GREATER MEKONG SUBREGION CORE AGRICULTURE SUPPORT PROGRAM

ADB Project Document

Livestock Movement and Disease Risk in the Greater Mekong Sub-region – a Rapid Assessment

September 2015

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CONTENTS

ABBREVIATIONS

ADB – Asian Development Bank
ASEAN – Association of Southeast Asian Nations
CASP – Core Agriculture Support Program
CBTA – Cross - Border Transport Agreement
CDM – Clean Development Mechanism
EWEC – East – West Economic Corridor
FAO – Food and Agriculture Organization
FMD - Foot and Mouth Disease
GHG – greenhouse gas
GMS – Greater Mekong Subregion
GMS-AINS – Greater Mekong Subregion - Agriculture Information Network Service
ICT – information and communication technology
LITS – Livestock Identification and Traceability System
MDGs – Millenium Development Goals
NSEC – North – South Economic Corridor
PRC – People's Republic of China
SEC – Southern Economic Corridor
SMEs – small and medium - sized enterprises
SPS – sanitary and phytosanitary
WGA – Working Group on Agriculture

I. EXECUTIVE SUMMARY

1. Increased cross-border livestock trade in the Greater Mekong Sub-region (GMS) is changing disease risk landscapes, including higher incidence to tainted meat and meat fraud in regional markets. This report presents a rapid assessment of recent trends in animal movement and disease reporting. As part of ADB's GMS Core Agriculture Support Program, Phase II (CASP 2), this work supports a regional livestock identification and traceability system (LITS) that can more effectively manage and mitigate regional disease risk. If successful, this project will not only improve animal and public health outcomes, but contribute to higher value agrifood trade and regional poverty reduction.

2. In addition to more detailed information on patterns of GMS animal movements and disease reporting, our general finding is that conditions are ripe for improved oversight and trade facilitation. At the transboundary level, informal animal flows predominate in many areas, leading to higher transactions cots and significant uncertainties regarding health status and other product quality characteristics. These market failures promote adverse selection, limited supply chain engagement, and underinvestment, undermining public trust and leaving this category of regional agrifood development far below its potential to contribute to regional livelihoods.

II. INTRODUCTION

3. Livestock trade is driven by a complex interaction of supply and demand. Overlaid on these market forces are administrative and cultural systems that regulate the movements of animals and people, which combine to form a mosaic of economic incentives. These interactions stimulate the participation of a remarkably diverse set of economic actors, from low income peasant households who seek opportunity in livestock markets to large agrifood companies. There strategies for market engagement, and the rules and incentives that regulate them, are extremely complex and require careful consideration to support the public interest effectively.

4. As livestock supply chains continue to grow, governments generally encourage animal trade for economic growth. However, livestock movements propagate several negative externalities, including disease risk to both animal and human populations. Even though the potential harm of disease spread is significant, there is still only limited consistency in animal health regulations governing of livestock movement within and between GMS countries. In addition, conditions of disease risk vary significantly within the sub-region, especially with regards to habitat, production, and trading practices.

Because of this heterogeneity, disease transmission across a particular boundary is often propagated in both directions. This particularly a challenge in boundary regions like the GMS, where health standards still vary at national and especially local levels, in addition to the private practices for production and movement of livestock. These conditions may be challenging for public health agencies, but they provide a great and mutually beneficial opportunity for multilateral cooperation. While national control measures may be less in the presence of informal trading networks within the GMS, all member countries can gain from more coordinated management of the livestock trade.

5. To address these public health concerns, governments usually devote their attention and resources to registering formal animal trade. While this may be easier to observe and monitor, it is still necessary to address the informal trade of animals. Regardless of the market size of informal trade, the contagious nature of many animal diseases proves its importance. To be most effective, innovations like traceability should be designed to provide incentives for informal traders to join, clearly demonstrating the enhanced value benefits of voluntary participation.

6. In the following rapid assessment, we report on sub-regional initial conditions for disease risk and animal flows. Special attention is given to Foot and Mouth Disease (FMD) because of its overarching economic importance to the viability of the ruminant trade.

III. OVERVIEW OF AVAILABLE INFORMATION ON GMS ANIMAL FLOWS

7. Despite its long history, official and independent research on transboundary animal trade patterns within the GMS has been limited, and the data is fragmented and inconsistent. In part this is due to the predominance of informal trade, a consequence of de jure or de facto prohibitions on live animal movement over many of the region's borders. A few early examples (Cheva-Isarakul, 1995 and Cleland et al., 1996) were confined to data compilation and descriptive statistics. These authors recognized the importance of informal activities, both in terms economic growth and disease risk, but authoritative contributions to the region were limited until recently.

8. With the rapid growth of regional agrifood markets in recent years, there have been a few large and well-executed studies. The most robust of these is Cocks et al. (2009), which was the product of collaboration between the Food and Agriculture Organization of the UN (FAO), the Asian Development Bank (ADB) and the World Organization for Animal Health (OIE). This study focused on the risk of disease spread, and set a new standard for regional scope and rigor. A combination of official data synthesis and

original surveys, this report offers a solid basis for regional risk assessment and best practice standards for more refined policy.

9. Among bilateral institutions, AusAID and the Australian Centre for International Agricultural Research (ACIAR) have been prominent supporters and contributors to regional livestock research. Several other institutions, such as the Danish International Development Agency (DANIDA), UKAID and the Japan International Cooperation Agency (JICA), have provided livestock sector development support across the GMS. However, apart from poultry sector work on HPAI, this support has yet to produce a significant body of research on trade or disease risk.

10. Several publications of independent research have also emerged. These include studies focused on an individual country, such as Kyaw (2009) on Myanmar, Perry et al. (2002) on Lao PDR, Cleland et al. (1996) and Cheva-Isarakul (1995) on Thailand, as well as surveys, such as Gleeson (2002). A promising recent development is a new line of research using genetic inference to trace patterns of historical infections (Di Nardo et al., 2011). However, this literature still remains in the early stages of development.

11. As the GMS continues its rapid growth within Asian agrifood supply chains, the priority should be to gather and improve evidence on animal trade flows and their implications for disease risk origination and transmission. The present study aims to make several contributions to this agenda, including a synthesis of the most current official data, a variety of original approaches to estimate informal trade flows, and an initial examination of the linkage between animal trade flows and disease risk.

IV. ECONOMICS OF INFORMAL TRANS-BOUNDARY TRADE

12. Trade in livestock at the informal level is largely spontaneous and market driven, particularly between rural farm communities and urban consumers. When the forces of excess supply or demand cross national boundaries, it is typical to find informal traders exploiting national market disparities, while attempting to reduce transactions costs. Public institutions generally seek to regulate or even prohibit the resulting trans-boundary trade, which can undermine the livelihood potential of these activities. Alternative policies, focused more on promoting higher product quality and lower trade and transport margins, could instead achieve both public health goals and the improvement of living standards. In this section, the salient points of these market dynamics are discussed.

A. Livelihood Perspective

13. Those taking part in the informal livestock trade are motivated to obtain economic reward from local resource and market conditions. Market access is the primary gateway out of poverty for the majority of rural poor, and livestock are relatively high value agrifood products that can contribute to poverty alleviation. Farmers directly benefit from their livestock, but they are also linked to urban consumers across large supply chain networks comprised mostly of small or low-income intermediaries that can share in the benefits of this value chain.

B. Market Dynamics

14. Demand side forces in the livestock trade are generally dominated by population density and purchasing power. Because of similar demographics and economic fundamentals, livestock markets have been growing faster in Asia over the last two decades than in other parts of the world. The supply capacity in Asian markets arises from a wealth of natural resources and a commitment to investment in animal production, processing, and distribution.

C. Risk Management

15. Informal livestock movement is spread out geographically and has some clandestine roots, creating potential safety hazards and difficulties for cost effective monitoring. At one end of the spectrum, smallholders living near mountainous borders may transport animals through areas defined by kinship networks, with limited regard for national boundaries. Potentially thousands of animals move daily through the GMS in such a fashion, each one with the potential to transmit disease. At the other end of the spectrum, organized syndicates might manage informal livestock trade. They would have a strong incentive to avoid surveillance, and possibly even to exploit animal disease for personal gain.

16. Most commonly, however, informal livestock trade in the GMS consists of networks of small enterprise and individual agents. Their behavior suggests that the net risk of informal livestock trade is in fact quite low. Since these private agents are not deterred from current surveillance and enforcement mechanisms, and are unlikely to be internalizing the cost of disease transmission, policy makers need to re-evaluate their position. Currently, clandestine border trade in the GMS is a place where punishment dominates strategic interactions, and the institutional environment in such areas is not conducive to positive growth. Many researchers have concluded that the most cost effective way to reduce the risks of informal trade should not be punitive, but instead provide incentives to divert animals into formal channels. These would include domestic

processing, certification or traceability systems, and pooled transport and distribution resources.

17. The following overview of trans-boundary livestock movement in the GMS consists of two parts. The first part consists of official data from government sources. The results are presented on a per-country basis for livestock populations in Lao PDR, Cambodia, Vietnam and Thailand. The rest of the official data section involves information on imports and exports of Thailand from/ to Vietnam, Thailand, Cambodia, Lao PDR and Myanmar. The second part is unofficial data, which mostly consists of anecdotal evidence and informal conversations with traders.

