2%	7.3%	2.8%	2.8%
Commercial Chicks/Ducklings	0%	0%	0%	0%	5.6%	2.8%
Local Birds	81.5%	70.4%	92.7%	80.5%	88.9%	55.6%
Local Chicks/Ducklings	11.1%	7.4%	2.4%	7.3%	5.6%	2.8%
Muscovy Ducks	.	3.7%	.	36.6%	.	0%
Eggs	0%	0%	9.8%	7.3%	0%	0%
Fertilized Eggs	0%	0%	2.4%	0%	0%	0%
Other	3.7%		0%		0%	

Many aggregators also raise birds themselves. Aggregators were also asked if they keep birds overnight, and therefore we can identify how common it is for an aggregator to mix traded birds with their own flock. This presents a large biosecurity risk because infected birds can be introduced to an aggregator's flock which can then become disease carriers for future birds that aggregator's trade. We find that mixing of birds was



most common in the north where nearly 50% of aggregators raised birds and kept traded birds overnight.

**Table 81: Keep Birds Overnight and Raise Birds**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Yes	10	37	20	48.8	6	16.7

Aggregators in Vientiane traded with more sources than those in the North and Savannakhet. Vientiane aggregators purchased birds from 12 sources on average and sold to 9, while aggregators in other regions purchased from approximately 3.5 sources and sold to 1.5.

**Table 82: Average Number of Sources Traded with per Month**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Buy	12.1	27.2	3.5	1.5	3.4	1.6
Sell	9.2	24.6	1.6	1.0	1.5	1.2

#### 4.3.2 Trade Volumes, Costs, and Income

Aggregator's primarily source products from smallscale farmers, however there are differences between regions. In Vientiane, aggregators source exclusively from smallscale farmers or other traders. Vientiane traders are the most likely overall to source from small farmers and may explain why they purchase from more sources on average than traders in other regions. In the North, traders also source from largescale farmers and were the only group to so in our sample. However, our largescale observations show that aggregators are the largest marketing channel for large producers, and therefore these aggregators were missed in our sample. In Savannakhet, aggregators are the most likely to source from other traders and over 25% of purchases on average come from this source.

**Table 83: Source of Poultry Products**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Smallscale farms (<100 birds)	88.4%	89.0%	77.3%	76.6%	65.8%	63.9%
Largescale farms (>100 birds)	0%	0%	6.8%	7.1%	0%	0%
Commercial Farms (>1000 birds)	0%	0%	0%	0%	0%	0%
Other Traders	11.5%	11.0%	10.5%	11.1%	28.3%	27.8%
Vendors	0%	0%	5.1%	5%	5.8%	4.8%
Other	0%	0%	0	0%	0%	3.5%

In regards to costs, gasoline was the most common cost listed for aggregators which can be expected as the majority of traders use a motorbike for the transportation of their products. Feed is another large source of costs because many aggregators hold birds over night, or will feed birds before sales to increase weight.

**Table 84: Aggregators with Costs Associated with Trading Business**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Feed	10	37.0	36	87.8	18	50
Water	2	7.4	27	65.8	3	8.3
Employees	0	0	0	0	1	2.7
Gasoline	19	70.4	37	90.2	32	88.9
Transportation Rental	9	33.3	0	0	12	33.3
Building an Enclosure	1	3.7	25	61.0	7	19.4

Gasoline and transportation rental are the two largest costs for aggregators as well. Gasoline costs vary depending on the distance traveled, but on average we find aggregators spent between \$51 and \$152 USD a month on gasoline. Similar to gasoline, transportation costs are large as well, and in Vientiane they were much higher than gasoline costs. Aggregators that must rent transportation spend between \$123 to \$136 USD a month. Feed costs were also high especially when compared to smallscale producer feed costs. In the North, aggregators spent nearly twice the amount on feed as smallscale producers and in Savannakhet they spent over double. We also encountered an aggregator in Savannakhet that utilized employees, which yielded sizable costs.

**Table 85: Average Cost of Each Input for Respondents Using Inputs (LAK/Month)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Feed	85,000	55,045	305,944	292,565	318,111	193,957
Water	.	.	32,938	71,475	56,667	11,547
Employees	.	.	.	.	1,800,000	.
Gasoline	422,000	386,372	701,600	400,344	1,249,375	1,821,428
Transportation Rental	1,117,500	283,133	.	.	1,010,000	306,594
Building an Enclosure	20,000	.	249,200	116,079	80,000	40,000

Looking at reported buying and selling quantities reveals some important characteristics despite large discrepancies in data. The data reveals that broilers are the primary product traded among aggregators especially in the North where trader's only reported selling broilers birds. Layers, males for breeding, and chicks were all much less common and their quantities were far below those of broilers. In regards to quantities, our data demonstrates the strong seasonal characteristic of poultry sales, especially for broilers. This is because poultry meat is an important food source during festivals and holidays and aggregators meet the increased demand by purchasing and selling larger quantities. We also find that aggregators trade larger volumes of chickens than ducks, as this data only examines producers who trade these products and thus accounts for the fact that more aggregators trade chicken than duck.

Sales quantities show that the reported buying and selling margins do not always add up. This could occur for a variety of reasons. First, aggregators may purchase more birds than they sell and keep the birds for later dates. It is common for aggregators to keep birds overnight and 70% said they routinely do, keeping birds for 1 to 7 days at a time. Secondly, aggregators may want to underemphasize the amount of birds they sell in fear that if their revenues are too large they may be subject to tax and inspection. Although enumerators stated they were working with the National University of Lao PDR and the FAO, many respondents can still be skeptical. Finally, there is likely a large amount of human error both from the respondents and enumerators. In theory, a good enumerator should catch any large discrepancies between the reported buying and selling quantities, but in practice this is not always the case. Additionally, many

aggregators may not readily know these numbers off the top of their heads and simply provide loose estimates.

**Table 86: Average Amount of Products Purchased Per Week**

Chicken	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Meat	139.3	180.2	102.5	155.3	141.6	246.2
Layer	10	16.4	0	0	0.1	0.1
Male (breeding)	2.1	3.2	0	0	6.7	11.4
Chicks	16.6	16	0	0	2.7	2.2
Eggs	0	0	34.1	45	0	0
Fertilized Eggs	0	0	0	0	0	0
Duck	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Meat	81.6	107.8	72.6	114.1	53.5	111.8
Layer	10.7	18.1	0	0	0.3	0.2
Male (breeding)	6.1	10.2	0	0	2.8	15.7
Chicks	3.8	3.8	0	0	4.5	3.6
Eggs	0	0	41.1	52.1	0	0
Fertilized Eggs	0	0	0	0	0	0

**Table 87: Average Amount of Products Sold Per Week**

Chicken	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Meat	56.9	119.7	32.6	46.8	145.8	216.4
Layer	4.6	12.1	0.1	0.2	0.3	0.1
Male (breeding)	3.6	6.2	0.1	0.1	10.6	11.4
Chicks	11.5	13.3	0	0	3.3	2.2
Eggs	0	0	29.5	40.9	0	0
Fertilized Eggs	0	0	0	0	0	0
Duck	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Meat	73.3	51.3	21.9	32.9	55.8	116.0
Layer	12.3	18.3	0.1	0.2	0.2	0
Male (breeding)	2.9	5.9	0.1	0.1	3.0	16.4
Chicks	2.9	4.1	0	0	4.8	3.8
Eggs	0	0	36.6	47.6	0	0
Fertilized Eggs	0	0	0	0	0	0

Similar to producers, aggregators outside of Vientiane price birds per head rather than per kilogram. Aggregator pricing information presents a similar pattern as discussed before; chicken meat is more expensive than duck meat, prices are lower in

Savannakhet, and there are is little variation between prices of different bird types. Purchase and sale prices also can provide estimates on aggregator's revenue margins.

**Table 88: Average Buying Price (LAK/Head<sup>8</sup> , LAK/EGG)**

Chicken	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Meat	24,231	26,500	26,605	32,026	21,575	23,625
Layer	25,500	27,167	.	.	25,000	25,000
Spent Layer	25,111	26,778	.	.	22,500	25,000
Male (breeding)	24,600	27,600	.	.	23,000	24,150
Chicks	.	.	.	.	1,500	1,500
Eggs	.	.	722	833	.	.
Fertilized Eggs	.	.	.	.	.	.
Duck	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Meat	19,286	21,095	32,083	38,000	32,905	35,190
Layer	19,142	20,429	.	.	37,000	37,000
Spent Layer	19,428	21,000	.	.	35,500	40,500
Male (breeding)	19,200	20,000	.	.	35,533	38,167
Chicks	.	.	.	.	1,500	1,500
Eggs	.	.	1044	1,156	.	.
Fertilized Eggs	.	.	.	.	.	.

**Table 89: Average Selling Price (LAK/Head<sup>9</sup> , LAK/EGG)**

Chicken	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Meat	28,000	30,375	30,855	37,632	28,303	32,485
Layer	26,667	30,000	30,000	35,000	35,000	35,000
Spent Layer	24,833	28,833	30,000	35,000	29,800	35,400
Male (breeding)	27,857	30,000	35,000	40,000	29,857	34,857
Chicks	.	.	.	.	.	.
Eggs	.	.	900	1,133	.	.
Fertilized Eggs	.	.	.	.	.	.
Duck	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Meat	22,684	25,368	37,639	44,028	40,900	44,050
Layer	21,000	24,857	35,000	40,000	50,000	55,000
Spent Layer	20,200	24,200	35,000	40,000	42,800	49,400
Male (breeding)	21,000	24,857	40,000	45,000	50,400	56,800
Chicks	.	.	.	.	.	.
Eggs	.	.	1,333	1,567	.	.
Fertilized Eggs	.	.	.	.	.	.

<sup>8</sup> Vientiane: LAK/KG

<sup>9</sup> Vientiane: LAK/KG

Looking at broiler pricing data which is the most commonly sold product and has the largest amount of observations we can estimate aggregator's revenue margins per bird. We find that aggregators in Vientiane that price per kilogram earn approximately \$0.41 to \$0.52 per kilogram sold. In the North and Savannakhet, where birds are priced per head we find that aggregators earn approximately \$0.52 to \$1.08 per bird sold. In general, revenue margins are larger in Savannakhet than in the North, and are higher for ducks overall. We also find that revenue margins increase for all aggregators during the high season.

Aggregators sell to a variety of sources, and there are large differences between regions. For all aggregator's market vendor sales are the largest marketing channel, particularly for aggregators in Vientiane. Direct sales to consumers are also high in Vientiane, but are largest in the North where over a third of all sales go to end users. In Savannakhet, aggregators sell primarily to market vendors and then a mixture between consumers, restaurants and shops, other traders, and poultry farmers.

**Table 90: Sales Channels**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Market Vendors	70.4%	79.5%	43.5%	45.8%	46.9%	59.5%
Consumers	23.5%	14.5%	35.1%	33.6%	11.4%	12.7%
Restaurants/Shops	1.2%	1.5%	10.1%	11.4%	18.6%	8.2%
Other Traders	5%	4.5%	11.0%	9.5%	10.9%	4.5%
Poultry Farmers	0%	0%	0%	0%	6.6%	5.9%
Other	0%	0%	0%	0%	5.7%	9.1%

Aggregators earn approximately \$150 to \$510 USD month, but income from poultry trading varies widely between aggregators and between regions. Income was highest overall in Savannakhet, but there is a large standard deviation for this average and is skewed by larger, more successful trading operations. The North and Vientiane data represents a more accurate estimate given the smaller standard deviations and similar values.

**Table 91: Average Income from Poultry Trading (LAK/Month)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Income	1,754,444	1,320,997	1,209,900	1,358,877	4,187,059	6,335,233
% of Total Income	63.1	30.1	44.8	30.8	55.6	27.7

### 4.3.3 Biosecurity and HPAI Disease Experience

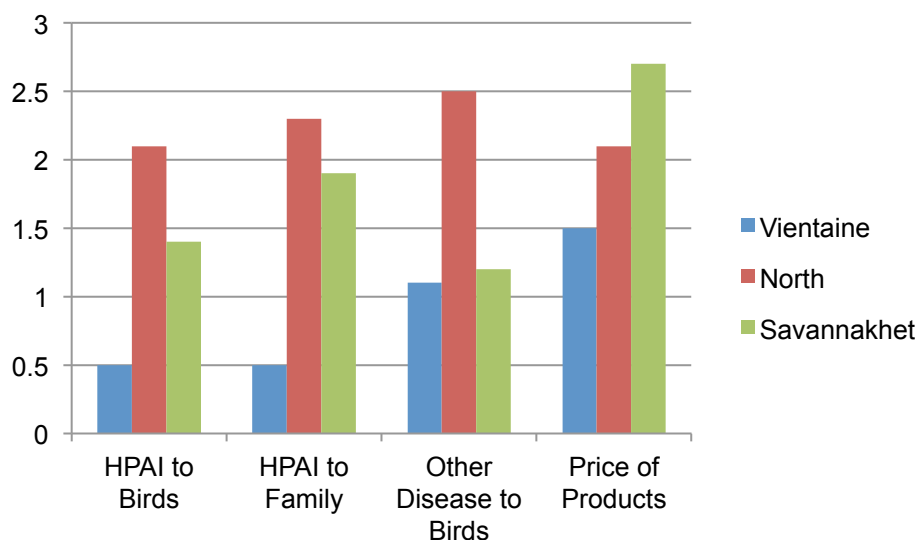
Aggregators take some precautionary measures against disease, most commonly cleaning holding facilities and culling birds that appear sick. Most aggregators have never had their trading practice inspected by authorities, and therefore biosecurity measures are likely done under their own accord. Inspections were highest in Vientiane with 26% of aggregators claimed their trading operation faced some sort of examination.

Over 85% of aggregators reported they had changed their trading practices after HPAI outbreaks. The most common responses were that aggregators now trade less poultry and have changed the products that they trade. Increasing biosecurity measures, such as keeping flocks separate, were not listed as a common response to HPAI.

**Table 92: Changed Trading Practices after HPAI**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Yes...	23	85.2	34	85	31	86.1
...Trade less poultry	16	69.6	35	100	24	72.7
...Trade more poultry	1	4.3	0	0	0	0
...Changed people to trade with	3	13.0	0	0	2	6.5
...Trade different products	7	30.4	16	47.1	9	28.1
...Increased biosecurity	1	4.3	2	5.9	0	0

We find that aggregators in Vientiane and Savannakhet are less concerned about disease risk than poultry producers and more concerned about product prices. Aggregators from all regions expressed greater concern about HPAI affecting their family instead of their birds, and respondents in the Vientiane and the North were even more concerned about other disease.

**Figure 14: Aggregator Disease Concerns**

#### 4.3.4 Transboundary Risk

Aggregators present a huge potential for transboundary risk, but the majority of aggregators our enumerators encountered in the North did not trade foreign poultry products. However, traders of foreign poultry products tend to be nationals of the foreign countries and therefore our enumerators could not interview these individuals because of possible language or social barriers.

Aggregators were asked what foreign poultry products were bought for their business, and 27% said they purchased eggs. However, when we look at our background data only 3 of these 11 aggregators identified that they sell eggs and thus it appears the remaining 8 aggregators likely purchased for consumption. In terms of sales, no aggregators reported selling products to other countries.

**Table 93: What Products are Bought (Percent of Aggregators)**

	North			
	China		Viet Nam	
	Freq.	Percent	Freq.	Percent
Eggs	11	26.8	0	0
Chicks	0	0	0	0
Live Birds	1	2.4	0	0
Slaughtered Birds	0	0	0	0
Feed	1	2.4	0	0
None	30	73.2	41	100



However data on the prevalence of Chinese poultry adds further evidence to the ubiquity of Chinese poultry products, especially eggs. Only 3 aggregators reported that they have never seen Chinese poultry in their village, and the majority (66%) said that Chinese poultry products were very common.

**Table 94: Types of Chinese Poultry Products Seen (Percent of Aggregators)**

	North	
	Freq.	Percent
Live Birds	6	14.6
Slaughtered Birds	3	7.3
Eggs	37	90.2

#### 4.4 Market Vendor

Representing the final stage of the supply chain, market vendors are an essential link connecting rural producers to urban consumers. In total, 187 market vendor observations were recorded with the most coming from Vientiane due to higher number of markets.

**Table 95: Market Vendor Sample Size**

	Vientiane	North	Savannakhet	Total
Observations	99	43	45	187

##### 4.4.1 Poultry Vending Background

Vendors in Vientiane most frequently sold commercial chickens, followed by local chickens. This is unique among all vendors due to the large and expanding presence of CP products at local wet markets. In other regions, local birds were the most common product sold, although commercial chickens were sold by over a quarter of producers in the North and Savannakhet. Across all regions chicken vendors were more common than duck vendors.