Table 1: Livestock Population of Lao PDR ('000 head)

	2006	2007	2008	2009	2010	2011
Cattle	**1,324**	**1,353**	**1,499**	**1,426**	**1,474**	**1,538**
Buffaloes	**1,108**	**1,123**	**1,155**	**1,178**	**1,183**	**1,197**
Pigs	**2,032**	**2,186**	**2,548**	**2,947**	**2,753**	**2,650**
Goats and Sheep	**211**	**268**	**289**	**367**	**366**	**433**

Source: Statistical Yearbook, Lao PDR Statistics Bureau

Figure 1: Livestock Population of Lao PDR ('000 head)

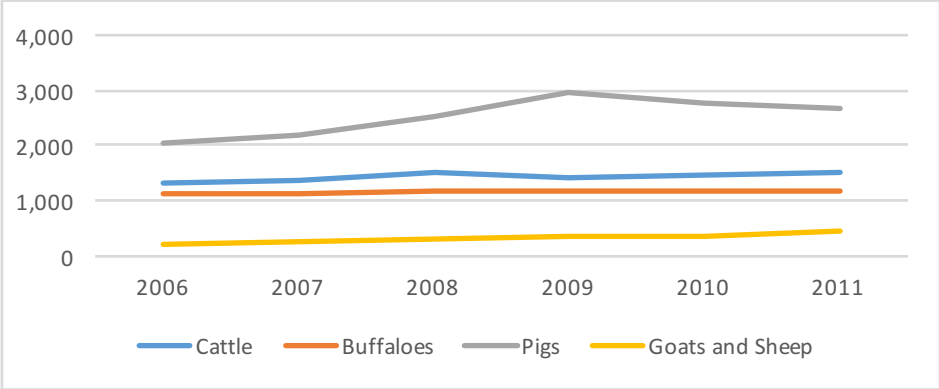


Table 2: Livestock Population of Cambodia ('000 head)

	2009	2010	2011
Cattle	**3,768**	**3,052**	**2,787**
Buffaloes	**711**	**669**	**582**
Pigs	**1,860**	**1,435**	**1,415**
Sheep	**5**	**5**	**1**
Goats	**58**	**35**	**15**

Source: National Institute of Statistics, Cambodia

Figure 2: Livestock Population of Cambodia ('000 head)

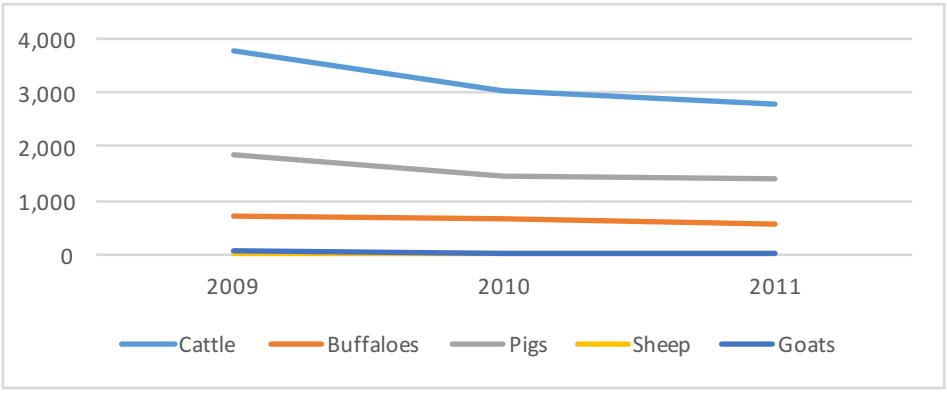


Table 3: Livestock Population of Vietnam ('000 head)

	2006	2007	2008	2009	2010	2011
Cattle	**6,511**	**6,725**	**6,338**	**6,103**	**5,808**	**5,437**
Buffaloes	**2,921**	**2,996**	**2,898**	**2,887**	**2,877**	**2,712**
Pigs	**26,855**	**26,561**	**26,702**	**27,628**	**27,373**	**27,056**
Goats and sheep	**1,525**	**1,778**	**1,483**	**1,375**	**1,288**	**1,268**

Source: The General Statistics Office of Vietnam

Figure 3: Livestock Population of Vietnam ('000 head)

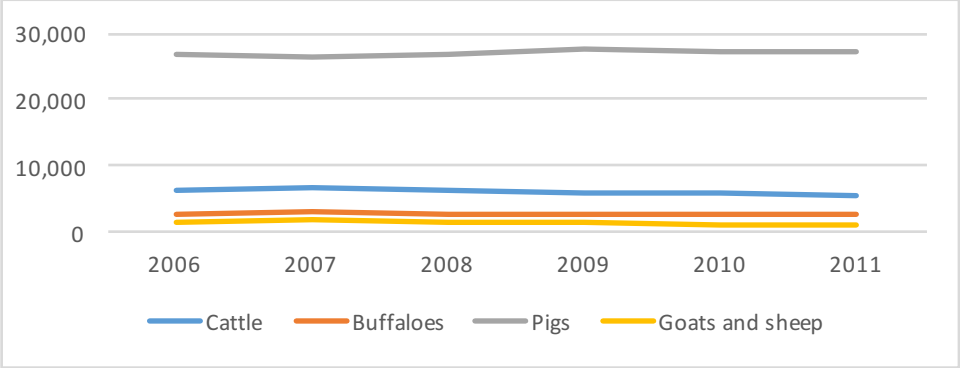
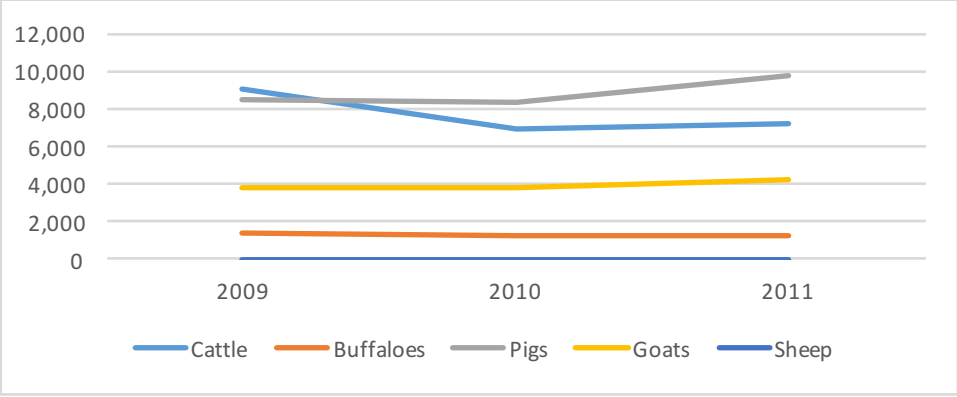


Table 4: Livestock Population of Thailand ('000 head)

	2009	2010	2011
Cattle	**9,079**	**6,956**	**7,144**
Buffaloes	**1,389**	**1,191**	**1,234**
Pigs	**8,538**	**8,347**	**9,682**
Goats	**3,838**	**3,800**	**4,276**
Sheep	**40**	**43**	**58**

Source: Department of Livestock Development, Thailand

Figure 4: Livestock Population of Thailand ('000 head)



18. Cocks et al. (2009) determined that both Cambodia and Lao PDR are transit countries for large ruminants moving from Thailand to Vietnam. Domestically, Cambodia can meet its demand for these animals, and generally is an exporter of livestock. However, the domestic production in Lao PDR is insufficient, and the country must import large ruminants to satisfy domestic demand. This trend is only exacerbated by higher prices in the export markets to China and Vietnam. Table 4 shows that the livestock population of Lao PDR has increased almost every year since 2009. Tables 5-8 provide the livestock populations of Cambodia, Vietnam and Thailand, respectively.

D. Thai Imports and Exports of Live Animals

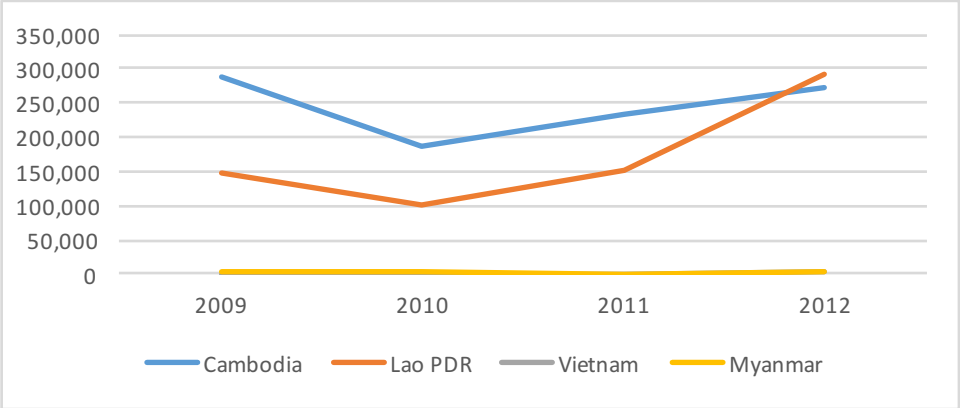
19. The most recent data from the Ministry of Commerce in Thailand reveals that there is a large movement of swine from Thailand to Cambodia and Lao PDR (Table 5). Although the quantity of swine exports to each country fluctuates annually, Cambodia and Lao PDR consistently have a combined share of at least 97% of the entire swine export market in Thailand. While the movement of bovine animals from Thailand to Lao PDR is also relatively high, the data suggests that Thai cattle exports are generally diminishing within the GMS (Table 6).

Table 5: Thai Exports of Live Swine (head)

Destination	2009	2010	2011	2012
Cambodia	**286,529**	**185,165**	**233,646**	**273,227**
Lao PDR	**146,383**	**100,514**	**150,777**	**290,853**
Vietnam	**546**	**468**	**35**	**3,130**
Myanmar	**2,098**	**3,180**	**1,160**	**2,215**

Source: Ministry of Commerce, Thailand

Figure 5: Thai Exports of Live Swine (head)



20. Thailand continues to import the majority of its bovine animals from Myanmar, and the quantity has increased yearly since 2009 (Table 7). Thailand has also begun to import live sheep and goats from Myanmar (Table 8).

Table 6: Thai Exports of Live Bovine Animals (head)

Destination	2009	2010	2011	2012
Cambodia	**3,497**	**220**	**1,329**	**1,650**
Lao PDR	**100,004**	**86,835**	**13,033**	**85,654**
Myanmar	**33,409**	**52,574**	**1,738**	**4,720**
Vietnam	**5,602**	**713**	**0**	**322**

Source: Ministry of Commerce, Thailand

Figure 6: Thai Exports of Live Bovine Animals (head)

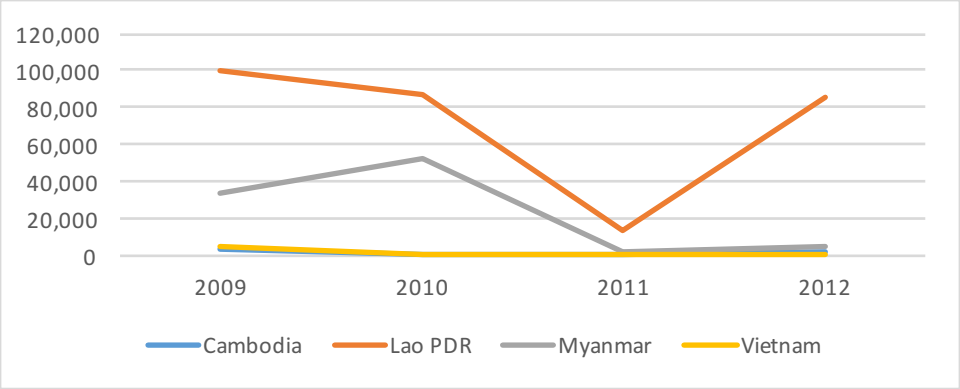


Table 7: Thai Imports of Live Bovine Animals (head)

Source	2009	2010	2011	2012
Myanmar	**20,653**	**40,119**	**71,680**	**102,644**

Source: Ministry of Commerce, Thailand

Table 8: Thai Imports of Live Sheep and Goats (head)

Source	2009	2010	2011	2012
Myanmar	**0**	**0**	**100**	**24,000**

Source: Ministry of Commerce, Thailand

E. Thai Exports of Livestock Products

21. Recently, the majority of animal parts, including guts, bladders, stomachs and other edible offal, are being exported to Lao PDR or Myanmar (Tables 9 and 10).

Table 9: Thai Exports of Edible Offal (HS Code 0206) (tonnes)

Destination	2009	2010	2011	2012
Lao PDR	**0.09**	**215**	**464**	**1,285**

Source: Ministry of Commerce, Thailand

Table 10: Thai Exports of Animal Guts, Bladders and Stomachs (HS Code 0504) (tonnes)

Destination	2009	2010	2011	2012
Lao PDR	**0**	**0**	**122**	**50**
Myanmar	**0**	**0**	**0**	**421**

Source: Ministry of Commerce, Thailand

22. Table 11 presents Thai export data on a variety of animal products. Several trends exist, but one of the most prominent is that Lao PDR is importing a significantly larger amount of bovine meat in recent years.

Table 11: Thai Exports of Various Animal Products for Human Consumption by HS Code and Country

Destination	2009	2010	2011	2012
0202 (KG) Meat of bovine animals, frozen				
Lao PDR	**27,000**	**1,342,075**	**11,357,918**	**16,900,609**
Myanmar	**530,185**	**85,746**	**-**	**2,801,875**
021020 (KG) Meat of bovine animals, salted, in brine, dried or smoked				
Lao PDR	**-**	**373,810**	**1,351,149**	**4,407,598**
0203 (KG) Meat of swine				
Lao PDR	**349,500**	**916,500**	**2,323,509**	**1,752,323**
Myanmar	**1,596,595**	**192,458**	**-**	**190**
021012 (KG) Bellies (streaky) & cuts thereof				
Cambodia	**-**	**-**	**10**	**2,904**
Lao PDR	**5,162**	**27,044**	**22,825**	**16,537**
0401 (KG) Milk and cream, not concentrated nor containing added sugar or other sweete-ning matter				
Cambodia	**6,216,360**	**6,400,280**	**7,353,634**	**8,276,450**
Lao PDR	**502,504**	**949,902**	**1,019,581**	**434,328**

Myanmar	484,893	93,247	27,539	62,784
Vietnam	329,339	708,618	905,683	1,348,062
0402 (KG) Milk and cream, concentrated or containing added sugar or other sweetening				
Cambodia	4,908,430	7,076,961	9,672,793	8,502,198
Lao PDR	2,105,702	3,120,452	3,575,822	3,788,308
Myanmar	1,971,101	3,578,570	6,017,798	2,534,951
Vietnam	890,446	672,218	672,493	943,459
040390 (KG) Buttermilk, curdled milk and cream, kephir and other fermented or acidified milk and cream (excluding yogurt)				
Cambodia	1,895,623	3,266,979	3,310,396	3,287,926
Lao PDR	1,557,443	1,152,494	1,877,001	2,035,552
Myanmar	935,745	888,983	1,553,982	2,382,197
Vietnam	186,519	348,133	353,851	197,028
040310 (KG) Yogurt				
Cambodia	1,272,707	1,477,292	1,174,039	724,885
Lao PDR	2,701,233	4,355,558	5,213,609	6,755,866
Myanmar	68,689	176,389	795,095	192,581
Vietnam	1,383,894	1,412,686	1,129,909	1,143,778
0407 (NO) Birds' eggs, in shell, fresh, preserved or cooked				
Cambodia	-	3,002	1,034,134	3,170,500
Lao PDR	13,260,300	440,230	78,710	270,300
Myanmar	4,173,160	4,509,846	4,328,260	2,425,905
0406 (KG) Cheese and curd				
Cambodia	18,941	32,694	103,202	63,068
Lao PDR	3,366	2,623	8,510	24,618
Myanmar	1,925	6,991	1,020	4,846
Vietnam	5,769	1,176	14,204	3,033
0405 (KG) Butter and other fats and oils derived from milk				
Cambodia	27,948	43,303	49,787	11,054
Lao PDR	126,160	132,736	170,350	219,334
Myanmar	17,615	31,938	397,038	171,614
Vietnam	58,760	-	-	-
0404 (KG) Whey; products consisting of natural milk constituents				
Cambodia	6,657,331	7,145,161	8,303,831	9,681,550
Lao PDR	2,701,384	2,772,460	2,781,282	3,115,555
Myanmar	2,742,051	3,755,332	5,207,541	62,896
Vietnam	363,350	820,800	296,500	320,400

Source: Ministry of Commerce, Thailand

23. Very little reliable evidence was found on the trade of animals, parts or feed from Vietnamese, Cambodian or Laotian authorities. For an investigation of Vietnamese agricultural statistics, the Ministry of Agriculture and Rural Development, Vietnam

Customs, the General Statistics Office and the Ministry of Industry and Trade were all examined, and found to be either out of date or containing no relevant information on agriculture. The same predicament occurred in Cambodia with the Ministry of Agriculture, Forestry and Fisheries, the National Institute of Statistics, the General Department of Customs and Excise and the Ministry of Commerce, as well as in Lao PDR with the National Agriculture and Forestry Research Institute, the Lao PDR Statistics Bureau, the Agricultural and Forestry Extension, the Customs Department, the Ministry of Agriculture and Forestry and the Lao PDR Trade Portal. Additional information from these countries would contribute to improved understanding and assessment of livestock trade and its inherent risks.

Table 12: Annual per capita availability of meat and eggs (kg, Cambodia and Lao PDR 2011, Myanmar, Thailand and Vietnam 2013)

	Cambodia	Lao PDR	Myanmar	Thailand	Vietnam
Bovine meat	5	7.1	4.9	2.6	7.4
Pig meat	8	8.7	11.3	13	35
Poutry meat	1.9	3.8	21.9	13.7	12.4
Eggs	1.4	2	6.5	12.4	3.8

Source: FAOSTAT, accessed Sep. 2015

Figure 7: Annual per capita availability of meat and eggs (kg, Cambodia and Lao PDR 2011, Myanmar, Thailand and Vietnam 2013)

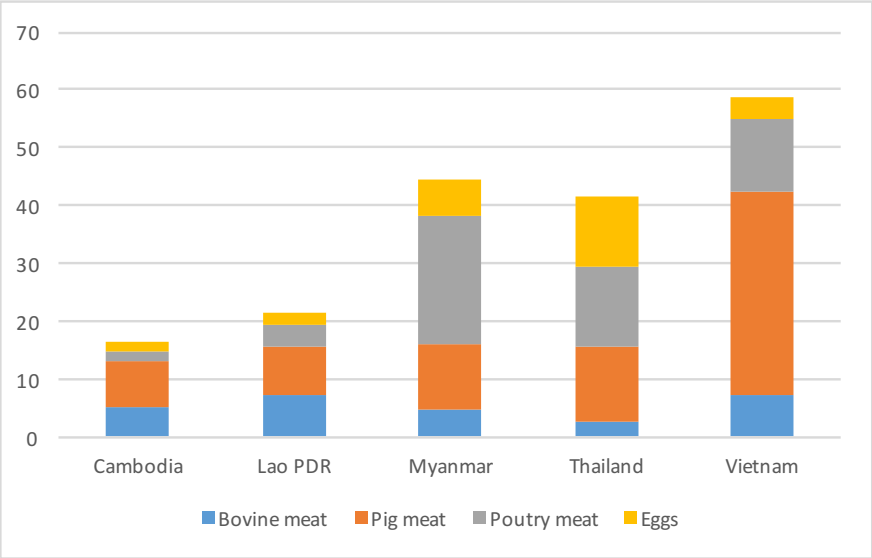


Table 13: Domestic Animal Production: Headcount (thousands, pigs on right axis)

Headcount (thousands, pigs on right axis)					
	Cambodia	Lao PDR	Myanmar	Thailand	Vietnam
Buffalo	60	178	306	10	436
Cattle	530	216	1,644	651	1,653
Pig	1,722	2,144	8,058	13,332	45,968
Chicken	17	25	925	1,102	352
Eggs	5	3	64	85	72