**Table 96: Poultry Products Sold**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Commercial Birds	47.5	7.1	30.2	23.3	24.4	8.9
Local Birds	40.4	28.3	79.1	65.1	75.6	53.3
Muscovy Ducks	.	0	.	37.2	.	2.2
Eggs	20.2	4.0	11.6	9.3	0	6.7
Fertilized Eggs	0	0	0	0	0	2.2
Other	7.1		0		4.4	

Most market vendors have a market space that they rent either on a daily, monthly or yearly basis. Outside of Vientiane where there are more informal markets it was more common for vendors to have no rental space where vendors place their products on a mat on the ground outside the market.

**Table 97: Market Space**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Temporary (No rental)	2	2.1	6	14.6	5	11.4
Temporary (Rental)	86	91.5	30	73.2	39	88.6
Permanent (purchased)	6	6.4	5	12.2	0	0

No smallscale producers reported selling any slaughtered birds, and thus the majority of birds are slaughtered as they move down the supply chain either by aggregators or vendors. We found slaughtered birds most common in Vientiane and Savannakhet, and vendors in Vientiane were more likely to buy birds already slaughtered while vendors in Savannakhet were likely to slaughter the birds themselves.

**Table 98: Sell Slaughtered Birds**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Yes	72	75.8	15	35.7	31	68.9
Slaughter at Market	0	0	0	0	3	9.7
Buy Slaughtered	43	59.7	5	33.3	8	25.8
Personally Slaughter	26	36.1	10	66.7	21	67.7
Pay someone else to slaughter	0	0	0	0	2	6.5

Vendors with the potentially hazardous risk of keeping birds overnight and raising poultry were identified, and were most common outside of Vientiane. The low rates in Vientiane can be explained in two parts. First vendors in Vientiane are the least likely to raise poultry. Second, vendors in Vientiane were more likely to sell commercial birds which are purchased slaughtered from a company. Therefore the rate of birds mixing in Vientiane is very low compared to other regions.

**Table 99: Keep Birds Overnight and Raise Birds**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Yes	5	5.1	12	27.9	10	22.2

Market vendors also engaged in other poultry related activities. The most common of which was to operate as aggregators where they buy birds directly from farmers and then sell in the market. This was most common in Vientiane (69% of vendors) and the North (51%).

**Table 100: Other Poultry Activities**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Sell Other Meat (non-poultry)	22	22.2	4	9.3	3	6.7
Operate a poultry trading business	68	68.7	22	51.2	15	33.3
Operate a poultry slaughtering business	4	4.0	14	32.6	18	40
Sell from other locations	14	14.1	1	2.3	7	15.6

#### 4.4.2 Trade Volumes, Costs, and Income

Looking at the source of poultry products for market vendors, again the importance of aggregators in the supply chain can be seen. Aggregators are the most important source of inputs for vendors across all regions, where birds are either purchased at the market or are delivered to the vendor's home. Outside of Vientiane, sourcing from a farm was more common, and was more common for duck purchases than chicken purchases. Sourcing from a company was most common in Vientiane as many vendors sell CP products. Vendors in the North also sourced from a company with 4 vendors reporting they sourced 100% of their products from a Chinese company.

**Table 101: Source of Poultry Products**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Trader delivers to market	36.8	39.7	37.4	35.4	51.8	51.7
Trader delivers to home	9.8	23.1	18.0	17.6	12.7	5.5
Directly from farm	13.6	19.4	23.9	24.0	21.1	29.7
Other market vendors	5.7	11.1	8.0	8.8	4.5	5.2
Own Flock	0.2	1.1	0.2	0.2	0.7	1.0
Company	34	5.6	12.8	13.9	4.5	0
Other	0	0	0	0	4.5	6.9

There were a variety of costs that market vendors reported having. Overall renting market space was the most common cost among vendors. Feed and water is necessary when selling live birds and therefore more vendors in the North and Savannakhet reported having these costs as there are live bird sales. Conversely, ice is a cost associated with slaughtered birds and was therefore more frequent in Vientiane. Plastic bags were used most frequently in Vientiane, and the majority of vendors reported having this input. Gasoline and transportation rental is for all vendors who do not purchase birds at the market and must transport their products. In Savannakhet, many producers identified an additional cost, which was a basket for bird housing at the market.

**Table 102: Market Vendors with Costs Associated with Vending**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Feed	1	1.0	30	69.8	27	60
Water	14	14.1	16	37.2	15	33.3
Ice	47	47.5	5	11.6	10	22.2
Plastic Bags	89	89.9	28	65.1	32	71.1
Gasoline	48	48.5	29	67.4	20	44.4
Transportation Rental	13	13.1	3	7.0	15	33.3
Market Space	91	91.9	34	79.1	42	93.3
Other	0	0	5	11.6	24	53.3

Gasoline and transportation rental are the largest overall costs for producers reporting using those inputs. There is little variation between regions in average costs except for ice and plastic bags in Vientiane for the larger amount of slaughtered birds. We also find that market rental space in Vientiane is significantly more expensive than in the other regions.

**Table 103: Average Cost of Each Input for Respondents Using Inputs (LAK/Day)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Feed	6,000	.	6,880	5,389	4,440	2,357
Water	4,595	2,898	1,495	1,664	10,156	21,883
Ice	14,933	14,076	6,229	2,899	4,601	2,270
Plastic Bags	7,336	6,754	3,672	4,035	3,886	6,455
Gasoline	17,040	20,584	19,696	16,150	18,917	18,207
Transportation Rental	21,308	11,056	13,810	6,442	24,292	15,071
Market Space	25,440	33,819	4,500	8,652	5,734	3,510
Other	.	.	12,866	20,856	1,281	3,292

Looking at purchase and sales quantities, we only take the averages of vendors that trade that product. Vendors that purchase and sell commercial birds in Vientiane have larger volumes than vendors of local birds. In other regions, local bird purchases and sales are larger, or slightly less (except ducks in Savannakhet). Overall, vendors in Vientiane and Savannakhet had larger purchase and sale quantities than vendors in the North.

We find much smaller discrepancies the reporting buying and selling quantities of vendors than we do with aggregators and most vendors sell the majority of their products. Vendors were asked what is done with unsold products and over 86% responded that products were kept for sales the next day. Outside of Vientiane, another common response was to keep products for home consumption.

**Table 104: Average Amount of Products Purchased Per Day (Heads/Day, Eggs/Day)**

Chicken	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Commercial	38	64	8.7	12	21	33.9
Local	20	31	9.6	15.6	18.5	40.3
Eggs	843	1,138	56.2	91	0	0
Fertilized Eggs	0	0	0	0	0	0
Duck	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Commercial	23	57	5.6	9.5	22	45
Local	15	23	6.7	12.5	9.9	36.1
Eggs	645	908	53.3	95	45	55
Fertilized Eggs	0	0	0	0	70	175

**Table 105: Average Amount of Products Sold Per Day (Heads/Day, Eggs/Day)**

Chicken	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Commercial	34	51	7.9	10.9	19.2	33.8
Local	20	24	9.4	14.9	18	40.1
Eggs	612	798	114	178	0	0
Fertilized Eggs	0	0	0	0	0	0
Duck	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Commercial	22	57	5.1	7.6	16.5	43.2
Local	9	16	6.9	12.7	9.9	35.6
Eggs	473	735	48	92.5	45	55
Fertilized Eggs	0	0	0	0	40	50

Product prices were again given in per kilogram in Vientiane and per head outside of Vientiane. Pricing data strengthens statements previously made about differences between commercial and local meat, as well as differences between regions. Data from Vientiane demonstrates that end user prices of commercial meat is significantly cheaper than local meat. During the low season commercial meat costs approximately \$3.03 USD per kilogram while local meat (slaughtered) costs \$4.29 USD per kilogram.

**Table 106: Average Selling Price (LAK/Head<sup>10</sup> , LAK/Egg)**

Chicken	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Commercial (live)	.	.	22,750	25,500	30,000	30,000
Commercial (slaughtered)	24,875	27,167	27,000	30,200	25,875	30,375
Local (live)	34,600	38,200	30,958	39,000	25,555	27,555
Local (slaughtered)	35,226	38,686	35,625	42,375	31,076	37,846
Eggs	853	888	807	953	.	.
Fertilized Eggs	.	.	.	.	.	.
Duck	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Commercial (live)	.	.	31,250	35,000	25,000	25,000
Commercial (slaughtered)	26,800	30,200	32,375	34,875	38,333	50,000
Local (live)	22,500	25,833	40,111	48,055	38,125	41,500
Local (slaughtered)	29,391	32,261	45,357	53,928	49,941	57,765
Eggs	1,025	1,067	1,025	1,217	1,600	2,500
Fertilized Eggs	.	.	.	.	1,500	2,750

Just like aggregators, we find that market vendor income varies widely between regions and vendors. Vendors in Vientiane and Savannakhet reported earning the most, making \$322 and \$446 USD per month respectively. Vendors in Vientiane and Savannakhet sold more birds on average than vendors in the North and therefore the higher income in these regions reasonable.

**Table 107: Average Income from Selling Poultry (LAK/Month)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Income	2,637,077	4,677,628	1,244,535	1,082,524	3,655,778	2,839,644
% of Total Income	47.4	25.8	40.6	26.7	65.6	23.9

#### 4.4.3 Biosecurity and HPAI Disease Experience

Despite Northern farmers taking the most biosecurity measures, we see that Northern vendors take the least biosecurity measures. Vendors in Vientiane reported conducting the most measures with almost all vendors claiming they clean their holding facilities and market space frequently. Using any sort of protection when handling or slaughtering

<sup>10</sup> Vientiane: LAK/KG

birds was also most frequently done in Vientiane. Separating birds by species was done most commonly among vendors in Savannakhet. Markets in the north were more basic than those in Savannakhet and especially Vientiane, and therefore it's unsurprising that Northern vendors take the least precautions.

**Table 108: Biosecurity Measures**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Regularly Clean Holding Facilities	91	91.9	8	18.6	22	48.9
Regularly clean market space	97	98.0	11	25.6	36	80
Use gloves, mask, and/or boots when handling birds	32	32.3	3	7.0	7	15.6
Keep live birds separated by species	17	17.2	1	2.3	23	51.1

Vendors were less likely to change their operations in response to HPAI outbreaks than aggregators and in Vientiane only 62% of vendors reported undertaking any changes. The most frequent changes were selling less poultry and changing the products that are sold.

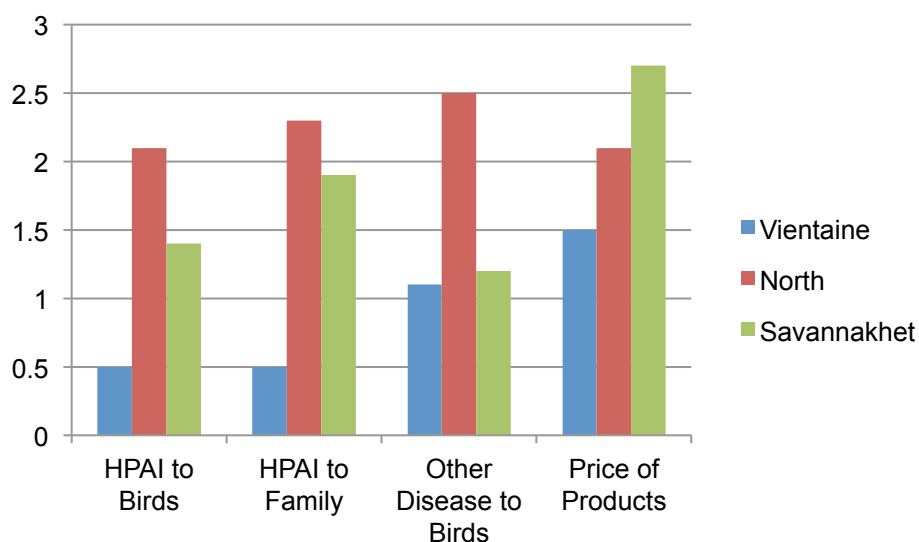
**Table 109: Changed Trading Practices after HPAI**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Yes...	61	62.2	39	90.7	39	86.7
...Sell less poultry	31	50.8	39	100	32	82.1
...Sell more poultry	1	1.6	0	0	0	0
...Changed people to source from	7	11.5	1	2.6	5	12.8
...Sell different products	48	78.7	7	18.0	6	15.4
...Increased biosecurity	1	1.6	7	18.0	1	2.6
...Only sell slaughtered birds	0	0	2	5.1	6	15.4

Similar to aggregators, vendors are generally more concerned about the price of products than they are worried about disease. Vendors in Vientiane were especially unworried about HPAI, while vendors in the North expressed the largest concerns about HPAI and disease which is understandable given recent HPAI outbreaks in the North.



**Figure 15: Market Vendor Disease Concerns**



#### 4.4.4 Transboundary Risk

Nearly a third of vendors in the North reported buying products from neighboring countries. It is likely that the actual number is much higher than this, as many vendors in Northern markets are Chinese and only speak Mandarin, and were thus not interviewed. The most common products bought for sales were eggs, followed by slaughtered birds.

**Table 110: What Products are Bought (Percent of Vendors)**

	North			
	China		Viet Nam	
	Freq.	Percent	Freq.	Percent
Eggs	10	23.3	1	2.3
Live Birds	0	0	0	0
Slaughtered Birds	4	9.3	0	0
Other	3	7.0	0	0

Vendors were asked to rank the importance of different attributes in deciding to buy foreign poultry products. Price was selected as the most important reason for purchasing foreign/Chinese products followed by availability. The relationship or networks was not listed as an important reason. This reveals that the large supply of Chinese products into Lao PDR encourage many vendors to purchase eggs in order to remain competitive with other vendors.

**Table 111: Importance of Different Attributes in Buying Foreign Poultry Products (Ranked 1 to 3)**

	North	
	Mean	SD
Price	2.9	0.5
Availability	1.8	0.4
Relationship with Seller	1.3	0.6

Because of the stigma attached to Chinese poultry products enumerators also asked vendors how common Chinese products were with among other vendors at the same market. Only 1 vendor reported they had not seen Chinese products in their market, while 63% said Chinese products were very common. Just as our other data illustrates, Chinese eggs are the most widespread followed by slaughtered and live birds.

**Table 112: Types of Chinese Poultry Products Seen at Market**

	North	
	Freq.	Percent
Live Birds	7	16.3
Slaughtered Birds	13	31.0
Eggs	42	97.7

## 5. Household Survey Findings

In total, 1,804 consumer observations were recorded from the urban villages in our sample. Household information reveals a variety of useful information about consumer's preferences and how they purchase poultry.

**Table 113: Consumer Household Sample Size**

	Vientiane	North	Savannakhet	Total
Observations	782	520	502	1,804

### 5.1 Household Shopping Background

Consumers went to the market 3.8 to 5.1 on average depending on the region. Vientiane household's visited households most often, which is logical given the higher density of markets in the capital.

In regards to food expenditures, we find that across the country most households spend approximately \$40 on food per month. Households in the North had the largest expenditures on food eaten outside the home or prepared food, spending approximately \$12 per month. Expenditures on food to be prepared in the home ranged from 69% of total food expenditures in the North to 82% in Savannakhet. Chicken meat expenses were largest in Vientiane, where households spent \$4.76 USD per month on average or 15% of the total amount spent on food to be prepared in the home. Duck meat expenses were largest for northern households, spending \$3.35 USD per month or 12% of the total amount spent on food to be prepared in the home. Duck egg expenses were also largest in the North, while Chicken egg expenses were largest in Savannakhet.

**Table 114: Weekly Food Expenditures (LAK/Week)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Total on all food	321,217	178,850	328,052	163,244	328,384	201,701
Food eaten outside the home/ prepared food	66,898	81,513	99,865	82,459	57,821	80,938
Food to be prepared in the home	254,182	157,558	227,296	113,388	268,641	173,781
Chicken meat	39,081	39,796	29,673	19,838	30,732	32,074
Duck meat	16,535	28,884	27,452	20,914	18,835	27,919
Chicken eggs	15,939	12,501	14,020	10,764	16,683	11,634
Duck eggs	3,455	8,957	11,934	12,024	8,003	11,084
Other meat	62,355	70,786	73,900	45,370	84,034	76,935

Looking at quantities purchased largely mirrors the food expenditure data. Households in Vientiane and Savannakhet consumed the most chicken per week, although Savannakhet households spent less because of lower chicken meat prices. Duck meat and egg consumption was highest in the North.