Source: FAOSTAT, accessed Sep. 2015

Figure 8: Domestic Animal Production: Headcount (thousands, pigs on right axis)

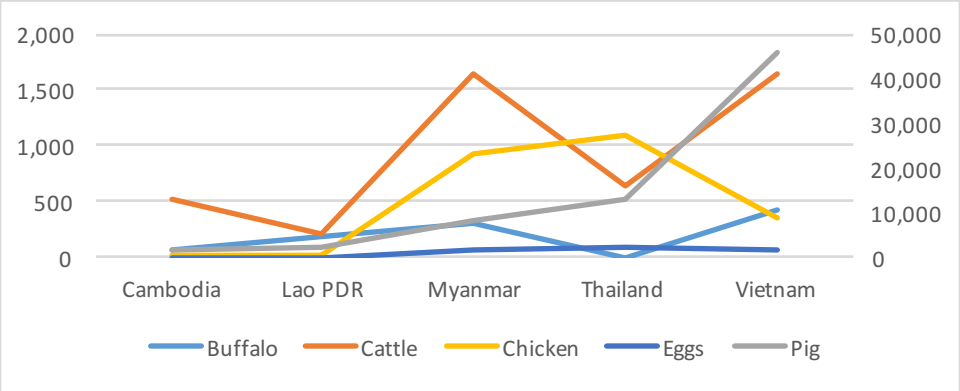
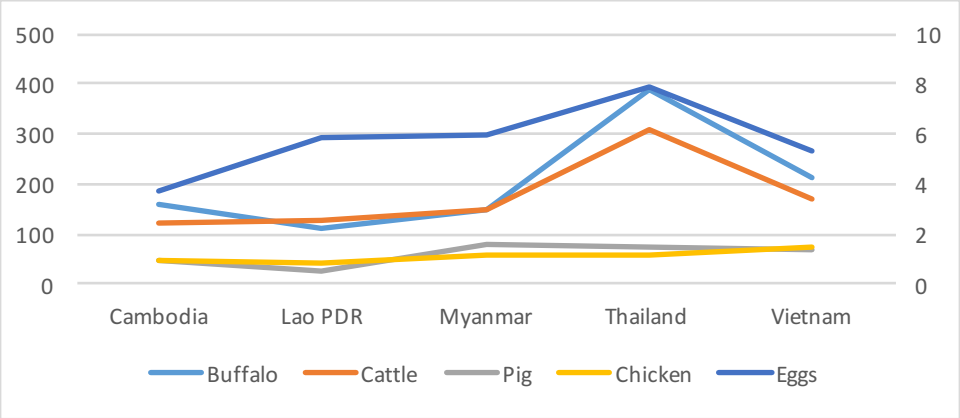


Table 14: Domestic Animal Production: Yield (kg/head/year)

	Yield (kg/head/year)				
	Cambodia	Lao PDR	Myanmar	Thailand	Vietnam
Buffalo	160	110	150	386	215
Cattle	120	125	150	306	172
Pig	50	28	77	74	70
Chicken	1	1	1	1	2
Eggs	4	6	6	8	5

Source: FAOSTAT, accessed Sep. 2015

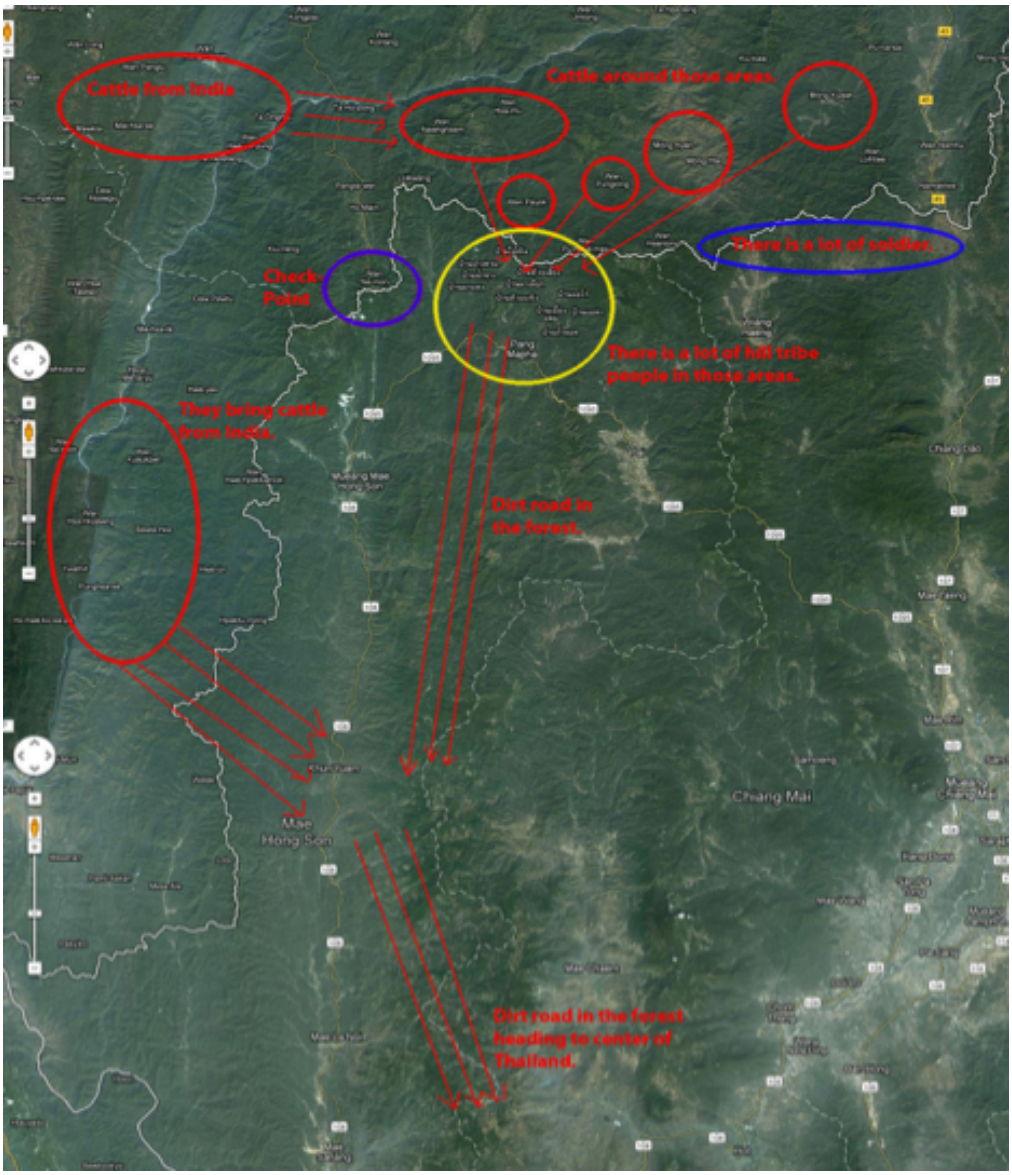
Figure 9: Domestic Animal Production: Yield (kg/head/year)



V. INFORMAL ANIMAL TRADE

24. Given the many official restrains on past GMS transboundary animal trade, it is hardly surprising that informal trading networks have persisted. To assess the significance of these parallel market activities, we conducted informal surveys and relied on prior work by our own researchers interviewing active members in the informal trans-boundary animal trade. This approach does not provide a rigorous database, but it is nonetheless an effective way of qualitative assessment based on otherwise inaccessible sources.

Figure 10: Cattle Movement Across the Thai-Myanmar Border in Northern Thailand

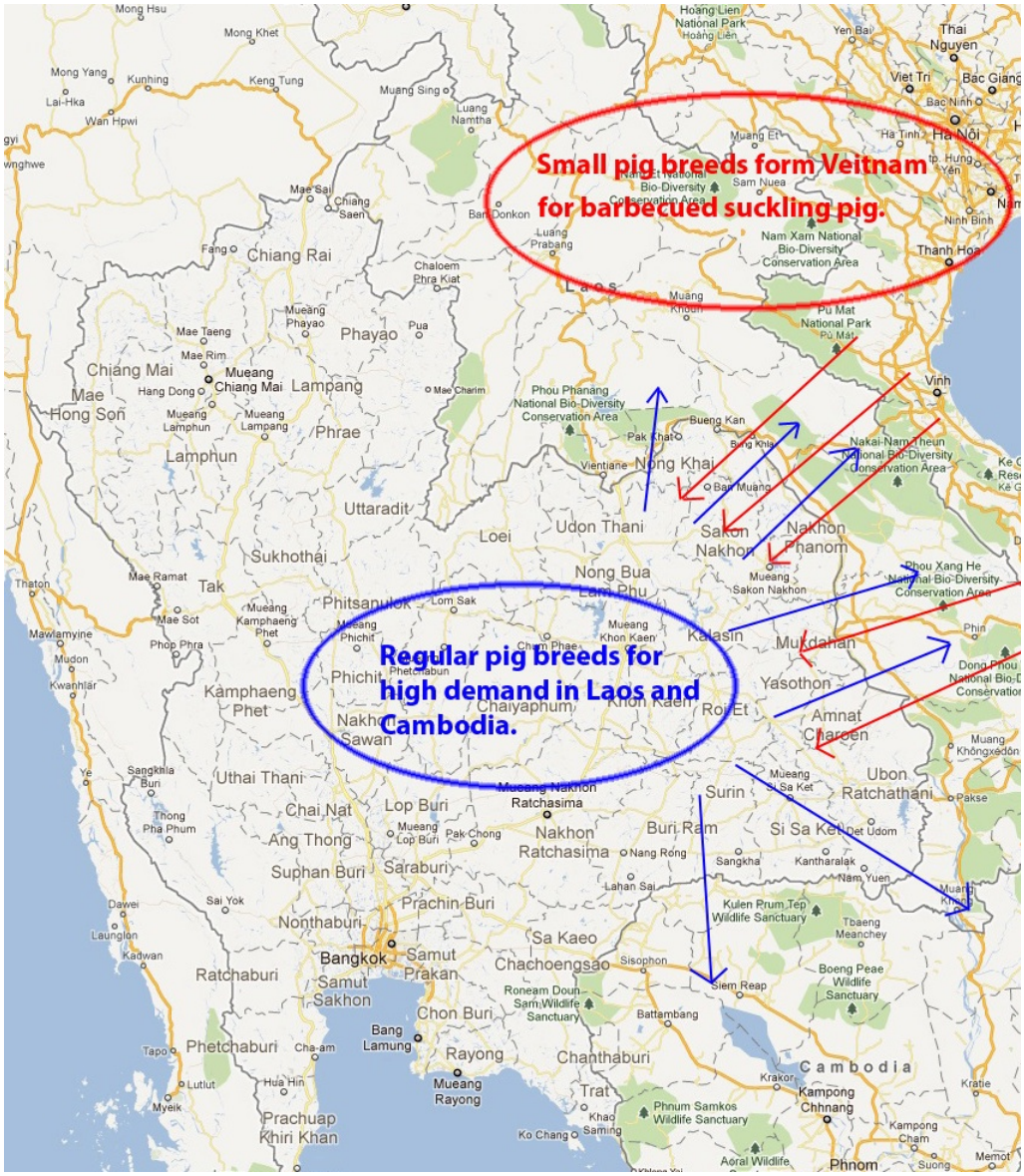


Source: Informal conversation with traders

25. Meetings with traders from Chiang Mai, Lampang, and Mae Hong Son provinces gathered information about informal livestock movement across several borders, with a focus on Northern Thailand. A preliminary finding is that cows and pigs move regularly across the borders between Thailand and Myanmar. There are separate trading networks for formal and informal movements, and both types of trade are common. Our information is anecdotal, but the primary impetus for informal trade appears to be avoidance of higher perceived transactions costs in formal trade, as well as aversion to inspection of the animals. Cows imported from Myanmar generally arrive by truck on dirt

roads or by foot through the forest. The traders who use dirt roads have a relay system in place to confirm that no soldiers are present while moving animals. It is easier to avoid detection when walking animals, but it is also quite slow. Typically, there are one to two hundred head of cattle per trip, and while the level of flow fluctuates with demand, this form of informal trade functions year round.

Figure 11: Pig Movement in the Eastern GMS



Source: Informal conversation with traders

26. The largest informal flows in the north of Thailand exist around Mangmapha in Mae Hong Son province. This village has several couriers, is geographically high and contains a dense forest along the border between Thailand and Myanmar. Ampur

Khunyuam, the second most popular border crossing, has a similar geography, which makes both villages ideal locations for informally moving animals across borders. A diagram of these trade routes is seen in Figure 3. It has also been suggested that approximately 80% of this type of informal trade is operated by ethnic minorities who have family members on both sides of the border.

27. Punishments for smuggling livestock can be severe, including confiscation, fines, and imprisonment. For this reason, many traders sub-contract ethnic minorities to move animals across the border because of their willingness and local extended family networks. Traders who informally import livestock generally have arrangements to hand off the animals to traders immediately after crossing the border. Buyers of these animals are typically illegal slaughterhouses or traders who come from Central Thailand. There is a higher demand for cattle in the central provinces, and the imported animals travel there for slaughter or for sale. According to several traders who are involved in the cross-border trade between Thailand and Myanmar, the origin of most cattle is India, and to a lesser extent, Bangladesh. Among the former, spent dairy cattle are dominant, as India has a thriving dairy industry but limited meat demand.

VI. FOOT AND MOUTH DISEASE IN GMS COUNTRIES

28. FMD affects ruminants (cattle, buffalo, sheep and goats) and pigs, is by far the disease of greatest concern to animal health authorities in Southeast Asia.[1] Although FMD is rarely fatal, it causes severe losses in productivity in dairy cattle and in draft animals, the latter of particular concern in the region. Given the high contagiousness of FMD, once introduced into a herd or village, a large proportion of susceptible livestock will contract the disease, leading to high aggregate losses.

29. Despite on-going efforts by countries in South-East Asia to control FMD, it remains endemic throughout much of the region (with Indonesia, Philippines and Eastern States of Malaysia being the only areas to have eradicated the disease). Figure X provides a global overview of the FMD status with regional FMD virus pools[2] and predominant virus serotypes

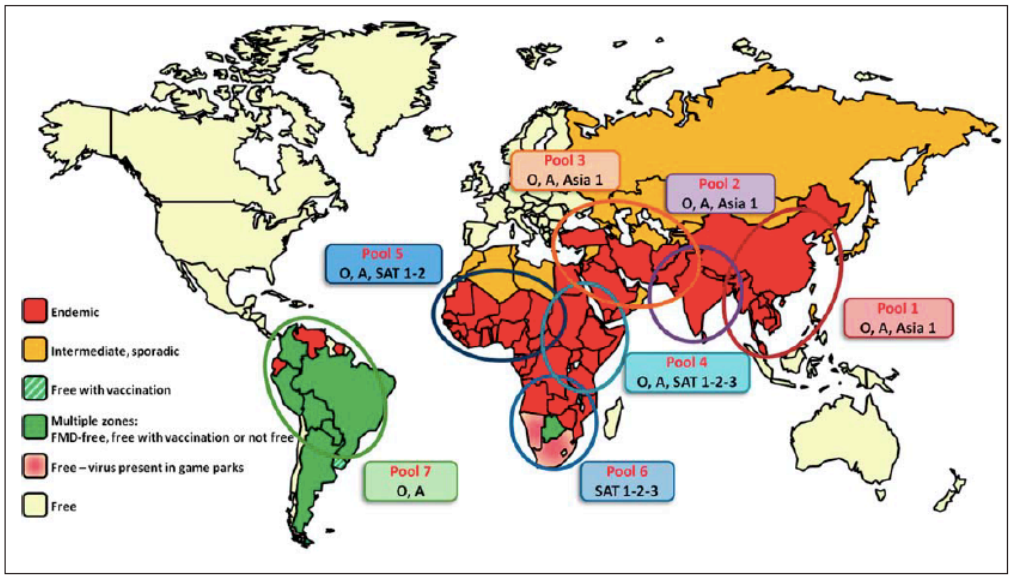
30. The FMDv serotypes present in the GMS are O, A and Asia-1. Serotype O is the most common strain and there are several topotypes (genetic lineages) present - the

[1] Classical swine fever (CSF) and Porcine Respiratory and Reproductive Syndrome (PRRS) are the two major diseases of pigs of concern to veterinary authorities in the region while Highly Pathogenic Avian Influenza is the main disease of poultry in Southeast Asia.

[2] Pools represent independently circulating and evolving FMDV genotypes; within the pools, cycles of emergence and spread occur that usually affect multiple countries in the region. In the absence of specific reports, it should be assumed that the serotypes indicated are continuously circulating in parts of the pool area and would be detected if sufficient surveillance was in place.

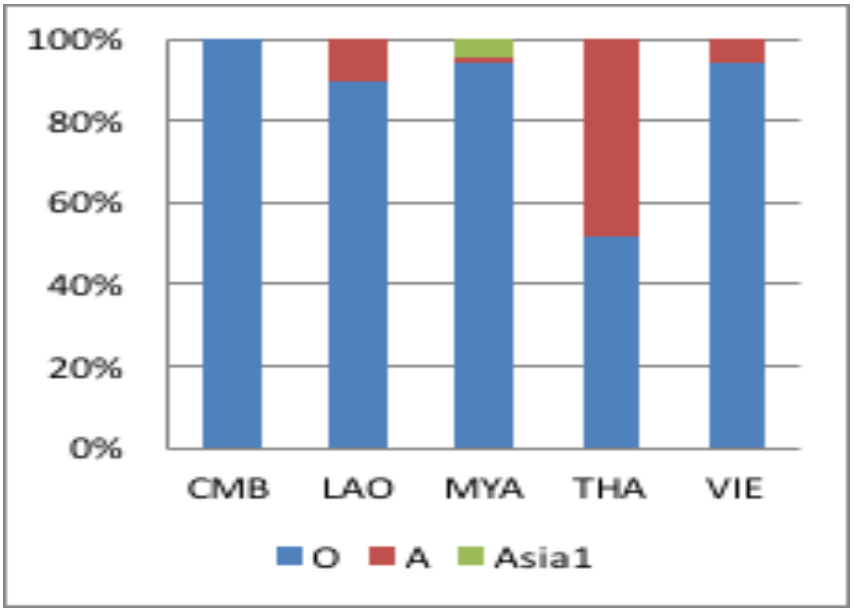
Southeast Asia, the Pan-Asia and the Cathay (pig adapted strain). The Southeast Asia topotype, which could be considered an indigenous strain in the region, is present in all GMS countries. The Pan-Asia topotype was probably introduced into the region in the late 1990s and has been confirmed in Cambodia (2000), Lao (2000), Malaysia (2000), Myanmar (1999), Thailand (1999) and Vietnam (2002). The pig-adapted serotype O was detected in the Philippines in 1995 and Vietnam in 1997.

Fig. 12: FMD Status with regional FMD virus pools and predominant virus serotypes (Source: Di Nardo et al., 2011)



31. Serotype A has been consistently present in Thailand. In 2003, there was relative increase in outbreaks and this spread to Lao PDR and Malaysia. In August 2004, Vietnam was hit for the first time affecting the southern provinces, which could be due to cattle movement from Cambodia and Thailand. In Myanmar, serotype A was reported in 2010 in Rakhine State situated close to the border with Bangladesh after its last report in 1999 in Tanintharyi Region.