**Table 115: Weekly Meat and Egg Consumption (KG/Week, Egg/Week)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Chicken Meat	1.3	1.2	1.1	0.6	1.3	1.4
Duck Meat	0.7	1.1	1.0	0.6	0.7	0.9
Other meat	2.3	1.4	2.7	3.1	2.8	2.2
Chicken Eggs	16.3	12.7	14.8	12.4	18.5	13.5
Duck Eggs	2.7	5.7	10.3	9.0	7.4	10.6

Chicken meat was the most frequent meat purchase among consumers, where the majority purchase birds weekly. In Vientiane and Savannakhet, we find that the majority of households do not in fact purchase duck meat at all. Households that do purchase duck meat in these regions, either purchase primarily for special occasions (Vientiane) or on a weekly basis (Savannakhet). Poultry meat purchasing is the lowest overall in Savannakhet where nearly 20% of households do not purchase any poultry meat all.

**Table 116: Frequency of Meat Purchases (% of Respondents)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Daily	1.0	0.4	0.2	0.2	0.8	0.4
Every Other Day	3.3	1.5	7.3	3.9	6.2	1.6
Weekly	34.4	12.7	48.7	46.4	58.0	31.7
Every Two Weeks	20.1	8.6	18.9	16.	7.2	4.4
Monthly	28.1	11.1	12.7	13.1	3.0	2.8
Special Occasions	10.0	27.5	6.7	8.5	2.0	10.4
Never	3.1	38.2	5.6	11.9	22.9	48.8

Daily purchases are much more common for eggs, especially chicken eggs and over 10% of consumers reported buying chicken eggs daily. Weekly purchases of chicken eggs are the next most common. For duck eggs we find that similar to duck meat, many households in Savannakhet and Vientiane never purchase duck eggs and consumers in these regions have a strong aversion to duck. In the North, duck egg purchases are much more common.

**Table 117: Frequency of Egg Purchases (% of Respondents)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Daily	11.3	1.5	11.9	9.2	12.6	4.6
Every Other Day	9.6	1.8	6.2	4.4	13.9	7.4
Weekly	60.5	13.4	71.6	63.1	61.8	27.5
Every Two Weeks	8.9	3.8	5.0	5.8	2.2	2.2
Monthly	3.6	2.6	1.4	2.3	0.8	1.6
Special Occasions	3.2	17.5	0	0.8	1.8	6.0
Never	3.0	59.3	3.7	14.2	7.0	50.8

## 5.2 Poultry Purchasing Preferences

Most consumers prefer local birds as indicated by the type of birds purchased. This is true for both chickens and ducks, although local or Muscovy ducks are especially favored over commercial ducks. Consumers in Vientiane were the most likely to purchase commercial birds which is rational given market vendor data shows that vendors in Vientiane were the most likely to sell commercial birds. Cross-breeds are uncommon outside of the North and are likely crosses between local and Chinese commercial breeds.

**Table 118: Types of Birds Purchased**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Commercial	37.9	16.7	20.1	12.2	22.5	4.9
Local/Common	60.3	70.4	64.7	48.3	76.7	91.1
Cross-Bred	0.9	2.8	15.1	14.7	0.8	1.6
Muscovy	.	8.6	.	24.5	.	2.3
Other	0.8	1.5	0	0.1	0	0

Live birds are favored heavily in the North, while in Vientiane and Savannakhet slaughtered bird purchases are much more frequent. Ducks are more likely to be purchased live than chickens and can likely be explained by consumer preference for local duck blood salad which requires a freshly slaughtered duck. If birds are purchased live they are rarely slaughtered at the market.

**Table 119: Percent of Live and Slaughtered Purchases**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Live (slaughtered at home)	9.6	34.8	58.0	61.6	9.9	27.3
Live (slaughtered at market)	6.4	6.2	0	0	6.3	6.2
Slaughtered	83.5	58.7	41.8	38.2	83.8	66.0
Other	0.5	0.2	0.4	0.	0	0.4

Most poultry products are purchased at local wet markets, especially in Vientiane and Savannakhet. In the North, buying directly from neighbors and farmers was done by over 10% of households and may be due to limited markets in the North compared to other regions. We also see that ducks were on average more likely to be purchased from neighbors than chickens across all regions.

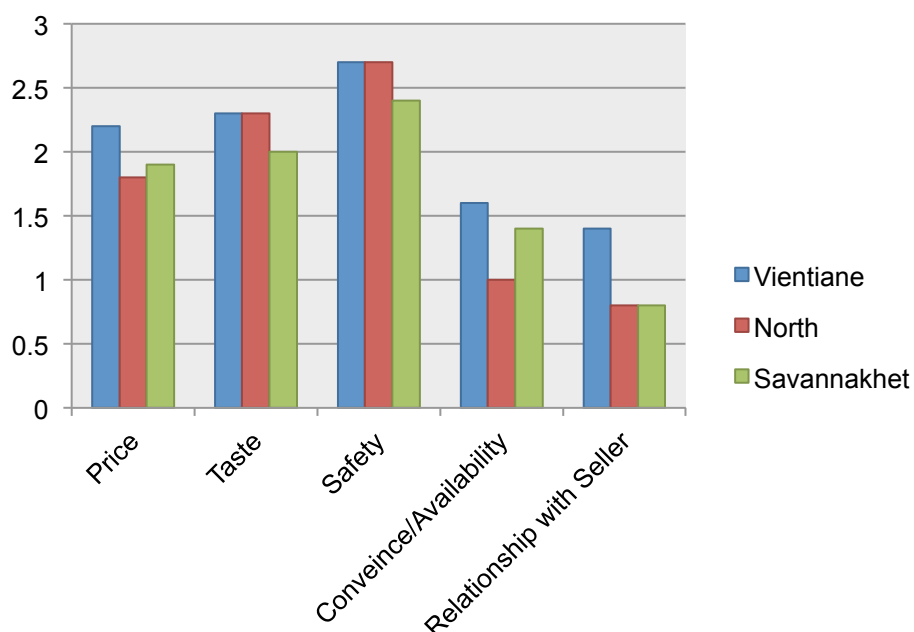
**Table 120: Location of Poultry Purchases**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Wet Market	86.4	73.1	73.9	73.7	88.3	85.1
Supermarket	1.5	1.0	3.2	2.3	0	0
Local Store	2.6	2.8	5.7	5.8	8.9	2.0
Neighbor/Farmer	4.4	16.2	12.9	13.8	3.6	11.4
Trader	4.2	5.9	4.2	4.3	0.8	1.1
Other	1.0	1.0	0	0	0	0.4

### 5.3 Poultry Purchasing Safety Concerns

Across all regions, safety was identified as the most important attribute when purchasing poultry, followed by taste and price. Consumers in Vientiane were overall the most price conscious. Most consumers said the relationship with their vendor or the convenience in purchasing birds was of little importance.

**Figure 16: Importance of Attributes When Buying Poultry**



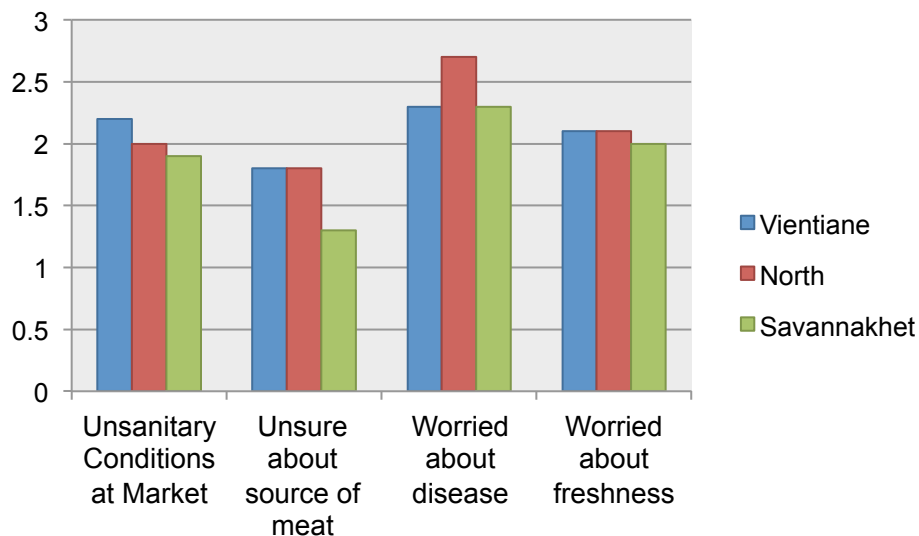
Consumers determined safety mostly using superficial methods such as looking at the live appearance of the bird or the appearance of the meat. Approximately, 50% households in the North said they trusted the meat based on their relationship with their vendor. We also see that packaging is a strong indication of safety across regions, signaling that consumers more readily trust large commercial companies such as CP.

**Table 121: How Consumers Determine Safety**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Live Appearance	288	36.8	409	78.7	284	56.6
Meat Appearance	602	77.0	357	68.6	376	74.9
Relationship with Seller	157	20.1	262	50.4	116	23.1
Know the Source	74	9.5	155	29.8	41	8.2
Look at Packaging	192	24.6	129	24.8	211	42.0
Do not think about meat safety	59	7.5	46	8.9	19	3.8
Other	4	0.5	1	0.2	7	1.4

When asked to rank their concerns regarding poultry safety, consumers identified that disease was their largest concern across all regions. This was followed by concerns over freshness and unsanitary conditions at the market, the latter particularly in Vientiane where wet markets are being pushed out as the city modernizes.

**Figure 17: Consumer Concerns about Poultry Safety**



Most consumers reported changing their shopping behavior as a result of HPAI outbreaks. The most commonly cited changes were purchasing less poultry, and being more careful about what poultry they buy. Overall consumers express that they are extremely concerned about disease risk and the safety of their meat, which is why a certification program that ensures healthy birds was popular among the majority of consumers.

#### 5.4 Willingness to Pay for Certified Poultry

A proposed certification system was explained in detail and respondents were asked to if they would be interested in purchasing this type of meat. Overall, more than 80% of households said they would be interested in purchasing certified poultry, with the largest proportion of interested respondents being in the North.



**Table 122: Interest in Purchasing Certified Poultry**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Yes	647	83.5	471	91.3	393	78.3
No	128	16.5	45	8.7	109	21.7

For those consumers that said they were uninterested, respondents asked to list the reasons. Most consumers cited that they were already satisfied with the health of the poultry they buy and would not want to pay extra for certified birds.

**Table 123: Reasons Respondents do not Want Certified Poultry**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Do not want to pay extra	36	28.1	16	34.8	50	45.5
Worried the system may not work well	26	20.3	7	15.0	14	12.8
Need more information	27	21.1	22	46.8	22	20.2
Already satisfied with the safety of poultry purchased	63	49.2	1	2.2	58	53.2

### 5.5 Transboundary Risk

Consumers in Northern Lao PDR were asked if they purchased poultry products from neighboring countries, and almost 60% purchased Chinese eggs. Vietnamese egg purchases were much less common, and demonstrates that Vietnamese poultry products are uncommon which is strengthened by market chain data. Bird purchases, slaughtered or live, were much less common.

**Table 124: What Products are Bought (Percent of Consumers)**

	North			
	China		Viet Nam	
	Freq.	Percent	Freq.	Percent
Eggs	309	59.4	12	2.3
Live Birds	32	6.2	0	0
Slaughtered Birds	18	3.5	0	0
Other	4	0.1	0	0

Although only 60% of households said they purchased Chinese eggs, nearly all the consumers said they had seen Chinese eggs in their local market. Consumers also reveal that live birds are relatively common at wet markets in the north with over a quarter of consumers reporting they had seen live birds in their market.

**Table 125: Types of Chinese Poultry Products Seen at Market  
(Percent of Consumers)**

	North	
	Freq.	Percent
Live Birds	150	28.8
Slaughtered Birds	72	13.9
Eggs	503	96.7

## 6. Policy Recommendations

Smallholder poultry production currently dominates the poultry sector of Lao PDR and given the country's development prospects, drastic changes in the sector are unlikely in the near future. Although incomes are rising and urbanization rates continue to grow, the country still remains sparsely populated and largely rural. Outside of the large municipalities, life is characterized by subsistence farming and poultry offers a viable opportunity for improved livelihoods.

However, the current state of the smallholder production model is not as efficient as it could be, limiting much-needed potential revenue to producers. The lack of enforceable contracts or product certifications leads to problems of moral hazard and adverse selection. Smallholder producers have no incentive to invest in higher quality or disease free birds because there are no mechanisms to signal their product is of higher value. Furthermore, vendors that purchase birds through traders have no way of evaluating the health or quality of the product other than superficial means or trusting the aggregator. These information failures have negative impacts on animal health as well, because weak incentives compromise biosecurity leading to potentially serious escalations of disease risk. Most solutions to these problems produce inadequate results. Simply enforcing formal systems, such as health certification or vaccine programs, often leads to fraud or concealment and may only further complicate the issue. Another option is to create formal markets, but this too has its drawbacks. Formal marketing channels, such as those used by industrial producers, have increased transaction costs and are often not viable for smallholder producers as their margins are so low.

Micro-contracts, certification systems, and smallscale producer cooperatives are just some of the opportunities to solve these information and market failures. However, the real challenge remains to demonstrate to smallholders that their birds and a valuable investment and worth the added trouble of entering more formal channels for marketing. For most producers, we see that poultry production is an ancillary activity and encouraging smallholders to increase product quality and safety remains a large hurdle.

In regards to HPAI, although outbreaks in Lao PDR have been minimal compared to other neighboring countries, the control of the disease is a regional issue and therefore Lao PDR has an important role to play. Transboundary risk and cross-border trade are of particular relevance, especially in northern Lao PDR where trade with China appears to be responsible for recent HPAI outbreaks. Our survey data demonstrates that Chinese poultry products are ubiquitous in the North, and despite official bans the boarder remains porous. Rather than attempt to restrict border crossings, neighboring countries must acknowledge that the trade exists and cooperate to monitor it in the open. Simply trying to close borders is an unsuitable solution because the borders are so penetrable that this approach is ineffective. A much more beneficial approach would be ensuring the cooperation of neighboring countries' governments. The diligent monitoring and reporting of animal health in host countries would be a much more successful approach as this could ensure that in the event of outbreaks, all trade between countries is stopped.

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## 8. Annex: Summary Statistics

### 8.1 Annex 1: Smallscale Farmers

**Table A1.1: Smallscale Farmer Sample Size**

	Vientiane	North	Savannakhet	Total
Observations	1,047	421	508	1,976

**Table A1.2: Gender of Survey Respondents**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Male	459	44.1	303	73.0	352	69.3
Female	582	55.9	112	27.0	156	30.7

**Table A1.3: Age of Survey Respondents**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Age	46.3	13.7	41.0	10.2	47.9	11.7

**Table A1.4: Education of Survey Respondents**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
None	158	15.1	16	3.8	112	22.1
Primary	416	39.8	154	36.6	192	37.8
Lower Secondary	223	21.3	138	32.8	103	20.3
Upper Secondary	132	12.6	80	19.0	63	12.4
Vocational	87	8.3	28	6.7	29	5.7
University	29	2.8	5	1.2	9	1.8

**Table A1.5: Household Size**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Males	2.8	1.5	3.4	1.4	3.4	1.7
Females	2.8	1.4	2.7	1.2	3.2	1.6
Total	5.6	2.3	6.0	2.0	6.6	2.4

**Table A1.6: Household Characteristics**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Electricity	1,044	99.7	302	71.7	505	99.4
Running Water	138	13.2	115	27.3	96	18.9
Neither	5	0.5	114	27.1	1	0.2

**Table A1.7: Sector of Household**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Urban	96	9.2	104	24.7	92	18.11
Rural	951	90.8	317	75.3	416	81.9

**Table A1.8: Average Household Land Size (HA)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Total Land Size	6.1	66.3	1.6	1.1	4.2	26.8
Agricultural Land	1.2	2.5	0.8	0.6	2.0	2.6

**Table A1.9: Crop Production**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Glutinous Rice	614	58.6	284	67.5	416	81.9
Ordinary Rice	199	19	25	5.9	78	15.4
Vegetables	53	5.06	178	42.3	30	5.9
Fruits	5	0.5	2	0.5	2	0.4
None	383	36.6	87	20.7	83	16.3

**Table A1.10: Duck Scavenging Activities in Rice Producing Households (Previous 12 Months)**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Own ducks scavenged in rice paddy	36	5.7	34	11.0	104	24.9
Other ducks scavenged in rice paddy	78	12.3	28	9.9	39	9.4
No ducks scavenged in rice paddy	493	77.5	267	86.7	281	67.4

**Table A1.11: Other Livestock Production**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Pig	56	5.4	268	63.7	216	42.5
Cattle	391	37.3	99	23.5	321	63.2
Buffaloes	79	7.6	73	17.3	197	38.8
Goats	56	5.4	24	5.7	45	8.9
Fish	58	5.5	9	2.1	10	2.0
None	524	50.1	132	31.4	103	20.3

**Table A1.12: Average Years of Poultry Raising Experience**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Number of Years	15.9	13.6	13.0	6.9	15.3	9.8