Fig 13: Relative occurrence of FMD virus serotypes in GMS countries, 2000-2010



32. Serotype Asia-1 has not been very active in the GMS, but in August 2005 an outbreak was reported in Kayah State and Magway Region of Myanmar. Nucleotide sequencing revealed that it was closely related to the 1998 Asia-1 virus in the region. The central and northern parts of Vietnam were also affected with Asia-1 in 2005.

33. The results of typing of 2,561 FMD viruses isolated in outbreaks between 2000 and 2010 in GMS countries are shown in Figure 13. Type O was the dominating serotype across the region and all 5 countries, overall accounting for 82% of all typed isolates. Type A was isolated in 4 of the 5 countries (the exception being Cambodia, from which however only 3 isolates were typed), accounting for 17% of isolates. Serotype Asia-1, as mentioned above, has only been isolated in Myanmar and Vietnam in 2005.

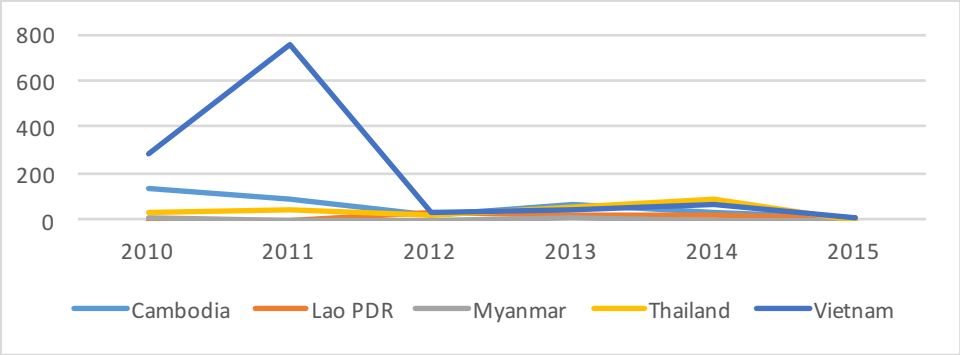
34. The number of FMD outbreaks reported to the World Animal Health Organization (Office International des epizooties, OIE) by the respective national animal health authorities from 2010 to date are presented in Table 15. The majority of outbreaks affect cattle, followed by buffalo while less than 15% of the reported outbreaks occur in swine (serotypes A and Asia1 are rarely if ever isolated from swine).

Table 15: FMD outbreaks reported to OIE from 2010 to mid 2015

	2010	2011	2012	2013	2014	2015	Total
Cambodia	139	92	22	72	28	16	369
Lao PDR	0	1	31	21	25	8	86
Myanmar	11	4	3	9	4	0	31
Thailand	35	45	27	51	92	0	250
Vietnam	281	751	29	41	63	13	1178

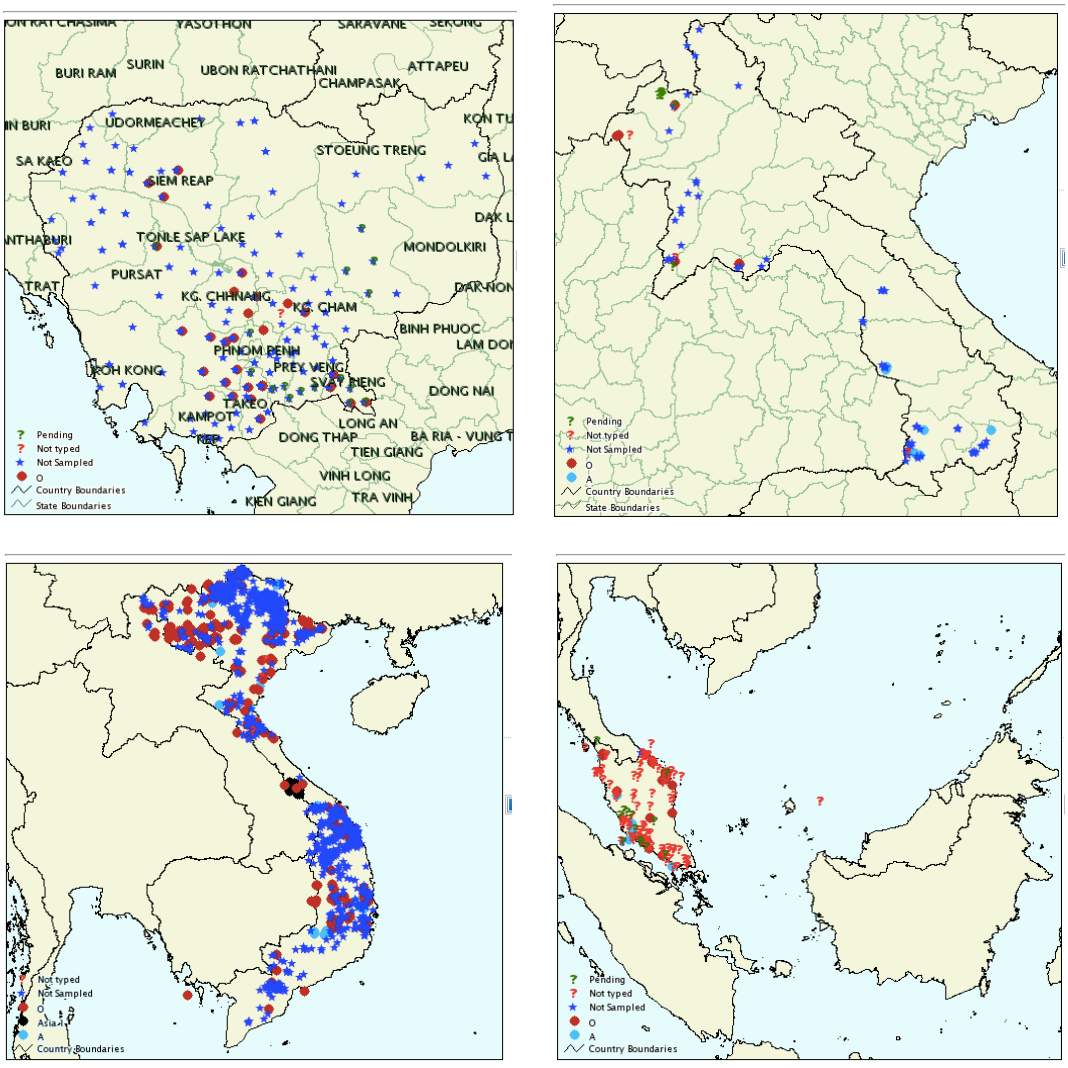
Source: www/seafmd-rcu.oie.int

Figure 14: FMD outbreaks reported to OIE from 2010 to mid 2015



35. As the current situation of FMD in the GMS is characterized by an endemic virus causing sporadic outbreaks of comparatively mild disease, disease reporting is far from complete and the numbers reported must be considered as gross underestimates. In Cambodia, for instance, Vergne et al. (2011) estimated that only around 5% of outbreaks were reported to provincial authorities and Bellet et al. (2012) note that “Our study shows that even if FMD is ranked second in the list of priority diseases, livestock owners did not see any benefit in reporting it since the disease entailed low direct losses.” A serological surveillance study conducted in 2006 in the southern provinces of Cambodia revealed that the village level prevalence of foot-and-mouth disease (FMD) was 87% with an overall individual animal prevalence of 30%. The serotypes O, A, and Asia-1 were detected in with a prevalence of 28.5, 9.5 and 9.3%, respectively (Tum et al. 2015).

Fig. 15: Location of FMD outbreaks in Myanmar, Thailand, Cambodia, Lao PDR, Vietnam and Malaysia reported to OIE between 2010 and July 2015



36. Thus far, none of the GMS countries has established routine mass vaccination against FMD and its livestock populations remain largely susceptible to infection. Having said this, residual immunity from previous infections is often present in older animals, mitigating risks to subsistence smallholders who are spatially dispersed and keep older animals.

37. The spatial distribution of internationally reported FMD outbreaks between 2010 and July 2015 in GMS countries and Malaysia is presented in Figure 15 (see also detailed country data in Annex 1 below).

- In Myanmar, reported FMD outbreaks cluster in the central zone, which is the zone with the highest density of cattle and small ruminants.
- In Thailand, outbreaks of serotype A are scattered throughout the country while serotype O outbreaks are predominantly found in the western and southern part of the country, along routes known to be used to transfer cattle from Myanmar to Malaysia.
- In Cambodia, outbreaks occur throughout the country with the majority being reported from the southeastern part of the country between Phnom Penh and the border with Vietnam.
- In Lao PDR, reported outbreaks cluster in the Ventiane region and in the southern tip of the country.
- In Vietnam, FMD outbreaks occur throughout the country, with an apparently slightly lower incidence in the southern compared to the central and northern part of the country.

VII. FMD TRANSMISSION AND SPREAD IN THE GMS

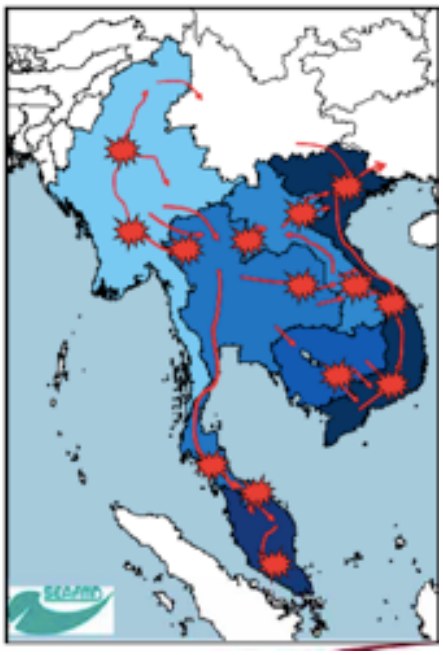
38. Transmission of FMDV most readily occurs during direct contact between acutely infected and susceptible animals, often following movement of infected animals. Indirect transmission is less common but can be effected through contaminated people or objects, especially through the consumption of contaminated animal products, such as meat, offal or milk, which may be fed to pigs or calves.

39. Movements of animals and animal products are the main risk factors involved in the cross-border spread of transboundary diseases such as FMD, especially in countries where such movements are poorly regulated.

40. Figure 7 depicts major flows of large ruminants and FMD hotspots across the GMS. The clustering of outbreaks in the south of Thailand and northern part of Malaysia follows the flow of cattle movement particularly during the months of October to December when the demand of cattle is high in Malaysia. The clustering of outbreaks in the south of Cambodia and Vietnam also follows the flow of cattle movement. According to the FMD information system of Thailand, about 40–50% of FMD outbreaks were associated with movement of animals, which included movement via animal markets, livestock vendors and directly by the owner.

41. It is widely accepted that in Southeast Asia, the distribution of FMD outbreaks correlates with the movement pathways of livestock and the movement of livestock, either officially or unofficially, has been identified as the main risk factor associated with the spread of FMD in the region (Abila and Forman, 2006). While movement of livestock for management and husbandry purposes, such as sharing of grazing or watering areas, can be important for local, contiguous spread of disease, long distance spread of disease is more likely to be associated with commercial or trade related movement.

Fig. 16: Livestock movements and FMD hotspots in the GMS



Source: Abila: 2006

42. Animal movements follow livestock price gradients, hence areas with higher price are at a higher risk of getting the disease. One of the classic examples is the introduction of serotype A to Vietnam. When the price of cattle increased in the second quarter of 2004, it attracted traders from all over the region to sell their animals to Vietnam. And the result was the introduction of new serotype A in August 2004, first time in the FMD history of Vietnam (Abila and Forman, 2006).

43. Myanmar represents a major source of livestock to the Malaysia-Thailand zone, mainly supplied from its central region. Cattle movement pathways show Myanmar livestock as widely distributed throughout the Southeast Asian mainland. Moreover,

large numbers of cattle are imported into Myanmar from Bangladesh, which in turn receives up to two million head of cattle per year from Nepal and India as a result of insufficient domestic beef production, differences in market prices and religious practices. Therefore, Myanmar could be considered a key country in terms of regional epidemiology and spread of FMDV, due to the very large ruminant population and their significant export flow into the MTM peninsula (DiNardo, 2011).

44. Thailand is the largest importing country of cattle and buffalo from Myanmar. The main trading route involves cattle moving within the country to the Bangkok market and towards the south to supply markets in Malaysia. Since the local supply of fresh meat cannot meet the demand for local consumption, Malaysia takes up a central position for the importation of livestock into the Myanmar-Thailand-Malaysia (MTM) peninsula, with around 80% of its imports of beef and buffalo meat originating from India (Gleeson et al., 2003).

45. Cambodia can be described as an exporter and a transit country for large ruminants within the GMS. The production of livestock in Cambodia is sufficient to meet the demand for livestock and livestock products within the country and also to supply some of the Vietnamese market. While there is a market in Vietnam for cattle produced in Cambodia, there is also a demand for Brahman type animals from Thailand. The latter tends to involve much higher volumes of livestock than does the former and there are approximately 10,000 head of cattle crossing from Thailand into Cambodia each month. These transit animals enter from Thailand, pass through Cambodia (often in a very short time), to reach the markets in Vietnam.

46. The highest volume of cross border movement of livestock into, and out of, Lao PDR involves the transit of livestock from Thailand to Vietnam. There is a significant movement of livestock through Lao PDR en?route to the higher value markets of Vietnam (and China). These transit movements through Lao PDR differ from those through Cambodia in that Cambodian traders actually take ownership of the transit cattle, whereas in Lao PDR these cattle are generally purchased by Vietnamese traders in Thailand and then moved through Lao PDR, with just administrative assistance provided by Lao companies (Cocks et al., 2009).

47. Within the Southeast Asia market chain, livestock traders act at different levels: whereas small traders are involved in livestock trade within districts and provinces, large traders and livestock companies engage in cross-border trading. However, since many of the transboundary movements are unregulated, much of this trade is not officially acknowledged and therefore informal cross-border routes tend to prevail (Wongsathapornchai et al., 2008). Livestock transporters travel rapidly across countries

delivering 'transit' cattle, i.e. from Thailand to the Vietnamese border depots and vice versa. Transport operators have a poor understanding of how livestock diseases spread. Therefore, trucks are washed infrequently and disinfection is not practiced (Cocks et al., 2009).

VIII. ANIMAL ID AND CROSS-BORDER TRADE OBSERVATIONS IN THE GMS

48. Our research suggests that livestock ID systems are very unevenly developed in the GMS. Thailand has advanced systems of private sector tagging and traceability, as well as significant official capacity to support national traceability. The latter has limited implementation at present, however, and no other country in the region has deployed animal identification or traceability schemes yet as part of a national program. In Lao, a large number of animals have been tagged, but these identification schemes are not integrated. Myanmar, Cambodia, and Viet Nam are all at the earliest stages of planning or implementing such programs. For these reasons, the economic benefits of implementing traceability remain far below their potential, and the LITS model can make an essential contribution to growth.

49. To support the project's rapid assessment generally and design and development of the LITS system in particular, we conducted two local site visits. These areas were seen as possible candidates for piloting LITS, but also offered detailed insights about transboundary and local market conditions for livestock trade. We offer a brief summary of the site visits below and then some general remarks about disease risk in local livestock markets.

A. Myawaddy Site Visit, Myanmar: August 16 2015

50. A field visit to the Mae Sot and Myawaddy border supplemented the team's research on cross-border cattle movement from Myanmar into Thailand, and suggests both opportunities and limitations for scanning tags at the Myanmar-Thailand border in the pilot. Interviews with farmers and traders near the Myawaddy border revealed that the cattle entering Thailand at Mae Sot are predominately from Mon State. Cattle originating from the two regions nominated for pilot implementation, Yangon and Mandalay, are likely to cross the Myanmar-Thai body further north.

51. According to local sources, Thai traders travel to Myanmar in order to select cattle and negotiate purchases with cattle owners. A price and a delivery time/location in Thailand are agreed upon and a third-part Myanmar trader is hired to transport the animals across the border to be delivered at the designated time and location. The

cattle crossing at the Myawaddy/Mae Sot border reportedly originate primarily from Mawlamyine, in Mon State, located nearly 200 km from the border. While cattle can be selected for purchase closer to the Myawaddy border, traders reported better selection and lower prices in Mawlamyine. Official paperwork and a veterinary inspection for Myanmar can be obtained for a fee of 2,500 THB. Acquiring this paperwork is useful for establishing ownership documentation once the animals are in Thailand. Cattle do not reportedly cross at the official checkpoint,3 but there are a number of unofficial crossing locations used for moving cattle across the border. Once the animals have crossed into Thailand, ownership documentation and vaccination records from Myanmar can be used to establish official ownership of the animals in Thailand.

52. There is a weekly live cattle market on the Thai side of the border in Mae Sot that occurs every Sunday where many of these cattle are traded again. While the cattle congregate at markets like this on the Thai side of the border, there do not appear to be congregation points in Myanmar for cattle bound for Thailand. This makes scanning logistics for cattle being sold into Thailand difficult. Logistically, it would be easier to scan cattle on the Thai side of the border at the live animal markets, however, this may not be appropriate because Thailand is not officially involved in this project.

B. Luang Namtha Site Visit, Lao PDR: August 18 - 19 2015

53. The BEAR team conducted a site visit to examine cattle movement along Asian Highway 3 (AH3) in order to assess the viability of conducting a pilot in northern Lao PDR. This region was chosen as a potential pilot site due to its proximity to China (~50 km), Myanmar (~100 km), and Thailand (~150 km) and thus the significant potential for transboundary cattle movement. The team traveled from the Chiang Khong,Thailand-Huay Xai, Lao PDR border along AH3 through Luang Namtha nearly all the way to Lao-China border. While there were high levels of truck movements along the highway, however, no transportation of cattle was directly observed. Cattle movement was observed, however, on the Thai side of the border moving toward Lao.

54. Along AH3 in Lao PDR, small-scale cattle production was observed in numerous towns, most notably Bo Kew. Anecdotal evidence based on interviews with farmers along AH3 and in Luang Namtha suggests that young cattle enter Lao PDR from Myanmar around Xieng Kok and remain in Lao PDR to increase body mass for one to two years before being sold to Chinese traders. Muang Sing and Bo Ten were both identified as locations where cattle sourced from Myanmar are raised. We were told that Chinese traders travel to these locations to purchase live cattle to be slaughtered in China. The price of cattle in the Luang Namtha region, roughly two hours from the

China border, were similar to the prices reported in Myanmar (~900 USD), however, average prices reportedly increase with closer proximity to China. Roughly a third of the cattle observed had visible ear tags, which were used by farmers to identify their animals which often grazed in groups.

55. The observed cattle movement implies that coordination and cooperation with multiple stakeholders, such as Chinese traders, Lao traders, and Lao farmers, would be necessary to establish a LITS pilot in this region targeting cattle moved from Myanmar though Lao into China. Without official checkpoints, it would be difficult to encourage traders to agree to participate given the informal nature of cattle movement.[3] Additionally, it would be a logistical challenge to capture cattle movement in the allotted pilot timeframe given the period of time cattle remain in Lao before moving to China.

56. Despite the proximity of this site to the North-South corridor, we saw little potential for a pilot conducted this year. Cattle were relatively scarce and we observed nothing in the way of systematic trading patterns. Some individual Chinese traders were reported to be looking for animals occasionally, but there are no established venues for trade, processing, or animal transport on a significant scale. This could all change in a few years, however, with growing corridor use and some new cattle production initiatives in the area.