**Table A1.13: Primary Purpose of Poultry Production**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
To Sell	13	1.2	82	19.6	4	0.8
To Consume	651	62.2	124	29.7	227	44.7
To Consume and Sell	335	32.0	152	36.6	267	52.6
To consume, but sell in times of emergency	46	4.4	60	14.3	8	1.6
Other	1	0.1	0	0	2	0.4

**Table A1.14: Primary Production System**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Egg Production	5	1.3	0	0	0	0
Meat Production	237	59.7	29	7.1	277	56.2
Mixed	136	34.3	376	92.4	212	43.0
Hatchery	17	4.3	2	0.5	2	0.4
Other	2	0.5	0	0	2	0.4

**Table A1.15: Average Flock Sizes**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Chicken	26.7	19.1	37.0	19.6	27.7	25.3
Common Duck	10.5	13.8	4.3	9.5	8.3	14.0
Muscovy	0.4	2.4	0.3	2.6	0.6	4.5
Other	1.2	31.2	0.1	1.5	0.1	1.1
Total	38.6	41.5	41.7	22.1	36.7	30.3

**Table A1.16: Percent of Farmers That Only Raise One Bird Type**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Chicken Only	339	32.4	276	421	210	41.3
Duck Only	31	3.0	11	2.6	13	2.6

**Table A1.17: Change in Flock Size over Previous Month**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Bought	+0.8	4.9	+0.3	3.4	+0.3	1.7
Gift	+0.3	1.3	+0.0	0.5	+0.2	1.3
Birth	+9.5	13.3	+18.8	19.4	+11.1	14.4
Sold	-4.3	10.9	-10.8	14.9	-6.3	38.6
Died	-2	6.2	-6.2	12.0	-5.6	12.5
Eaten	-2.1	4.2	-3.4	3.1	-2.1	4.0
Gift	-0.2	1.5	-0.2	1.4	-0.1	1.0

**Table A1.18: Average Egg Production and Use over Previous Month**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Total Eggs Laid	17.8	10.1	35.1	11.5	14.6	11.3
Eggs Consumed	1.9	1.4	3.7	1.6	1.4	2.0
Eggs Sold	0.1	0.4	0.6	1.3	0	0.5
Eggs Gifted	0.2	0.2	0.0	0.1	0	0
Eggs Fertilized	15.3	7.8	28.4	8.4	12.2	6.3
Fertilized Eggs Sold	0.1	0.1	0.1	0	0.1	0
Eggs Hatched	11.7	6.1	22.6	6.4	9.8	4.9
Eggs Spoiled	3.6	1.7	6.0	2.1	2.8	1.3

**Table A1.19: Percent of Producers That Separate Birds into different Flocks**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
No	834	80.1	391	93.1	489	96.6
Yes	207	19.9	29	6.9	17	3.4

**Table A1.20: Percent of Producers that Let Birds Scavenge**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
No	528	50.8	24	5.7	109	21.5
Yes	512	49.2	395	94.3	398	78.5

**Table A1.21: Where Birds Scavenge (Percent of Flocks)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Yard	96.4	91.9	99.5	89.5	90.8	86.6
Village/Neighbors Yard	32.4	25.8	86.3	80.5	38.1	28.8
Personal rice paddies	3.6	3.6	12.7	32.3	23.6	27.8
Other people's rice paddies	4.6	5.1	12.2	34.6	1.8	1.8
Public water bodies	1.0	1.2	20.3	38.4	0.3	1.4

**Table A1.22: Major Problems Regarding Poultry Production**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Theft	420	40.1	343	81.5	317	62.4
Disease	571	54.5	388	92.2	389	76.6
Low Price of Products	70	6.7	36	8.6	41	8.1
High Cost of Inputs	149	14.2	72	17.1	95	18.7
Far from Market	51	4.9	47	11.2	16	3.2
Predators	109	10.4	73	17.3	151	29.7
Nothing	161	15.4	3	0.7	17	3.4

**Table A1.23: Reasons for Not Expanding Production**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Not Enough Space	573	54.7	242	57.5	249	49.0
Not Enough Time	292	27.9	224	53.2	148	29.1
Feed Scarcity	144	13.8	282	67.0	93	18.3
Water Scarcity	34	3.3	62	14.7	10	2.0
High Cost of Inputs	362	34.6	128	30.4	318	62.6
Low Price of Products	56	5.4	31	7.4	23	4.5
No Credit Access	19	1.8	20	4.8	10	2.0

**Table A1.24: Source of Chicks/Ducklings (Percent)**

	Vientiane		North		Savannakhet	
	Chicks	Ducklings	Chicks	Ducklings	Chicks	Ducklings
Own Flock	91.1	85.1	98.3	95.7	95.1	91.3
Other Farmers	7.0	13.4	1.5	4.3	3.6	6.6
Market	0.1	0.2	0	0	0.8	1.6
Trader	0	0.1	0	0	0.2	0
Hatchery	0.5	0.9	0.2	0	0.1	0.2
Other	1.3	0.9	0	0	0.2	0.4

**Table A1.25: Percent of Producers that Purchase Adult Birds**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
No	942	90.9	404	97.6	470	92.7
Yes	94	9.1	10	2.4	37	7.3

**Table A1.26: Source of Adult Birds (Percent)**

	Vientiane		North		Savannakhet	
	Chickens	Ducks	Chickens	Ducks	Chickens	Ducks
Other Farmers	83.9	83.3	94.4	100	74	62.3
Market	2.4	0	5.6	0	8.3	21.8
Trader	5.6	4.2	0	0	9.1	6.8
Other	8.1	12.5	0	0	8.6	9.1

**Table A1.27: Importance of Factors Deciding Who to Buy From (0 to 3)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Price	1.9	1.2	2.1	1.1	1.9	1.0
Quality/Health	2.4	1.0	1.9	0.9	2.2	0.9
Relationship with Seller	1.0	1.1	1.2	0.7	0.7	0.8
Breed	2.1	1.1	2.2	0.9	2.2	1.0
Quantity	0.8	0.9	1.0	0.7	0.6	0.7
Timing of Purchase	0.7	0.9	0.9	0.7	0.7	0.8
Source of Bird	.	.	1.9	1.0	1.6	1.2

**Table A1.28: Types of Housing**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Enclosed Unit	61	6.5	3	0.7	9	1.8
Confined Yard with Roof	804	85.3	285	70.0	326	64.4
Confined Yard (no roof)	55	5.8	8	2.0	58	11.5
Roof only (no fence)	21	2.2	106	26.0	14	2.8
No Enclosure	90	8.7	3	0.8	98	19.4

**Table A1.29: Types of Feed**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Paddy Rice	423	40.4	377	89.6	197	38.8
Broken Rice	690	65.9	399	94.8	411	80.9
Bran	881	84.2	319	75.8	430	84.7
Corn	.	.	261	62.0	7	1.4
Kitchen Scraps	113	10.8	203	48.2	59	11.6
Commercial Feed	527	50.33	124	29.5	52	10.2
None	3	0.3	1	0.2	1	0.2
Other	31	3.0	0	0	0	0

**Table A1.30: Sources of Water (% of Flocks)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Supplied by farmer	78.1	74.8	65.5	68.4	90.5	88.1
Rice Paddies / crops	5.6	5.8	13.0	26.5	20.6	23.1
River / Stream	9.4	10.2	51.8	52.2	2.8	5.1
Pond	7.2	10.5	5.9	13.2	8.7	9.8
Other	1.7	1.3	6.1	10.3	0.4	0.3

**Table A1.31: Sources of Veterinary Services**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Village Vet. Worker	75	7.2	212	50.4	16	3.2
State Vet. Services	18	1.7	167	39.7	1	0.2
Private Vet.	92	8.8	87	20.7	4	0.8
Friend/ Relative/ Neighbor	69	6.6	195	46.3	51	10.0
Pharmacy	336	32.1	142	33.7	161	31.5
Hatchery Owner	11	1.1	2	0.5	17	3.4
Do not seek services	404	38.6	76	18.1	235	46.3
Do not know how to get services	105	10.0	59	14.0	72	14.2

**Table A1.32: Producers with Costs Related to Poultry Production**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Feed	1,093	99.2	396	94.1	505	99.4
Water	49	4.7	150	35.6	31	6.1
Employees	0	0	0	0	0	0
Gasoline	17	1.6	43	10.2	1	0.2
Transportation Rental	6	0.6	4	1.0	0	0
Pharmaceuticals	166	15.9	153	36.4	26	5.1
Vaccinations	92	8.8	135	32.1	10	2.0
Veterinary Services	15	1.4	41	9.7	2	0.4
Building an enclosure	604	57.7	410	97.4	338	66.5

**Table A1.33: Average Cost of Each Input for Respondents Using Inputs (LAK/Month)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Feed	169,837	337,695	188,719	164,810	138,720	199,434
Water	21,911	25,519	34,141	89,770	22,133	26,341
Employees	.	.	.	.	.	.
Gasoline	94,356	143,243	30,138	39,302	.	.
Transportation Rental	110,000	141,421	142,250	194,807	.	.
Pharmaceuticals	13,322	36,916	25,236	35,428	3,183	4,248
Vaccinations	17,111	16,374	24,238	26,194	6,932	8,515
Veterinary Services	7,708	9,647	36,974	26,652	2,917	589
Building an enclosure (Total)	136,855	223,829	132,490	104,994	89,281	171,195

**Table A1.34: Average Cost Per Bird (LAK/Month)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Cost Per Bird	5,122	5,963	6,075	6,776	5,146	6,485

**Table A1.35: Average Amount of Time Spent Tending to Flock (Hours)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Number of Hours	1.0	1.0	0.7	0.7	0.7	0.5

**Table A1.36: Percent of Producers Who Sold Poultry in Previous Year**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Sales	439	41.9	277	66.4	282	56.0
No Sales	608	58.1	140	33.6	222	44.0

**Table A1.37: Percent of Producers Who Sold Poultry in Previous Year (Urban)**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Sales	41	42.7	61	58.7	28	30.8
No Sales	55	57.3	43	41.4	63	69.2

**Table A1.38: Percent of Producers Who Sold Poultry in Previous Year (Rural)**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Sales	398	41.9	216	69.0	254	61.5
No Sales	553	58.1	97	31	159	38.5

**Table A1.39: Frequency of Sales (Percent of Producers)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Daily	0	0	0	0	0	0
Weekly	0.3	0.3	0.7	1.5	0	0
Every 2 Weeks	0	0.7	0.7	0	0.4	0
Monthly	9.8	10.7	12.9	4.4	0.7	0
Less Than Once a Month	90.0	88.3	84.9	94.1	98.9	100

**Table A1.40: Poultry Marketing Channels (Average Percent of Sales)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Aggregator	40.9	44.3	57.8	37.6	59.3	67.7
Market Vendors	20.0	17.8	24.8	31.3	22.1	22.0
Households/ Other Farmers	35.2	33.7	14.6	21.6	17.3	14.9
Restaurants / Food Vendors	0.4	0.2	2.9	10.3	0.1	0.
Other	3.3	3.6	0	0	1.5	1.9

**Table A1.41: Poultry Product Sale Prices (LAK/KG, LAK/Egg)**

	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Chicken Broiler	25,796	27,570	28,182	29,727	21,200	27,786
Chicken Egg	1,163	1,200	1,000	1,000	900	.
Duck Broiler	20,245	22,283	27,500	28,333	27,500	33,750
Duck Egg	1,143	1,1214	1,514	1,550	1,667	2,167

**Table A1.42: Poultry Product Sale Prices (LAK/Head)**

	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Chicken Broiler	34,045	34,750	26,755	31,548	22,678	24,842
Duck Broiler	34,714	38,571	38,226	43,107	37,453	40,677

**Table A1.43: Average Household Income from Poultry Sales (LAK/Month)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Income	50,380	191,175	58,973	100,066	64,017	244,829
% of Total Income	7.0	15.4	6.2	10.5	5.5	8.2

**Table A1.44: How Poultry Derived Income is Used**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Save for use in emergencies	185	17.7	208	49.4	121	23.8
Spend on school fees	114	10.9	156	37.1	50	9.8
Spend on essential consumption	287	27.4	228	54.2	248	48.8
Spend on non-essential consumption	111	10.6	137	32.6	7	5.3
Invest in other activities	57	5.4	98	23.3	22	4.3
Do not have	490	46.8	135	32.1	197	38.8
Do not know	32	3.1	6	1.4	2	0.4
Other	29	2.8	2	0.5	6	1.2

**Table A1.45: Actions Taken with Birds That Die from Disease**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Sell	0	0	1	0.2	2	0.4
Consume	25	2.4	0	0	14	2.8
Bury	949	90.6	394	93.6	473	93.1
Burn	214	20.4	51	12.1	87	17.1
Give Away	4	0.4	1	0.2	7	1.4
Other	14	1.3	23	5.5	5	1.0

**Table A1.46: Biosecurity Measures**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Keep Birds in an Enclosure	288	27.5	107	25.4	48	9.5
Clean Enclosure regularly	801	76.5	334	79.3	334	65.8
Use Gloves, boots, and/or masks when handling birds	123	11.8	48	11.4	33	6.5
Keep birds over cement	20	1.9	56	13.3	14	2.8
Keep flock separate from other birds	122	11.7	111	26.4	244	48.0
Use vaccinations	91	8.7	144	34.2	22	4.3

**Table A1.47: Number of Farmers Whose Poultry Were Culled for HPAI**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Culled	155	14.9	55	13.2	13	2.6

**Table A1.48: Summary Statistics of Farmers with Culled Birds**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
% of Flock Lost	92.2	23.6	69.1	39.3	.	.
Number of Birds	40.8	161.1	22.0	9.3	.	.
Compensation (LAK/KG)	8,274	15,653	9,681	5,255	.	.



**Table A1.49: Poultry Farmer Disease Concerns (0 to 3)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
HPAI to birds	2.3	1.1	2.0	1.1	1.5	1.0
HPAI to family	2.4	1.0	2.3	0.9	1.7	1.1
Other disease to birds	1.9	1.1	2.4	0.8	1.6	1.1
Price of products	0.9	1.0	1.0	0.9	1.0	1.1

**Table A1.50: Bought and/or Sold Poultry Products from Neighboring Countries**

	North	
	Freq.	Percent
Yes	235	56.0
No	86	20.5
Unsure	99	23.6

**Table A1.51: What Products are Bought**

	North			
	China		Viet Nam	
	Freq.	Percent	Freq.	Percent
Eggs	187	78.6	34	14.5
Chicks	0	0	0	0
Adult Birds	9	3.8	0	0
Feed	18	7.7	2	0.9
None	40	17.0	201	85.5

**Table A1.52: What Products are Sold**

	North			
	China		Viet Nam	
	Freq.	Percent	Freq.	Percent
Eggs	5	2.1	1	0.4
Chicks	0	0	0	0
Adult Birds	0	0	0	0
Slaughtered Birds	0	0	0	0
None	230	97.9	234	99.6

**Table A1.53: Prevalence of Chinese Poultry Products**

	North	
	Freq.	Percent
Chinese poultry products are very common in the village	238	57.4
Chinese poultry products are occasionally in the village	125	30.1
Chinese poultry products are rarely in the village	43	10.4
Never seen Chinese poultry products in the village	9	2.2

**Table A1.54: Types of Chinese Poultry Products Seen**

	North	
	Freq.	Percent
Live Birds	48	11.7
Slaughtered Birds	49	11.9
Eggs	395	95.9

**8.2 Annex 2: Largescale Chicken Farmers****Table A2.1: Largescale Chicken Farmer Sample Size**

	Vientiane	North	Savannakhet	Total
Observations	81	9	28	

**Table A2.2: Gender of Survey Respondents**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Male	58	73.4	7	77.8	22	88
Female	21	26.6	2	22.2	3	12

**Table A2.3: Age of Survey Respondents**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Age	42.6	12.7	44.6	11.0	52.4	11.0

**Table A2.4: Education of Survey Respondents**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
None	7	8.6	0	0	4	14.8
Primary	31	38.3	1	11.1	5	18.5
Lower Secondary	13	16.1	3	33.3	10	37.0
Upper Secondary	19	23.5	2	22.2	5	18.5
Vocational	8	9.9	2	22.2	3	11.1
University	3	3.7	1	11.1	0	0

**Table A2.5: Household Size**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Males	2.8	1.9	3	1.1	2.9	1.7
Females	2.5	1.4	3.3	1.4	3.2	1.1
Total	5.3	2.6	6.3	1.3	6.1	2.3

**Table A2.6: Household Characteristics**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Electricity	80	98.8	8	88.9	27	96.4
Running Water	9	11.1	4	44.4	23	82.1
Neither	1	1.2	1	11.1	1	3.6

**Table A2.7: Sector of Household**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Urban	0	0	5	55.6	12	42.9
Rural	81	100	4	44.4	16	57.1

**Table A2.8: Average Household Land Size (HA)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Total Land Size	3.2	3.4	1.7	0.9	7.5	14.2
Agricultural Land	1.8	2.6	1.1	0.7	2.3	3.6

**Table A2.9: Crop Production**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Glutinous Rice	34	42.0	6	66.7	18	64.3
Ordinary Rice	12	14.8	0	0	3	10.7
Vegetables	3	3.7	4	44.4	2	7.1
Fruits	1	1.23	0	0	0	0
None	39	48.2	2	22.2	10	35.7

**Table A2.10: Other Livestock Production**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Ducks	17	21.0	2	22.2	20	71.4
Pig	13	16.1	3	33.3	12	42.9
Cattle	28	35.6	0	0	20	71.4
Buffaloes	4	4.9	0	0	11	39.3
Goats	4	4.9	0	0	5	17.9
Fish	12	14.8	1	11.1	2	7.1
None	34	42.0	3	33.3	1	3.6

**Table A2.11: Average Years of Poultry Raising Experience**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Number of Years	9.9	9.8	9.1	8.2	8.4	6.0

**Table A2.12: Primary Production System**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Egg Production	31	38.3	1	11.1	0	0
Meat Production	31	38.3	6	66.7	2	7.1
Mixed	18	22.2	1	11.1	26	92.9
Hatchery	0	0	1	11.1	0	0
Other	1	1.2	0	0	0	0

**Table A2.13: Average Flock Sizes (Egg Production)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Layers	4,699.9	10,608.3	5,000	.	.	.
Males	65.5	359.2	0	.	.	.
Broilers	0	0	0	.	.	.
Chicks	0	0	5,000	.	.	.
Total	4,764.4	10,622.6	10,000	.	.	.

**Table A2.14: Average Flock Sizes (Meat Production)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Layers	19.6	11.3	15.7	12.5	37.5	17.7
Males	12.8	13.2	14.3	16.3	14	5.7
Broilers	21.7	22.3	29.8	22.8	340	480.8
Chicks	58.8	32.2	87.5	16.2	388.5	440.5
Total	112.9	37.2	147.3	29.9	780	933.3

**Table A2.15: Average Flock Sizes (Mixed Production)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Layers	1340.8	4688.8	57	.	488.2	1,647.2
Males	6.1	6.5	23	.	15.2	13.1
Broilers	16.3	14.8	5	.	30.8	156.9
Chicks	36.3	32.2	150	.	48.6	27.6
Total	1,399.6	4,671.4	235	.	582.8	1,721.6

**Table A2.16: Change in Flock Size over Previous Month (Egg Production)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Bought	+164.5	450.6	+5,000	.	.	.
Gift	+0	0	+0	.	.	.
Birth	+32.3	179.6	+0	.	.	.
Sold	-230.6	696.5	-0	.	.	.
Died	-3.8	14.7	-0	.	.	.
Eaten	-0.3	1.8	-0	.	.	.
Gift	-0.2	0.9	-0	.	.	.

**Table A2.17: Change in Flock Size over Previous Month (Meat Production)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Bought	+1.0	4.3	+0	0	+0	0
Gift	+0.6	2.5	+0	0	+0	0
Birth	+31.8	38.2	+59.3	31.4	+245.5	293.4
Sold	-26.4	32.4	-53.5	71.0	-125	176.8
Died	-3.2	5.5	-18.3	24.3	-0	0
Eaten	-4.3	7.5	-6.7	5.0	-5	7.1
Gift	-0.5	1.9	0	0	-0	0

**Table A2.18: Change in Flock Size over Previous Month (Mixed Production)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Bought	+0	0	+0	.	+115.4	588.3
Gift	+0.3	1.2	+0	.	+0.3	1.8
Birth	+13.1	21.1	+130	.	+21.2	25.5
Sold	-635.8	2,356.7	-58	.	-169.9	781.5
Died	-4.5	9.4	-30	.	-14.6	34.3
Eaten	-0.2	0.9	-7	.	-1.4	3.2
Gift	-6.1	25.9	-0	.	-0.8	3.9

**Table A2.19: Average Egg Production and Use over Previous Month (Egg Producer)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Total Eggs Laid	26,138.6	22,063.7	17,670	.	.	.
Eggs Consumed	89.5	102.3	0	.	.	.
Eggs Sold	26,535.5	21,984.9	17,670	.	.	.
Eggs Gifted	15.2	42.2	0	.	.	.
Eggs Fertilized	0	0	0	.	.	.
Fertilized Eggs Sold	0	0	0	.	.	.
Eggs Hatched	0	0	0	.	.	.
Eggs Spoiled	12.3	54.6	0	.	.	.

**Table A2.20: Average Egg Production and Use over Previous Month (Mixed Producer)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Total Eggs Laid	11,976.9	33,322.2	120	.	3,473.8	14,820.8
Eggs Consumed	12.5	36.4	20	.	1	4.2
Eggs Sold	11,923.9	33,338.1	35	.	3,450	14,826.5
Eggs Gifted	0	0	0	.	0	0
Eggs Fertilized	48.1	39.8	65	.	22.8	27.0
Fertilized Eggs Sold	3.8	16.3	0	.	0	0
Eggs Hatched	33.1	34.0	50	.	21.2	25.5
Eggs Spoiled	8.5	9.8	15	.	1.6	2.3

**Table A2.21: Major Problems Regarding Poultry Production**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Theft	20	24.7	7	77.8	23	82.1
Disease	37	45.7	6	66.7	21	75
Low Price of Products	28	34.6	2	22.2	4	14.3
High Cost of Inputs	30	37.0	5	55.6	3	10.7
Far from Market	11	13.6	1	11.1	1	3.6
Predators	5	6.2	1	11.1	0	0
Nothing	1	1.2	1	11.1	0	0

**Table A2.22: Reasons for Not Expanding Production**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Not Enough Space	23	28.4	7	77.8	2	7.1
Not Enough Time	18	22.2	4	44.4	3	10.7
Feed Scarcity	7	8.6	3	33.3	17	60.7
Water Scarcity	1	1.2	2	22.2	0	0
High Cost of Inputs	40	49.4	4	44.4	13	46.4
Low Price of Products	24	29.6	3	33.3	2	7.1
No Credit Access	1	1.2	0	0	0	0

**Table A2.23: Source of Chicks**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Own Flock	67.5	46.2	88.9	33.3	85.7	34.7
Other Farmers	2.8	14.2	0	0	3.9	18.9
Market	0.2	1.2	0	0	3.6	18.9
Trader	3.1	17.4	0	0	0	0
Hatchery	15.4	36.4	11.1	33.3	.	.
Company	8.8	13.8	0	0	3.6	18.9
Other	2.3	13.8	0	0	0	0

**Table A2.24: Percent of Producers that Purchase Adult Birds**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
No	45	55.6	9	100	26	92.9
Yes	36	44.4	0	0	2	7.1

**Table A2.25: Source of Chickens**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Other Farmers	10	28.5	.	.	50	70.7
Market	0	0	.	.	0	0
Trader	5.4	22.9	.	.	0	0
Hatchery	24.9	43.3	.	.	.	.
Company	39.5	48.9	.	.	50	70.7
Other	20.3	39.9	.	.	0	0

**Table A2.26: Importance of Factors Deciding Who to Buy From (0 to 3)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Price	2	1.1	1.8	1.2	2.5	0.7
Quality/Health	2.6	0.9	2.4	0.9	2.3	0.8
Relationship with Seller	1.6	1.2	1.3	1	1.4	0.8
Breed	2.6	0.8	1.6	1.2	2.3	0.8
Quantity	1.3	1.2	1	0.8	0.8	0.6
Timing of Purchase	1.2	1.3	0.7	0.8	0.7	0.5
Source of Bird	.	.	1.6	1.3	2.3	0.8

**Table A2.27: Types of Housing**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Enclosed Unit	15	16.9	2	22.2	2	7.1
Confined w/ Roof	63	70.8	6	66.7	22	78.6
Confined w/o Roof	9	10.1	0	0	4	14.3
Unconfined	2	2.2	1	11.1	0	0

**Table A2.28: Types of Feed**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Paddy Rice	28	34.6	4	44.4	7	25.0
Broken Rice	34	42.0	6	66.7	14	50.0
Bran	45	55.6	6	66.7	25	89.3
Corn	.	.	3	33.3	0	0
Kitchen Scraps	3	3.7	0	0	2	7.1
Commercial Feed	65	75.3	5	55.6	5	17.9
Other	7	8.6	2	22.2	6	21.4

**Table A2.29: Source of Water**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Standing / Rain Water	10	12.3	1	11.1	16	57.1
Well / Personal Water	52	64.2	2	22.2	1	3.6
Pipes / Public Water System	3	3.7	4	44.4	7	25
Closed Housing Unit	10	12.4	3	33.3	2	7.1
Other	11	13.6	0	0	2	7.1

**Table A2.30: Sources of Veterinary Services**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Village Vet. Worker	7	8.6	4	44.4	0	0
State Vet. Services	3	3.7	4	44.4	0	0
Private Vet.	11	13.6	3	33.3	1	3.6
Friend/ Relative/ Neighbor	5	6.2	3	33.3	0	0
Pharmacy	32	39.5	4	44.4	23	82.1
Hatchery Owner	8	9.9	1	11.1	0	0
Company	9	11.1	0	0	2	7.1
Do not seek services	16	19.8	1	11.1	1	3.6

**Table A2.31: Producers with Costs Related to Poultry Production**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Feed	81	100	9	100	28	100
Water	4	4.9	6	66.7	1	3.6
Electricity	32	39.5	4	44.4	1	3.6
Employees	8	9.9	2	22.2	1	3.6
Gasoline	10	12.4	5	55.6	1	3.6
Transportation Rental	2	2.5	2	22.2	0	0
Pharmaceuticals	31	38.3	5	55.6	1	3.6
Vaccinations	13	16.1	3	33.3	0	0
Veterinary Services	7	8.6	0	0	0	0
Building an enclosure	63	77.8	9	100	25	89.3

**Table A2.32: Average Cost of Each Input for Respondents Using Inputs (LAK/Month) (Flock Size <500)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Feed	754,625	1,162,443	782,000	626,100	430,800	276,434
Water	55,000	.	44,500	70,737	.	.
Electricity	35,833	42,710.2	50,000	.	.	.
Employees	.	.	.	.	.	.
Gasoline	.	.	204,000	226,321	.	.
Transportation Rental	240,000	.	.	.	.	.
Pharmaceuticals	21,844	50,029	43,333	55,960	.	.
Vaccinations	6,983	5,987	125,000	106,066	.	.
Veterinary Services	16,233	28,970	.	.	.	.
Building an enclosure	633,367	1,164,615	464,286	684,175	205,000	421,739



**Table A2.33: Average Cost of Each Input for Respondents Using Inputs (LAK/Month) (Flock Size >500)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Feed	33,700,000	56,400,000	25,000,000	24,000,000	99,000,000	88,500,000
Water	150,000	.	1,626,000	1,944,544	3,000,000	.
Electricity	424,166	1,192,921	1,610,000	1,965,757	5,000,000	.
Employees	1,222,500	1,776,487	1,400,000	848,528	16,400,000	.
Gasoline	631,000	609,611	5,400,000	.	2,700,000	.
Transportation Rental	600,000	.	3,250,000	3,889,087	.	.
Pharmaceuticals	794,884	1,513,077	500,000	.	126,000	.
Vaccinations	2,096,667	3,553,313	1,300,000	.	.	.
Veterinary Services	100,000	.	.	.	.	.
Building an enclosure	70,800,000	72,800,000	156,000,000	136,000,000	542,000,000	563,000,000

**Table A2.34: Average Cost Per Bird (LAK/Month)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Cost Per Bird	5,997	4,867	6,202	4,871	5,840	6,645

**Table A2.35: Average Amount of Time Spent Tending to Flock (Hours)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Number of Hours	2.1	2.6	2.8	2.7	1.7	1.7

**Table A2.36: Marketing Channels (Average Percent of Sales)**

	Vientiane		North		Savannakhet	
	Meat	Eggs	Meat	Eggs	Meat	Eggs
Aggregator	58.2	67.9	51.1	60	61.7	70
Market Vendors	19.6	19.8	35	35	37.7	16.6
Households/ Other Farmers	19.7	3.1	11.7	5	0.6	13.3
Restaurants / Food Vendors	0.4	3.8	2.2	0	0	0
Hatchery	0	2.4	0	0	.	.
Company	0	0	0	0	0	0
Other	2.1	2.9	0	0	0	0

**Table A2.37: Average Monthly Sales Quantities**

	Vientiane		North		Savannakhet	
	Low	High	Low Season	High Season	Low Season	High Season
Chickens	138	372	2	728	2	81
Eggs	16,871	27,833	0	1,964	179	265

**Table A2.38: Poultry Product Sale Prices (LAK/Head<sup>11</sup>, LAK/Egg Crate)**

	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Broiler	26,310	28,862	30,429	37,167	26,000	27,00
Layers	26,091	28,727	38,333	39,000	26,480	27,080
Spent Layers	23,429	25,538	31,250	31,750	26,761	27,048
Males	24,875	29,778	38,750	38,000	33,880	34,480
Egg	687	705	833	667	911	1,078

**Table A2.39: Average Income from Poultry Sales (LAK/Month)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Income	7,595,870	17,500,000	5,952,556	11,800,000	4,091,786	17,900,000
% of Total Income	50.6	40.9	42.6	37.2	22.3	25.9

**Table A2.40: Actions Taken with Birds That Die from Disease**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Sell	2	2.5	0	0	0	0
Consume	5	6.2	0	0	0	0
Bury	70	86.4	9	100	28	100
Burn	23	28.4	1	11.1	5	17.9
Give Away	2	2.5	0	0	0	0
Other	3	3.7	0	0	1	3.6

**Table A2.41: Biosecurity Measures**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Keep Birds in an Enclosure	48	59.3	6	66.7	2	7.1
Clean Enclosure regularly	70	86.4	7	77.8	27	96.4
Use Gloves, boots, and/or masks when handling birds	32	39.5	4	44.4	0	0
Keep birds over cement	5	6.2	3	33.3	1	3.6
Keep flock separate from other birds	25	30.9	2	22.2	25	89.3
Use vaccinations	31	38.3	5	55.6	1	3.6

<sup>11</sup> Vientiane: LAK/KG

**Table A2.42: Number of Farmers Whose Poultry Were Culled for HPAI**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Culled	8	10	0	0	1	3.6

**Table A2.43: Summary Statistics of Farmers with Culled Birds**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
% of Flock Lost	100	0	.	.	85	.
Number of Birds	1,757	2645	.	.	13,000	.
Compensation (LAK/KG)	6,000	5,692.1	.	.	16,800	.