57. Alternative pilot locations for consideration include Xieng Khoung to target the high volume of livestock moving from Lao PDR into Vietnam, or Vientiane Capital to target the largest domestic market. Existing political coordination at the province level between Xieng Khouang in Lao PDR and Nghe An in Vietnam supports potential for pilot implementation capturing cross-border movement.

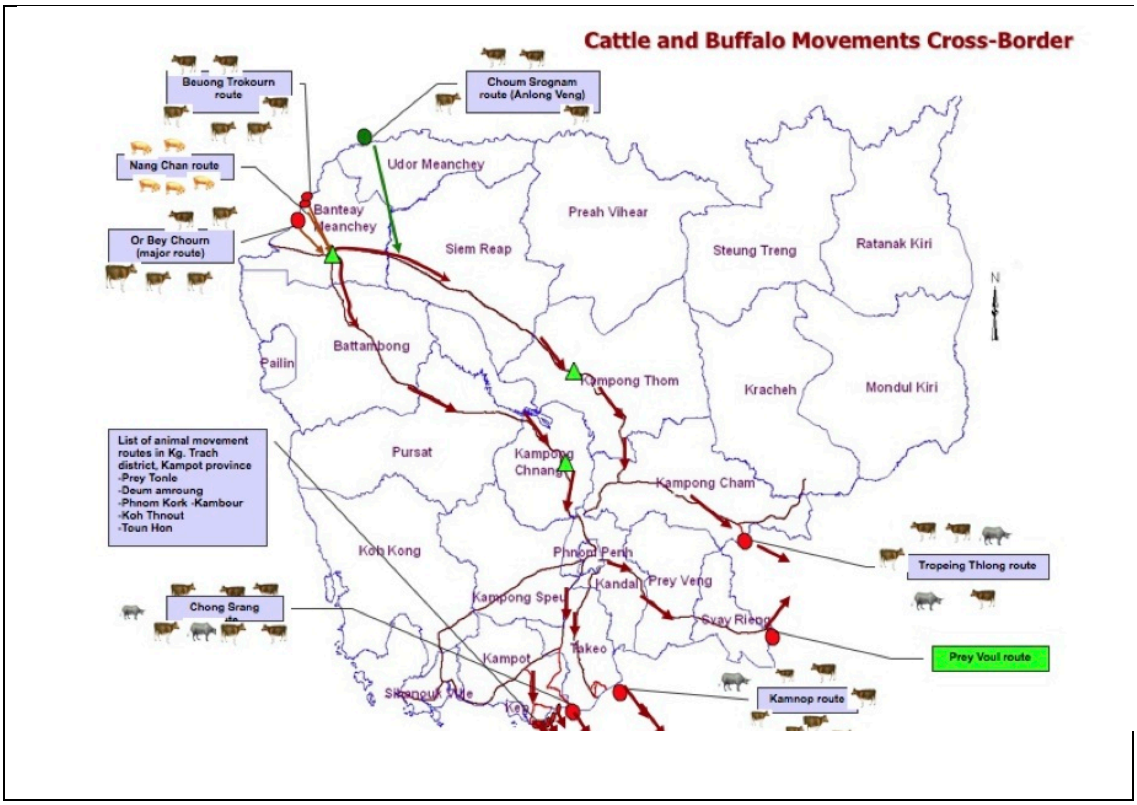
[3] One local taxi driver said that he had not seen any livestock transported at the official crossing in his 10 years living and working there.

IX. SUMMARY AND CONCLUSIONS

A. Livestock Population Trends

58. In Lao PDR populations of cattle, pigs, buffaloes, goats and sheep have grown every year since 2009. With the exception of pig populations in Vietnam, the reverse trend is occurring in Cambodia and Vietnam for the same animal species.

Figure 17: Mapped Cattle and Buffalo Trade Routes Thailand-Cambodia-Vietnam



Source: ACIAR (2010)

B. Official / Registered Trade in Livestock and Livestock Products

59. Thailand is increasing its swine exports to Cambodia, showing that the movement of pigs is generally east towards Vietnam, with the potential for continuation onto China. Myanmar is also exporting more bovine animals to Thailand, where slaughterhouses are producing and moving meat to several countries, such as Lao PDR.

60. Official trade data also shows that the production and trade of animal feed from Thailand is rapidly growing. This alone has many implications on the production and demand for livestock within the GMS. Additional trends include Lao PDR importing more frozen bovine meat, live swine and bellies every year since 2009 from Thailand. Cambodia is also increasing imports of whey, milk and milk products, and in general,

Thailand is increasing its exports of livestock products to all GMS countries in recent years.

C. Informal Transboundary Livestock Movements

61. The ACIAR spent several years collecting information on informal trans-boundary livestock movements in Cambodia (Figure 17; FAO, ADB, and OIE SEAFMD, 2009 and ACIAR, 2010). During the course of their project, snowball sampling and trader interviews were used to map the informal trade flows in Cambodia, Vietnam and Lao PDR. Their analysis extends to Thailand, and more information is currently being gathered on the trade between Myanmar, Thailand and Malaysia in order to connect these trade flows with what the ACIAR has mapped.

62. Our own "snowball" or network sampling suggests widespread and systematic (consistent by direction and species) informal transboundary trade persists in the region. Preliminary discussions with traders in the northeast have revealed several transit points for the informal trade of pigs (Figure 4).

D. Livestock-Related Trade Developments

63. On the supply side Myanmar is a country that is opening up more to foreign trade and investment. Myanmar has considerable farmland and livestock potential, and appears also to be a transit country for certain goods from South Asia. Although little evidence is available on current trade with Myanmar, there is considerable speculation about its future.

64. In terms of demand, the expanding middle class in China and higher relative prices in Vietnamese markets are two forces causing shifts in the direction of many traditional trade movements. Previous livestock patterns are also being amplified, such as significantly higher levels of bovine movement out of Myanmar. More research on this topic must be pursued in order to assess this situation for risks and opportunities.

65. Thailand's domestic cattle industry is reassessing their current trade strategy, with a potential focus of shifting upstream production towards Lao PDR. While debate is still ongoing, producers are approaching consensus on the value of traceability. There has been little success thus far with regards to traceability, but it is known to contribute to higher standards and productivity, technology growth, more coordination within the supply chain and the establishment of clusters. The local beef industry is preparing for regional trade liberalization, and these are important components of a competitive strategy.

E. Managing Livestock-Trade Related Disease Risks

66. Population density and the movement of livestock are primary drivers of infectious disease propagation. Unmonitored transport of animals from different regions contribute to the risk. However, the traders of livestock are responding to price differences in local and regional markets, and rarely consider the economic costs of this externality.

67. The animal health risk should be addressed through effective surveillance systems and movement control measures. Reliable evidence and risk models that contribute to more efficient targeting should also support disease risk management policies. Currently, the focus is on data that supports more advanced management of domestic and trans-boundary risk. For bovine animals and pigs, which are vulnerable to foot and mouth disease (FMD).

68. For example, the risk of disease spread continues to grow, not only due to an increasing population and its growing demand for livestock, but also by the interaction of nations that were unable to participate in same markets until recently. Agrifood trade also links the rural poor to opportunities in urban markets. The benefit of this livestock trade for smallholder farmers increases with the size of the market and the value of their products. For this reason, trade and poverty reduction are intertwined in a favorable regulatory environment.

F. LITS Potential

69. In the forthcoming LITS Implementation Plan, we argue strenuously for the benefits of a formal regional traceability system to manage animal health risk, reduce transactions costs and information failures in livestock supply chains, and promote incentives for higher-value animal trade and regional livelihoods improvement. Our assessment of initial conditions in the GMS suggest that LITS could make dramatic improvements in all these areas and in all GMS countries. We believe the LITS pilots can establish standards for successful scaling up and modernization of livestock supply chains across this important food producing region.

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XI. ANNEX 1 – ANNEX RECENT DATA ON GMS LIVESTOCK PRODUCTION

Table A.1: Domestic meat and egg production (2013)

	Cambodia	Lao PDR	Myanmar	Thailand	Vietnam
Buffalo					
Slaughtered	60,000	178,000	306,000	10,081	436,000
Yield/head (kg)	160	110	150	386	215
Meat (MT)	9,600	19,580	45,900	3,887	93,740
Cattle					
Slaughtered	530,000	215,967	1,643,600	651,065	1,652,722
Yield/head (kg)	120	125	150	306	172
Meat (MT)	17,415	26,996	246,540	199,551	284,599
Pigs					
Slaughtered	1,721,638	2,143,823	8,057,599	13,332,367	45,968,400
Yield/head (kg)	50	28	77	74	70
Meat (MT)	86,082	59,598	620,435	986,595	3,217,788
Chicken					
Slaughtered ('000)	17,415	25,408	924,700	1,102,405	351,800
Yield/head (kg)	1.0	0.8	1.2	1.2	1.5
Meat (MT)	17,415	20,326	1,081,899	1,377,896	527,665
Eggs					
Layers ('000)	5,200	2,800	63,500	85,000	71,500
Yield/head/yr (kg)	3.7	5.9	6.0	7.9	5.3
Egg mass (MT)	19,000	16,500	382,000	668,000	378,000

Source: FAOSTAT, accessed Sep. 2015

Table A.2: Annual per capita availability of meat and eggs (kg) (Cambodia and Lao PDR 2011, Myanmar, Thailand and Vietnam 2013)

	Cambodia	Lao PDR	Myanmar	Thailand	Vietnam
Bovine meat	5.0	7.1	4.9	2.6	7.4
Pig meat	8.0	8.7	11.3	13.0	35.0
Poutry meat	1.9	3.8	21.9	13.7	12.4
Eggs	1.4	2.0	6.5	12.4	3.8

Source: FAOSTAT, accessed Sep. 2015