**Table A2.44: Poultry Farmer Disease Concerns (0 to 3)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
HPAI to birds	2.3	1.1	1.8	1.4	1.8	0.7
HPAI to family	2.4	1.0	1.9	1.3	1.9	0.6
Other disease to birds	2.0	1.0	2.1	1.2	1.8	0.7
Price of products	1.8	1.2	2.1	1.1	2.4	0.7

**Table A2.45: Bought and/or Sold Poultry Products from Neighboring Countries**

	North	
	Freq.	Percent
Yes	3	33.3
No	5	55.6
Unsure	1	11.1

**Table A2.46: What Products are Bought**

	North			
	China		Viet Nam	
	Freq.	Percent	Freq.	Percent
Eggs	3	100	0	0
Chicks	0	0	0	0
Adult Birds	1	33.3	0	0
Feed	2	66.7	0	0
None	0	0	3	100

**Table A2.47: What Products are Sold**

	North			
	China		Viet Nam	
	Freq.	Percent	Freq.	Percent
Eggs	1	33.3	0	0
Chicks	0	0	0	0
Adult Birds	1	33.3	0	0
Slaughtered Birds	0	0	0	0
None	1	33.3	3	100

**Table A2.48: Prevalence of Chinese Poultry Products**

	North	
	Freq.	Percent
Chinese poultry products are very common in the village	7	77.8
Chinese poultry products are occasionally in the village	2	22.2
Chinese poultry products are rarely in the village	0	0
Never seen Chinese poultry products in the village	0	0

**Table A2.49: Types of Chinese Poultry Products Seen**

	North	
	Freq.	Percent
Live Birds	3	33.3
Slaughtered Birds	1	11.1
Eggs	7	77.8

**8.3 Annex 3: Largescale Duck Producers****Table A3.1: Largescale Duck Farmer Sample Size**

	Vientiane	North	Savannakhet	Total
Observations	81	9	28	

**Table A3.2: Gender of Survey Respondents**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Male	14	50	2	66.7	2	66.7
Female	14	50	1	33.3	1	33.3

**Table A3.3: Age of Survey Respondents**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Age	44.5	13.5	41.7	10.4	56.3	4.9

**Table A3.4: Education of Survey Respondents**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
None	3	10.3	0	0	1	33.3
Primary	11	38.0	0	0	1	33.3
Lower Secondary	10	34.5	1	33.3	0	0
Upper Secondary	4	13.8	2	66.7	0	0
Vocational	1	3.5	0	0	1	33.3
University	0	0	0	0	0	0

**Table A3.5: Household Size**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Males	2.7	1.2	3.7	1.2	3.3	2.3
Females	2.6	1.2	1.7	0.6	2.7	1.5
Total	5.3	2.1	5.3	0.6	6	3.6

**Table A3.6: Household Characteristics**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Electricity	29	100	1	33.3	3	100
Running Water	2	6.9	0	0	3	100
Neither	0	0	2	66.7	0	0

**Table A3.7: Sector of Household**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Urban	1	3.5	1	33.3	1	33.3
Rural	28	96.5	2	66.7	2	66.7

**Table A3.8: Average Household Land Size (HA)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Total Land Size	2.8	3.8	2	0	3.3	1.2
Agricultural Land	1.1	1.3	1.3	0.6	1.7	2.0

**Table A3.9: Crop Production**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Glutinous Rice	17	58.6	2	66.7	2	66.7
Ordinary Rice	6	20.7	0	0	1	33.3
Vegetables	3	10.3	2	66.7	0	0
Fruits	0	0	0	0	0	0
None	7	24.1	1	33.3	1	33.3

**Table A3.10: Duck Scavenging Activities in Rice Producing Households (Previous 12 Months)**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Own ducks scavenged in rice paddy	3	16.7	0	0	0	0
Other ducks scavenged in rice paddy	2	11.1	0	0	0	0
No ducks scavenged in rice paddy	13	72.2	1	50	1	50

**Table A3.11: Other Livestock Production**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Chickens	16	55.2	0	0	0	0
Pig	9	31.0	2	66.7	1	33.3
Cattle	13	44.8	2	66.7	2	66.7
Buffaloes	4	13.8	0	0	1	33.3
Goats	3	10.3	0	0	2	66.7
Fish	10	34.4	0	0	2	66.7
None	2	6.9	1	33.3	0	0

**Table A3.12: Average Years of Poultry Raising Experience**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Number of Years	11.8	10.5	7.3	8.5	5.3	2.5

**Table A3.13: Primary Production System**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Egg Production	6	20.7	0	0	0	0
Meat Production	13	44.8	3	100	3	100
Mixed	9	31.0	0	0	0	0
Hatchery	1	3.5	0	0	0	0
Other	0	0	0	0	0	0

**Table A3.14: Breeds Produced**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Muscovy	13	44.8	0	0	1	33.3
Common	20	69.0	1	33.3	3	100
Peking	2	6.9	2	66.7	0	0
Other Improved Breeds	1	3.5	0	0	0	0
Other	0	0	0	0	0	0

**Table A3.15: Average Flock Sizes (Egg Production)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Layers	7,754	13,624.2	.	.	.	.
Males	50	83.6	.	.	.	.
Broilers	0	0	.	.	.	.
Chicks	0	0	.	.	.	.
Total	7,794	13,612.6	.	.	.	.

**Table A3.16: Average Flock Sizes (Meat Production)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Layers	24	16.4	15	13.2	38.3	25.7
Males	11.8	7.9	7.3	6.8	19.7	15.0
Broilers	27.5	24.2	3.3	5.8	76.7	132.8
Chicks	86.7	82.6	58.3	27.5	71.7	18.9
Total	150	90.9	84	34.4	206.3	78.9

**Table A3.17: Average Flock Sizes (Mixed Production)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Layers	26.9	29.9	.	.	.	.
Males	4.7	6.1	.	.	.	.
Broilers	29.8	32.1	.	.	.	.
Chicks	49.2	26.1	.	.	.	.
Total	110.6	52.6	.	.	.	.

**Table A3.18: Change in Flock Size over Previous Month (Egg Production)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Bought	+0	0	.	.	.	.
Gift	+0	0	.	.	.	.
Birth	+0	0	.	.	.	.
Sold	-6.7	16.3	.	.	.	.
Died	-1.7	4.1	.	.	.	.
Eaten	-1.7	4.1	.	.	.	.
Gift	-0	0	.	.	.	.

**Table A3.19: Change in Flock Size over Previous Month (Meat Production)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Bought	+8.9	19.6	+0	0	+0	0
Gift	+0.5	1.9	+0	0	+0	0
Birth	+44.1	68.2	+51.7	34.0	+43.3	40.4
Sold	-20.2	22.6	-191.7	53.9	-30	26.5
Died	-1.3	4.2	-1.7	2.9	-0	0
Eaten	-2.4	3.9	-3	2.6	-3.7	3.2
Gift	-0.6	1.7	-0	0	-0	0

**Table A3.20: Change in Flock Size over Previous Month (Mixed Production)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Bought	+0	0	.	.	.	.
Gift	+0.2	0.7	.	.	.	.
Birth	+14.3	28.2	.	.	.	.
Sold	-18.3	33.6	.	.	.	.
Died	-0.1	0.3	.	.	.	.
Eaten	-1	1.3	.	.	.	.
Gift	-0.4	1.3	.	.	.	.

**Table A3.21: Average Egg Production and Use over Previous Month (Egg Producer)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Total Eggs Laid	16,175	21,603.4	.	.	.	.
Eggs Consumed	25	61.2	.	.	.	.
Eggs Sold	16,150	21,613	.	.	.	.
Eggs Gifted	0	0	.	.	.	.
Eggs Fertilized	0	0	.	.	.	.
Fertilized Eggs Sold	0	0	.	.	.	.
Eggs Hatched	0	0	.	.	.	.
Eggs Spoiled	0	0	.	.	.	.

**Table A3.22: Average Egg Production and Use over Previous Month (Mixed Producer)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Total Eggs Laid	290.5	462.0	.	.	.	.
Eggs Consumed	12.4	17.6	.	.	.	.
Eggs Sold	203.6	458.1	.	.	.	.
Eggs Gifted	1.1	3.3	.	.	.	.
Eggs Fertilized	73.4	63.7	.	.	.	.
Fertilized Eggs Sold	0	0	.	.	.	.
Eggs Hatched	69.4	61.1	.	.	.	.
Eggs Spoiled	4	5.6	.	.	.	.

**Table A3.23: Major Problems Regarding Poultry Production**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Theft	12	41.4	3	100	3	100
Disease	9	31.0	2	66.7	1	33.3
Low Price of Products	7	24.1	0	0	1	33.3
High Cost of Inputs	7	24.1	0	0	1	33.3
Far from Market	7	24.1	1	33.3	0	0
Predators	5	17.2	2	66.7	0	0
Nothing	4	13.8	0	0	0	0



**Table A3.24: Reasons for Not Expanding Production**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Not Enough Space	11	37.9	2	66.7	1	33.3
Not Enough Time	10	34.5	2	66.7	0	0
Feed Scarcity	2	6.9	3	100	3	100
Water Scarcity	0	0	0	0	0	0
High Cost of Inputs	10	34.5	1	33.3	2	66.7
Low Price of Products	6	20.7	0	0	1	33.3
No Credit Access	0	0	0	0	0	0

**Table A3.25: Source of Ducklings**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Own Flock	69.7	41.1	53.7	44.6	73.3	46.2
Other Farmers	12.8	28.8	0	0	3.3	5.8
Market	0	0	0	0	0	0
Trader	0	0	0	0	0	0
Hatchery	10.7	28.5	46.3	44.6	.	.
Company	3.4	18.6	0	0	23.3	40.4
Other	0	0	0	0	0	0

**Table A3.26: Percent of Producers that Purchase Adult Birds**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
No	24	85.7	3	100	3	100
Yes	4	14.3	0	0	0	0

**Table A3.27: Source of Adult Ducks**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Other Farmers	75	50	.	.	.	.
Market	0	0	.	.	.	.
Trader	25	50	.	.	.	.
Hatchery	0	0	.	.	.	.
Company	0	0	.	.	.	.
Other	0	0	.	.	.	.

**Table A3.28: Importance of Factors Deciding Who to Buy From (0 to 3)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Price	2.1	1.1	2	1.7	1.7	0.6
Quality/Health	2.8	0.6	2	1	2.7	0.6
Relationship with Seller	2.0	1.1	1.3	0.6	1.7	1.2
Breed	2.5	0.9	2	1	2.7	0.6
Quantity	1.8	1.2	1.7	0.6	0.7	0.6
Timing of Purchase	1.0	1.1	1	0	1	1
Source of Bird	.	.	2.3	1.2	1.3	1.2

**Table A3.29: Types of Housing**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Enclosed Unit	7	24.1	0	0	0	0
Confined w/ Roof	16	55.2	2	66.7	3	100
Confined w/o Roof	5	17.2	0	0	0	0
Unconfined	1	3.4	1	33.3	0	0

**Table A3.30: Types of Feed**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Paddy Rice	10	34.5	3	100	1	33.3
Broken Rice	17	58.6	3	100	1	33.3
Bran	22	75.9	3	100	2	66.7
Corn	.	.	2	66.7	0	0
Kitchen Scraps	3	10.3	3	100	1	33.3
Commercial Feed	26	89.7	3	100	0	0
Other	2	6.9	0	0	1	33.3

**Table A3.31: Percentage of Flocks with Daily Access to Water Bodies**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Pond	14	48.3	0	0	2	66.7
Rice Paddies	8	27.6	1	33.3	1	33.3
Canal	6	20.7	0	0	0	0
River	1	3.5	2	66.7	0	0
Lake	0	0	0	0	0	0
Other	0	0	1	33.3	0	0
None	7	24.1	1	33.3	0	0

**Table A3.32: Source of Drinking Water**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Standing / Rain Water	4	17.2	0	0	2	66.7
Well / Personal Water	18	62.1	1	33.3	0	0
Pipes / Public Water System	3	10.3	0	0	0	0
Closed Housing Unit	1	3.5	0	0	0	0
Water Body	4	13.8	2	66.7	0	0
Other	6	20.7	1	33.3	1	33.3

**Table A3.33: Sources of Veterinary Services**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Village Vet. Worker	0	0	3	100	0	0
State Vet. Services	0	0	3	100	0	0
Private Vet.	9	31.0	0	0	0	0
Friend/ Relative/ Neighbor	2	6.9	3	100	0	0
Pharmacy	12	41.4	0	0	2	66.7
Hatchery Owner	1	3.5	0	0	.	.
Company	0	0	0	0	0	0
Do not seek services	7	24.1	0	0	1	33.3

**Table A3.34: Producers with Costs Related to Poultry Production**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Feed	29	100	3	100	3	100
Water	0	100	0	0	0	0
Electricity	3	10.4	1	33.3	0	0
Employees	1	3.5	0	0	0	0
Gasoline	1	3.5	0	0	0	0
Transportation Rental	0	0	0	0	0	0
Pharmaceuticals	11	37.9	0	0	0	0
Vaccinations	3	10.3	2	66.7	0	0
Veterinary Services	1	3.5	0	0	0	0
Building an enclosure	21	72.4	1	100	3	100

**Table A3.35: Average Cost of Each Input for Respondents Using Inputs (LAK/Month) (Flock Size <500)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Feed	947,727	1,029,808	298,667	36,950	1,060,000	450,333
Water	.	.	.	.	.	.
Electricity	50,000	.	.	.	.	.
Employees	.	.	.	.	.	.
Gasoline	138,000	110,309	.	.	.	.
Transportation Rental	.	.	.	.	.	.
Pharmaceuticals	21,000	5,508	.	.	.	.
Vaccinations	40,000	.	100,000	0	.	.
Veterinary Services	130,000	.	.	.	.	.
Building an enclosure	1,424,118	3,195,526	233,333	152,753	1,400,000	1,039,230

**Table A3.36: Average Cost of Each Input for Respondents Using Inputs (LAK/Month) (Flock Size >500)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Feed	16,100,000	3,289,757	.	.	.	.
Water	.	.	.	.	.	.
Electricity	242,667	238,875	.	.	.	.
Employees	80,000	.	.	.	.	.
Gasoline	.	.	.	.	.	.
Transportation Rental	.	.	.	.	.	.
Pharmaceuticals	287,500	319,831	.	.	.	.
Vaccinations	200,000	.	.	.	.	.
Veterinary Services	.	.	.	.	.	.
Building an enclosure	14,500,000	3,316.625	.	.	.	.

**Table A3.37: Average Cost Per Bird (LAK/Month)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Cost Per Bird	7,670.5	6,181	4,644	912	5,387	2,564

**Table A3.38: Average Amount of Time Spent Tending to Flock (Hours)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Number of Hours	3.0	4.5			1.5	.5

**Table A3.39: Marketing Channels (Average Percent of Sales)**

	Vientiane		North		Savannakhet	
	Meat	Eggs	Meat	Eggs	Meat	Eggs
Aggregator	49.7	53.8	83.3	.	53.3	.
Market Vendors	20.7	20	16.7	.	23.3	.
Households/ Other Farmers	24.9	26.2	0	.	0	.
Restaurants / Food Vendors	4.8	0	0	.	0	.
Hatchery	0	0	0	.	.	.
Company	0	0	0	.	23.3	.
Other	0	0	0	.	0	.

**Table A3.40: Average Monthly Sales Quantities**

	Vientiane		North		Savannakhet	
	Low	High	Low Season	High Season	Low Season	High Season
Ducks	8.3	27.3	0	66.7	16.7	101.7
Eggs	4,105	4,264	.	.	.	.

**Table A3.41: Poultry Product Sale Prices (LAK/Head<sup>12</sup>, LAK/Egg)**

	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Broiler	21,824	23,313	31,667	40,000	43,333	45,000
Layers	24,000	26,000	.	.	40,000	40,000
Spent Layers	22,250	23,333	.	.	40,000	40,000
Males	22,333	24,000	.	.	50,000	50,000
Egg	1,012	1,023	.	.	.	.

**Table A3.42: Average Income from Poultry Sales (LAK/Month)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Income	2,190,023	4,248,226	850,000	482,183	2,176,667	1,642,143
% of Total Income	53.0	31.3	31.3	29.2	43.3	41.6

<sup>12</sup> Vientiane: LAK/KG

**Table A3.43: Actions Taken with Birds That Die from Disease**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Sell	0	0	0	0	0	0
Consume	2	6.9	0	0	0	0
Bury	26	89.7	3	100	3	100
Burn	9	31.0	0	0	1	33.3
Give Away	1	3.5	0	0	0	0
Other	1	3.5	0	0	0	0

**Table A3.44: Biosecurity Measures**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Keep Birds in an Enclosure	17	58.6	3	100	1	33.3
Clean Enclosure regularly	26	89.7	3	100	3	100
Use Gloves, boots, and/or masks when handling birds	6	20.7	1	33.3	0	0
Keep birds over cement	1	3.5	1	33.3	0	0
Keep flock separate from other birds	7	24.1	3	100	3	100
Use vaccinations	6	20.7	0	0	0	0

**Table A3.45: Number of Farmers Whose Poultry Were Culled for HPAI**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Culled	5	17.2	1	33.3	0	0

**Table A3.46: Summary Statistics of Farmers with Culled Birds**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
% of Flock Lost	100	0	20	.	.	.
Number of Birds	162	140.2	20	.	.	.
Compensation (LAK/KG)	5,200	5,020	15,000	.	.	.

**Table A3.47: Poultry Farmer Disease Concerns (0 to 3)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
HPAI to birds	2.4	1.1	3	0	1.7	0.6
HPAI to family	2.2	1.0	3	0	2.3	0.6
Other disease to birds	1.8	1.0	2	0	1.7	0.6
Price of products	1.6	1.2	1	0	2.3	0.6

**Table A3.48: Bought and/or Sold Poultry Products from Neighboring Countries**

	North	
	Freq.	Percent
Yes	3	100
No	0	0
Unsure	0	0

**Table A3.49: What Products are Bought**

	North			
	China		Viet Nam	
	Freq.	Percent	Freq.	Percent
Eggs	2	66.7	1	33.3
Chicks	0	0	0	0
Adult Birds	0	0	0	0
Feed	0	0	0	0
None	1	33.3	2	66.7

**Table A3.50: What Products are Sold**

	North			
	China		Viet Nam	
	Freq.	Percent	Freq.	Percent
Eggs	0	0	0	0
Chicks	0	0	0	0
Adult Birds	0	0	0	0
Slaughtered Birds	0	0	0	0
None	3	100	3	100

**Table A3.51: Prevalence of Chinese Poultry Products**

	North	
	Freq.	Percent
Chinese poultry products are very common in the village	0	0
Chinese poultry products are occasionally in the village	2	66.7
Chinese poultry products are rarely in the village	1	33.3
Never seen Chinese poultry products in the village	0	0

**Table A3.52: Types of Chinese Poultry Products Seen**

	North	
	Freq.	Percent
Live Birds	0	0
Slaughtered Birds	0	0
Eggs	2	66.7

## 8.4 Annex 4: Aggregators

Table A4.1: Aggregator Sample Size

	Vientiane	North	Savannakhet	Total
Observations	27	41	36	104

Table A4.2: Gender of Survey Respondents

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Male	5	18.5	8	20.5	1	2.8
Female	22	81.5	31	80.5	35	97.2

Table A4.3: Age of Survey Respondents

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Age	38.2	9.5	38.6		40.7	6.7

Table A4.4: Education of Survey Respondents

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
None	0	0	0	0	3	8.3
Primary	9	33.3	4	9.8	6	16.7
Lower Secondary	6	22.2	19	46.3	15	41.7
Upper Secondary	7	25.9	14	34.2	8	22.2
Vocational	3	11.1	4	9.8	4	11.1
University	2	7.4	0	0	0	0

Table A4.5: Poultry Products Traded

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Commercial Birds	22.2%	11.1%	12.2%	7.3%	2.8%	2.8%
Commercial Chicks/Ducklings	0%	0%	0%	0%	5.6%	2.8%
Local Birds	81.5%	70.4%	92.7%	80.5%	88.9%	55.6%
Local Chicks/Ducklings	11.1%	7.4%	2.4%	7.3%	5.6%	2.8%
Muscovy Ducks	.	3.7%	.	36.6%	.	0%
Eggs	0%	0%	9.8%	7.3%	0%	0%
Fertilized Eggs	0%	0%	2.4%	0%	0%	0%
Other	3.7%		0%		0%	

Table A4.6: Aggregators that Sell Slaughtered Birds

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Yes	6	22.2	1	2.44	3	8.3
Buy Slaughtered	3	50	0	0	1	33.3
Trader Slaughterers	3	50	1	100	2	66.7



**Table A4.7: Keep Birds Overnight and Raise Birds**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Yes	10	37	20	48.8	6	16.7

**Table A4.8: Average Number of Sources Traded with per Month**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Buy	12.1	27.2	3.5	1.5	3.4	1.6
Sell	9.2	24.6	1.6	1.0	1.5	1.2

**Table A4.9: Source of Poultry Products**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Smallscale farms (<100 birds)	88.4%	89.0%	77.3%	76.6%	65.8%	63.9%
Largescale farms (>100 birds)	0%	0%	6.8%	7.1%	0%	0%
Commercial Farms (>1000 birds)	0%	0%	0%	0%	0%	0%
Other Traders	11.5%	11.0%	10.5%	11.1%	28.3%	27.8%
Vendors	0%	0%	5.1%	5%	5.8%	4.8%
Other	0%	0%	0	0%	0%	3.5%

**Table A4.10: Average Amount of Products Purchased Per Week**

Chicken	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Meat	139.3	180.2	102.5	155.3	141.6	246.2
Layer	10	16.4	0	0	0.1	0.1
Male (breeding)	2.1	3.2	0	0	6.7	11.4
Chicks	16.6	16	0	0	2.7	2.2
Eggs	0	0	34.1	45	0	0
Fertilized Eggs	0	0	0	0	0	0
Duck	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Meat	81.6	107.8	72.6	114.1	53.5	111.8
Layer	10.7	18.1	0	0	0.3	0.2
Male (breeding)	6.1	10.2	0	0	2.8	15.7
Chicks	3.8	3.8	0	0	4.5	3.6
Eggs	0	0	41.1	52.1	0	0
Fertilized Eggs	0	0	0	0	0	0

**Table A4.11: Average Buying Price (LAK/Head<sup>13</sup> , LAK/EGG)**

Chicken	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Meat	24,231	26,500	26,605	32,026	21,575	23,625
Layer	25,500	27,167	.	.	25,000	25,000
Spent Layer	25,111	26,778	.	.	22,500	25,000
Male (breeding)	24,600	27,600	.	.	23,000	24,15
Chicks	.	.	.	.	1,500	1,500
Eggs	.	.	722	833	.	.
Fertilized Eggs	.	.	.	.	.	.
Duck	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Meat	19,286	21,095	32,083	38,000	32,905	35,190
Layer	19,142	20,429	.	.	37,000	37,000
Spent Layer	19,428	21,000	.	.	35,500	40,500
Male (breeding)	19,200	20,000	.	.	35,533	38,167
Chicks	.	.	.	.	1,500	1,500
Eggs	.	.	1044	1,156	.	.
Fertilized Eggs	.	.	.	.	.	.

**Table A4.12: Vehicles Used for Transportation of Products**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Walk	0	0	22	53.7	0	0
Bicycle	0	0	0	41	0	0
Motorbike	16	59.3	41	100	24	66.7
Tuk-Tuk	4	14.8	0	0	8	22.2
Car	1	3.7	0	0	0	0
Truck	4	14.8	0	0	7	19.4
Boat	0	0	0	0	0	0
Other	5	18.5	0	0	0	0

**Table A4.13: Average Distance Traveled (KM/Day)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Normal	26.6	20.3	21.3	15.0	32.7	50.9
High Season	27.9	20.3	30.3	18.8	38.5	56.4

<sup>13</sup> Vientiane: LAK/KG

**Table A4.14: Aggregators with Costs Associated with Trading Business**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Feed	10	37.0	36	87.8	18	50
Water	2	7.4	27	65.8	3	8.3
Employees	0	0	0	0	1	2.7
Gasoline	19	70.4	37	90.2	32	88.9
Transportation Rental	9	33.3	0	0	12	33.3
Building an Enclosure	1	3.7	25	61.0	7	19.4

**Table A4.15: Average Cost of Each Input for Respondents Using Inputs (LAK/Month)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Feed	85,000	55,045	305,944	292,565	318,111	193,957
Water	.	.	32,938	71,475	56,667	11,547
Employees	.	.	.	.	1,800,000	.
Gasoline	422,000	386,372	701,600	400,344	1,249,375	1,821,428
Transportation Rental	1,117,500	283,133	.	.	1,010,000	306,594
Building an Enclosure	20,000	.	249,200	116,079	80,000	40,000

**Table A4.16: Sales Channels**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Market Vendors	70.4%	79.5%	43.5%	45.8%	46.9%	59.5%
Consumers	23.5%	14.5%	35.1%	33.6%	11.4%	12.7%
Restaurants/Shops	1.2%	1.5%	10.1%	11.4%	18.6%	8.2%
Other Traders	5%	4.5%	11.0%	9.5%	10.9%	4.5%
Poultry Farmers	0%	0%	0%	0	6.6%	5.9%
Other	0%	0%	0%	0	5.7%	9.1%

**Table A4.17: Average Amount of Products Sold Per Week**

Chicken	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Meat	56.9	119.7	32.6	46.8	145.8	216.4
Layer	4.6	12.1	0.1	0.2	0.3	0.1
Male (breeding)	3.6	6.2	0.1	0.1	10.6	11.4
Chicks	11.5	13.3	0	0	3.3	2.2
Eggs	0	0	29.5	40.9	0	0
Fertilized Eggs	0	0	0	0	0	0
Duck	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Meat	73.3	51.3	21.9	32.9	55.8	116.
Layer	12.3	18.3	0.1	0.2	0.2	0.
Male (breeding)	2.9	5.9	0.1	0.1	3.0	16.4
Chicks	2.9	4.1	0	0	4.8	3.8
Eggs	0	0	36.6	47.6	0	0
Fertilized Eggs	0	0	0	0	0	0

**Table A4.18: Average Selling Price (LAK/Head<sup>14</sup> , LAK/EGG)**

Chicken	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Meat	28,000	30,375	30,855	37,632	28,303	32,485
Layer	26,667	30,000	30,000	35,000	35,000	35,000
Spent Layer	24,833	28,833	30,000	35,000	29,800	35,400
Male (breeding)	27,857	30,000	35,000	40,000	29,857	34,857
Chicks	.	.	.	.	.	.
Eggs	.	.	900	1,133	.	.
Fertilized Eggs	.	.	.	.	.	.
Duck	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Meat	22,684	25,368	37,639	44,028	40,900	44,050
Layer	21,000	24,857	35,000	40,000	50,000	55,000
Spent Layer	20,200	24,200	35,000	40,000	42,800	49,400
Male (breeding)	21,000	24,857	40,000	45,000	50,400	56,800
Chicks	.	.	.	.	.	.
Eggs	.	.	1,333	1,567	.	.
Fertilized Eggs	.	.	.	.	.	.

<sup>14</sup> Vientiane: LAK/KG

**Table A4.19: Importance in Deciding Who to Sell to (0 to 3)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Price	2.3	1.1	2.3	1.0	2.7	0.6
Quantity	1.8	1.2	1.6	0.8	1.7	1.1
Time	1.8	1.2	2.0	1.0	0.9	0.8
Perception of Fairness	2.4	1.0	1.6	0.9	2.5	0.8
Established Relationship	2.3	1.2	1.2	1.0	1.6	1.1
Pre-Payment for Products	0.4	0.8	0.4	0.5	0.1	0.4

**Table A4.20: Average Income from Poultry Trading (LAK/Month)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Income	1,754,444	1,320,997	1,209,900	1,358,877	4,187,059	6,335,233
% of Total Income	63.1	30.1	44.8	30.8	55.6	27.7

**Table A4.21: Trading Practice Inspected by Authorities**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Yes	7	25.9	2	4.9	6	18.8

**Table A4.22: Biosecurity Measures**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Regularly Clean Holding Facilities	18	66.7	40	97.6	34	94.4
Cull birds if they appear sick	5	18.5	21	51.2	24	66.7
Use gloves, mask, and/or boots when handling birds	9	33.3	3	7.3	1	2.8
Provide vaccines or medicine to birds	1	3.7	2	4.9	0	0
Keep birds separated by species	6	22.2	11	26.8	1	2.8

**Table A4.23: Changed Trading Practices after HPAI**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Yes...	23	85.2	34	85	31	86.1
...Trade less poultry	16	69.6	35	100	24	72.7
...Trade more poultry	1	4.3	0	0	0	0
...Changed people to trade with	3	13.0	0	0	2	6.5
...Trade different products	7	30.4	16	47.1	9	28.1
...Increased biosecurity	1	4.3	2	5.9	0	0

**Table A4.24: Aggregator Disease Concerns (0 to 3)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
HPAI to birds	1.7	1.3	2.0	0.9	1.6	0.8
HPAI to family	1.9	1.3	2.1	0.9	1.8	0.9
Other disease to birds	1.9	1.0	2.3	1.0	1.2	0.8
Price of products	2.2	1.0	1.4	0.8	2.5	0.9
Services become obsolete	2.0	1.2	1.6	1.0	2.6	0.8
Authorities will regulate trade	2.0	1.3	1.0	0.8	0.8	0.8

**Table A4.25: Bought and/or Sold Poultry Products from Neighboring Countries for Poultry Trading Business**

	North	
	Freq.	Percent
Yes	11	26.8
No	23	56.1
Unsure	7	17.1

**Table A4.26: What Products are Bought**

	North			
	China		Viet Nam	
	Freq.	Percent	Freq.	Percent
Eggs	11	100	0	0
Chicks	0	0	0	0
Live Birds	1	9.1	0	0
Slaughtered Birds	0	0	0	0
Feed	1	9.1	0	0
None	0	0	11	100

**Table A4.27: What Products are Sold**

	North			
	China		Viet Nam	
	Freq.	Percent	Freq.	Percent
Eggs	0	0	0	0
Chicks	0	0	0	0
Adult Birds	0	0	0	0
Slaughtered Birds	0	0	0	0
None	11	100	11	100

**Table A4.28: Prevalence of Chinese Poultry Products**

	North	
	Freq.	Percent
Chinese poultry products are very common in the village	27	65.9
Chinese poultry products are occasionally in the village	8	19.5
Chinese poultry products are rarely in the village	3	7.3
Never seen Chinese poultry products in the village	3	7.3

**Table A4.29: Types of Chinese Poultry Products Seen**

	North	
	Freq.	Percent
Live Birds	6	15.8
Slaughtered Birds	3	7.8
Eggs	37	97.4

**8.5 Annex 5: Market Vendor****Table A5.1: Market Vendor Sample Size**

	Vientiane	North	Savannakhet	Total
Observations	99	43	45	187

**Table A5.2: Gender of Survey Respondents**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Male	8	8.1	0	0	6	13.6
Female	91	91.9	43	100	38	86.4

**Table A5.3: Age of Survey Respondents**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Age	36.0	9.6	36.8	5.6	39.8	9.3

**Table A5.4: Education of Survey Respondents**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
None	7	7.1	1	2.3	2	4.4
Primary	22	22.2	10	23.3	14	31.1
Lower Secondary	38	38.4	12	27.9	13	28.9
Upper Secondary	18	18.2	18	41.9	12	26.7
Vocational	12	12.1	1	2.3	4	8.9
University	2	2.0	1	2.3	0	0

**Table A5.5: Poultry Products Sold**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Commercial Birds	47.5	7.1	30.2	23.3	24.4	8.9
Local Birds	40.4	28.3	79.1	65.1	75.6	53.3
Muscovy Ducks	.	0	.	37.2	.	2.2
Eggs	20.2	4.0	11.6	9.3	0	6.7
Fertilized Eggs	0	0	0	0	0	2.2
Other	7.1		0		4.4	

**Table A5.6: Market Space**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Temporary (No rental)	2	2.1	6	14.6	5	11.4
Temporary (Rental)	86	91.5	30	73.2	39	88.6
Permanent (purchased)	6	6.4	5	12.2	0	0

**Table A5.7: Sell Slaughtered Birds**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Yes	72	75.8	15	35.7	31	68.9
Slaughter at Market	0	0	0	0	3	9.7
Buy Slaughtered	43	59.7	5	33.3	8	25.8
Personally Slaughter	26	36.1	10	66.7	21	67.7
Pay someone else to slaughter	0	0	0	0	2	6.5

**Table A5.8: Keep Birds Overnight and Raise Birds**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Yes	5	5.1	12	27.9	10	22.2



**Table A5.9: Other Poultry Activities**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Sell Other Meat (non-poultry)	22	22.2	4	9.3	3	6.7
Operate a poultry trading business	68	68.7	22	51.2	15	33.3
Operate a poultry slaughtering business	4	4.0	14	32.6	18	40
Sell from other locations	14	14.1	1	2.3	7	15.6

**Table A5.10: Source of Poultry Products**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Trader delivers to marker	36.8	39.7	37.4	35.4	51.8	51.7
Trader delivers to home	9.8	23.1	18.0	17.6	12.7	5.5
Directly from farm	13.6	19.4	23.9	24.0	21.1	29.7
Other market vendors	5.7	11.1	8.0	8.8	4.5	5.2
Own Flock	0.2	1.1	0.2	0.2	0.7	1.0
Company	34	5.6	12.8	13.9	4.5	0
Other	0	0	0	0	4.5	6.9

**Table A5.11: Average Amount of Products Purchased Per Day (Heads/Day, Eggs/Day)**

Chicken	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Commercial	38	64	8.7	12	21	33.9
Local	20	31	9.6	15.6	18.5	40.3
Eggs	843	1,138	56.2	91	0	0
Fertilized Eggs	0	0	0	0	0	0
Duck	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Commercial	23	57	5.6	9.5	22	45
Local	15	23	6.7	12.5	9.9	36.1
Eggs	645	908	53.3	95	45	55
Fertilized Eggs	0	0	0	0	70	175

**Table A5.12: Average Buying Price (LAK/Head<sup>15</sup> , LAK/Egg)**

Chicken	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Commercial (live)	30,000	33,000	20,143	24,286	20,857	23,571
Commercial (slaughtered)	20,773	23,364	21,700	22,700	19,000	22,500
Local (live)	29,143	31,571	28,533	34,600	21,781	25,406
Local (slaughtered)	27,292	30,708	34,500	41,250	24,000	28,333
Eggs	733	723	772	818	.	.
Fertilized Eggs	.	.	.	.	.	.
Duck	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Commercial (live)	25,000	30,000	27,600	31,600	30,000	31,667
Commercial (slaughtered)	21,500	25,000	24,400	25,400	15,000	15,000
Local (live)	20,200	23,600	36,800	44,320	35,083	39,400
Local (slaughtered)	23,643	25,714	46,667	51,667	.	.
Eggs	842	892	908	950	1,100	1,350
Fertilized Eggs	.	.	.	.	1,200	1,450

**Table A5.13: Vehicles Used for Transportation of Products**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Walk	1	1.0	19	44.2	0	45
Bicycle	0	0	0	0	3	6.7
Motorbike	35	35.4	35	81.4	11	24.4
Tuk-Tuk	16	16.2	4	9.3	0	0
Car	11	11.1	1	2.3	20	44.4
Truck	3	3.0	0	0	2	4.4
Buy at market	31	31.3	3	7.0	8	17.8

**Table A5.14: Average Distance Traveled (KM/Day)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
High Season	8.6	11.1	7.8	11.0	3.4	3.6

<sup>15</sup> Vientiane: LAK/KG

**Table A5.15: Market Vendors with Costs Associated with Vending**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Feed	1	1.0	30	69.8	27	60
Water	14	14.1	16	37.2	15	33.3
Ice	47	47.5	5	11.6	10	22.2
Plastic Bags	89	89.9	28	65.1	32	71.1
Gasoline	48	48.5	29	67.4	20	44.4
Transportation Rental	13	13.1	3	7.0	15	33.3
Market Space	91	91.9	34	79.1	42	93.3
Other	0	0	5	11.6	24	53.3

**Table A5.16: Average Cost of Each Input for Respondents Using Inputs (LAK/Day)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Feed	6,000	.	6,880	5,389	4,440	2,357
Water	4,595	2,898	1,495	1,664	10,156	21,883
Ice	14,933	14,076	6,229	2,899	4,601	2,270
Plastic Bags	7,336	6,754	3,672	4,035	3,886	6,455
Gasoline	17,040	20,584	19,696	16,150	18,917	18,207
Transportation Rental	21,308	11,056	13,810	6,442	24,292	15,071
Market Space	25,440	33,819	4,500	8,652	5,734	3,510
Other	.	.	12,866	20,856	1,281	3,292

**Table A5.17: Sales Channels**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Home consumers	64.8	61.7	57.6	55	66	73
Restaurants/Shops	9.7	10.7	12.3	11.1	3.3	3.8
Traders	5.0	4.7	10.2	10.3	7.8	10.6
Other Vendors	9.5	7.3	6.6	6.8	1	0.6
Farmers	4.1	2.0	0	0	4.4	0
Unsure	6.5	12.3	13.3	15.7	18.1	12.3
Other	0	0	0	0	0	0

**Table A5.18: Average Amount of Products Sold Per Day  
(Heads/Day, Eggs/Day)**

Chicken	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Commercial	34	51	7.9	10.9	19.2	33.8
Local	20	24	9.4	14.9	18	40.1
Eggs	612	798	114	178	0	0
Fertilized Eggs	0	0	0	0	0	0
Duck	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Commercial	22	57	5.1	7.6	16.5	43.2
Local	9	16	6.9	12.7	9.9	35.6
Eggs	473	735	48	92.5	45	55
Fertilized Eggs	0	0	0	0	40	50

**Table A5.19: Average Selling Price (LAK/Head<sup>16</sup> , LAK/Egg)**

Chicken	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Commercial (live)	.	.	22,750	25,500	30,000	30,000
Commercial (slaughtered)	24,875	27,167	27,000	30,200	25,875	30,375
Local (live)	34,600	38,200	30,958	39,000	25,555	27,555
Local (slaughtered)	35,226	38,686	35,625	42,375	31,076	37,846
Eggs	853	888	807	953	.	.
Fertilized Eggs	.	.	.	.	.	.
Duck	Vientiane		North		Savannakhet	
	Low Season	High Season	Low Season	High Season	Low Season	High Season
Commercial (live)	.	.	31,250	35,000	25,000	25,000
Commercial (slaughtered)	26,800	30,200	32,375	34,875	38,333	50,000
Local (live)	22,500	25,833	40,111	48,055	38,125	41,500
Local (slaughtered)	29,391	32,261	45,357	53,928	49,941	57,765
Eggs	1,025	1,067	1,025	1,217	1,600	2,500
Fertilized Eggs	.	.	.	.	1,500	2,750

<sup>16</sup> Vientiane: LAK/KG

**Table A5.20: What is Done with Unsold Products**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Keep for home consumption	1	1.0	16	37.2	12	26.7
Keep for sales the next day	96	97.0	38	88.4	39	86.7
Sell to restaurant	4	4.0	9	20.9	25	55.7
Sell at reduced price	0	0	0	0	5	11.1
Trade for other goods	0	0	1	2.3	5	11.1
Prepare and sell	0	0	0	0	0	0
Discard	0	0	0	0	0	0

**Table A5.21: Average Income from Selling Poultry (LAK/Month)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Income	2,637,077	4,677,628	1,244,535	1,082,524	3,655,778	2,839,644
% of Total Income	47.4	25.8	40.6	26.7	65.6	23.9

**Table A5.22: Vending Space Inspected by Authorities**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Yes	76	77.6	12	27.9	12	26.7

**Table A5.23: Biosecurity Measures**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Regularly Clean Holding Facilities	91	91.9	8	18.6	22	48.9
Regularly clean market space	97	98.0	11	25.6	36	80
Use gloves, mask, and/or boots when handling birds	32	32.3	3	7.0	7	15.6
Keep live birds separated by species	17	17.2	1	2.3	23	51.1

**Table A5.24: Changed Trading Practices after HPAI**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Yes...	61	62.2	39	90.7	39	86.7
...Sell less poultry	31	50.8	39	100	32	82.1
...Sell more poultry	1	1.6	0	0	0	0
...Changed people to source from	7	11.5	1	2.6	5	12.8
...Sell different products	48	78.7	7	18.0	6	15.4
...Increased biosecurity	1	1.6	7	18.0	1	2.6
...Only sell slaughtered birds	0	0	2	5.1	6	15.4

**Table A5.25: Market Vendor Disease Concerns (0 to 3)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
HPAI to birds	0.5	0.7	2.1	0.9	1.4	0.9
HPAI to family	0.5	0.8	2.3	0.8	1.9	1.0
Other disease to birds	1.1	0.8	2.5	0.6	1.2	1.0
Price of products	1.5	0.8	2.1	0.8	2.7	0.8
Services become obsolete	1.9	0.7	1.9	1.0	2.5	0.9
Authorities will regulate sales	1.3	0.9	1.0	0.8	0.8	0.9

**Table A5.26: Bought Poultry Products from Neighboring Countries for Poultry Vending Business**

	North	
	Freq.	Percent
Yes	14	32.6
No	18	41.9
Unsure	11	25.6

**Table A5.27: What Products are Bought**

	North			
	China		Viet Nam	
	Freq.	Percent	Freq.	Percent
Eggs	10	71.4	1	7.1
Live Birds	0	0	0	0
Slaughtered Birds	4	28.6	0	0
Other	3	21.4	0	0

**Table A5.28: Importance of Different Attributes in Buying Foreign Poultry Products (Ranked 1 to 3)**

	North	
	Mean	SD
Price	2.9	0.5
Availability	1.8	0.4
Relationship with Seller	1.3	0.6

**Table A5.29: Prevalence of Chinese Poultry Products**

	North	
	Freq.	Percent
Chinese poultry products are very common in the market	27	62.8
Chinese poultry products are occasionally in the market	13	30.2
Chinese poultry products are rarely in the market	1	2.3
Never seen Chinese poultry products in the market	2	4.7

**Table A5.30: Types of Chinese Poultry Products Seen at Market**

	North	
	Freq.	Percent
Live Birds	7	17.1
Slaughtered Birds	13	31.7
Eggs	42	100

**8.6 Annex 6: Consumer Household Survey****Table A6.1: Consumer Household Sample Size**

	Vientiane	North	Savannakhet	Total
Observations	782	520	502	1,804

**Table A6.2: Gender of Survey Respondents**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Male	244	31.3	279	54.0	111	22.2
Female	535	68.6	238	46.0	390	77.8

**Table A6.3: Age of Survey Respondents**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Age	42.4	13.1	40.2	9.9	41.2	12.2

**Table A6.4: Education of Survey Respondents**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
None	54	6.9	1	0.2	55	11.0
Primary	195	25.0	50	9.6	144	28.7
Lower Secondary	183	23.4	160	30.8	97	19.3
Upper Secondary	169	21.6	163	31.4	129	25.7
Vocational	130	16.7	130	25.1	65	12.9
University	50	6.4	15	2.9	12	2.4

**Table A6.5: Household Size**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Males	2.7	1.4	3.2	1.4	3.0	1.5
Females	3.0	1.6	2.7	1.3	3.0	1.4
Total	5.7	2.3	6.0	2.1	6.0	2.2

**Table A6.6: Economic Status of Household**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Poorest	5	0.6	0	0	0	0
Poor	54	6.9	31	6.0	21	4.2
Medium	574	73.5	421	81.0	427	85.2
Better-Off	148	19.0	68	13.1	53	10.6

**Table A6.7: Number of Market Visits Per Week**

	Vientiane		North		Savannakhet	
	Mean	SD	Freq.	Percent	Freq.	Percent
Visits Per Week	5.1	2.9	3.8	2.5	4.7	2.3

**Table A6.8: Weekly Food Expenditures (LAK/Week)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Total on all food	321,217	178,850	328,052	163,244	328,384	201,701
Food eaten outside the home/ prepared food	66,898	81,513	99,865	82,459	57,821	80,938
Food to be prepared in the home	254,182	157,558	227,296	113,388	268,641	173,781
Chicken meat	39,081	39,796	29,673	19,838	30,732	32,074
Duck meat	16,535	28,884	27,452	20,914	18,835	27,919
Chicken eggs	15,939	12,501	14,020	10,764	16,683	11,634
Duck eggs	3,455	8,957	11,934	12,024	8,003	11,084
Other meat	62,355	70,786	73,900	45,370	84,034	76,935



**Table A6.9: Weekly Meat and Egg Consumption (KG/Week, Egg/Week)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Chicken Meat	1.3	1.2	1.1	0.6	1.3	1.4
Duck Meat	0.7	1.1	1.0	0.6	0.7	0.9
Other meat	2.3	1.4	2.7	3.1	2.8	2.2
Chicken Eggs	16.3	12.7	14.8	12.4	18.5	13.5
Duck Eggs	2.7	5.7	10.3	9.0	7.4	10.6

**Table A6.10: Frequency of Meat Purchases (% of Respondents)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Daily	1.0	0.4	0.2	0.2	0.8	0.4
Every Other Day	3.3	1.5	7.3	3.9	6.2	1.6
Weekly	34.4	12.7	48.7	46.4	58.0	31.7
Every Two Weeks	20.1	8.6	18.9	16.	7.2	4.4
Monthly	28.1	11.1	12.7	13.1	3.0	2.8
Special Occasions	10.0	27.5	6.7	8.5	2.0	10.4
Never	3.1	38.2	5.6	11.9	22.9	48.8

**Table A6.11: Frequency of Egg Purchases (% of Respondents)**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Daily	11.3	1.5	11.9	9.2	12.6	4.6
Every Other Day	9.6	1.8	6.2	4.4	13.9	7.4
Weekly	60.5	13.4	71.6	63.1	61.8	27.5
Every Two Weeks	8.9	3.8	5.0	5.8	2.2	2.2
Monthly	3.6	2.6	1.4	2.3	0.8	1.6
Special Occasions	3.2	17.5	0	0.8	1.8	6.0
Never	3.0	59.3	3.7	14.2	7.0	50.8

**Table A6.12: Types of Birds Purchased**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Commercial	37.9	16.7	20.1	12.2	22.5	4.9
Local/Common	60.3	70.4	64.7	48.3	76.7	91.1
Cross-Bred	0.9	2.8	15.1	14.7	0.8	1.6
Muscovy	.	8.6	.	24.5	.	2.3
Other	0.8	1.5	0	0.1	0	0

**Table A6.13: Percent of Live and Slaughtered Purchases**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Live (slaughtered at home)	9.6	34.8	58.0	61.6	9.9	27.3
Live (slaughtered at market)	6.4	6.2	0	0	6.3	6.2
Slaughtered	83.5	58.7	41.8	38.2	83.8	66.0
Other	0.5	0.2	0.4	0.	0	0.4

**Table A6.14: Location of Bird Purchases**

	Vientiane		North		Savannakhet	
	Chicken	Duck	Chicken	Duck	Chicken	Duck
Wet Market	86.4	73.1	73.9	73.7	88.3	85.1
Supermarket	1.5	1.0	3.2	2.3	0	0
Local Store	2.6	2.8	5.7	5.8	8.9	2.0
Neighbor/Farmer	4.4	16.2	12.9	13.8	3.6	11.4
Trader	4.2	5.9	4.2	4.3	0.8	1.1
Other	1.0	1.0	0	0	0	0.4

**Table A6.15: Location of Non-Poultry Purchases**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Wet Market	84.5	27.1	77.4	46.8	90.6	19.0
Supermarket	3.4	13.8	9.5	17.6	0.3	2.5
Local Store	8.4	17.5	10.5	13.4	7.7	17.1
Neighbor/Farmer	2.5	9.6	4.3	8.6	1.2	6.1
Trader	0.1	1.4	0.1	1.3	0.1	1.3
Other	1.1	8.1	0	0	0.1	1.8

**Table A6.16: Importance of Attributes When Buying Poultry (0 to 3)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Price	2.2	1.0	1.8	1.1	1.9	1.0
Taste	2.3	0.7	2.3	0.8	2.0	1.0
Safety	2.7	0.6	2.7	0.6	2.4	0.9
Convenience/ Availability	1.6	0.9	1.0	0.8	1.4	1.0
Relationship with Seller	1.4	1.0	0.8	0.7	0.8	1.0

**Table A6.17: How Consumers Determine Safety**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Live Appearance	288	36.8	409	78.7	284	56.6
Meat Appearance	602	77.0	357	68.6	376	74.9
Relationship with Seller	157	20.1	262	50.4	116	23.1
Know the Source	74	9.5	155	29.8	41	8.2
Look at Packaging	192	24.6	129	24.8	211	42.0
Do not think about meat safety	59	7.5	46	8.9	19	3.8
Other	4	0.5	1	0.2	7	1.4

**Table A6.18: Knowledge of Poultry that Households Consume**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Know who raised the birds	42	5.4	35	6.8	27	5.4
Know which village the birds come from	73	9.4	34	6.6	93	18.6
Know which district the birds come from	32	4.1	5	1.0	40	8.0
Know which province the birds come from	108	13.9	21	4.1	14	2.6
Know nothing about where the birds come from	525	67.3	424	81.7	328	65.5

**Table A6.19: Consumer Concerns about Poultry Safety (0 to 3)**

	Vientiane		North		Savannakhet	
	Mean	SD	Mean	SD	Mean	SD
Unsanitary Conditions at Market	2.2	1.0	2.0	0.9	1.9	0.9
Unsure about source of meat	1.8	1.0	1.8	1.1	1.3	1.1
Worried about disease	2.3	0.8	2.7	0.6	2.3	0.9
Worried about freshness	2.1	1.0	2.1	0.9	2.0	1.0

**Table A6.20: Changes in Shopping Behaviour in Response to HPAI**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
No Change	163	20.9	33	6.4	54	10.8
Purchase less poultry	352	45.0	430	81.7	267	53.2
Purchase more poultry	1	0.1	7	1.4	6	1.2
More careful about buying poultry	290	37.1	324	62.3	305	60.8
Stop buying during outbreaks	141	18.0	13	2.5	117	23.3

**Table A6.21: Interest in Purchasing Certified Poultry**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Yes	647	83.5	471	91.3	393	78.3
No	128	16.5	45	8.7	109	21.7

**Table A6.22: Reasons Respondents do not Want Certified Poultry**

	Vientiane		North		Savannakhet	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Do not want to pay extra	36	28.1	16	34.8	50	45.5
Worried the system may not work well	26	20.3	7	15.	14	12.8
Need more information	27	21.1	22	46.8	22	20.2
Already satisfied with the safety of poultry purchased	63	49.2	1	2.2	58	53.2

**Table A6.23: Bought Poultry Products from Neighboring Countries**

	North	
	Freq.	Percent
Yes	318	61.4
No	90	17.4
Unsure	110	21.2

**Table A6.24: What Products are Bought**

	North			
	China		Viet Nam	
	Freq.	Percent	Freq.	Percent
Eggs	309	96.3	12	3.8
Live Birds	32	10.1	0	0
Slaughtered Birds	18	5.7	0	0
Other	4	1.3	0	0

**Table A6.25: Importance of Attributes When Buying Foreign Poultry Products (0 to 3)**

	North	
	Freq.	Percent
Price	2.1	1.1
Taste	2.1	0.9
Safety	2.4	0.7
Origin of Product	1.6	1.0
Convenience/ Availability	1.4	1.3
Relationship with Seller	0.6	0.6

**Table A6.26: Prevalence of Chinese Poultry Products**

	North	
	Freq.	Percent
Chinese poultry products are very common in the market	345	66.6
Chinese poultry products are occasionally in the market	125	24.1
Chinese poultry products are rarely in the market	44	8.5
Never seen Chinese poultry products in the market	4	0.8

**Table A6.27: Types of Chinese Poultry Products Seen at Market**

	North	
	Freq.	Percent
Live Birds	150	29.1
Slaughtered Birds	72	14.0
Eggs	503	97.5