GREATER MEKONG SUBREGION
CORE AGRICULTURE SUPPORT PROGRAM

ADB Project Document

Livestock Movement and Disease Risk in the Greater Mekong Sub-region – Framework and Design for the Pilot Project Implementation Plan

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This report was written by Tessa Lynn Emmer, Samuel Heft-Neal, Joachim Otte, and David Roland-Holst, under the direction of Pavit Ramachandran.

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Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
www.adb.org

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ABBREVIATIONS[1]

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 Sub-region
GMS-AINS – Greater Mekong Sub-region - Agriculture Information Network Service
ICT – information and communication technology
LITS – Livestock Identification and Traceability System
MDGs – Millennium 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

[1] A glossary of technical terms is available in an appendix at the end of this document.

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. Increased demand for livestock and their products in the GMS presents a large transboundary disease risk due to the informal supply chains that cross borders. As part of ADB's GMS Core Agriculture Support Program, Phase II (CASP 2), this project addresses the challenges associated with expanding cross-border trade working towards the goal of helping the GMS become a leading producer of high-quality agriculture products. This goal can partially be achieved through a region-wide Livestock Information and Traceability System (LITS), which can identify and trace all animals as they move through supply chains. Traceability is a necessary component in the reactive control system of disease risk management as it can trace outbreaks to their source and remove any potentially contaminated animals from the supply chain, effectively containing the outbreak. The potential benefits however of a LITS go beyond disease risk identification and containment by improving animal quality and providing reliable information to end users. Traceability allows producers to be recognized for higher quality products and encourages increased product quality and market access. Because market access is the primary gateway out of poverty for rural poor majorities in the GMS, traceability can be strongly pro-poor, supporting improved livelihoods for small farmers and enterprise intermediaries.

4. The proposed traceability system builds on the best practices from other developing countries and features low cost, efficient, and globally standardized technology with open source software support that can be easily adapted across the GMS. The proposed system will rely on ear tags featuring QR codes and RFID chips. Using these technologies allows smart phones to act as scanners. For QR codes any smart phone with a camera and internet connection will be able to scan tags. This allows great flexibility for producers as many already own smart phones and there is no need for separate technology to be purchased. In addition, we will also deploy RFID scanners for certain users (such as checkpoint officials or other authorities). This system connects to a smart phone but allows quick scanning for large batches of cattle.

5. Scanning the tags will occur (1) when the tag is initially registered to the cattle and (2) when an event occurs. Events will include veterinary visits, sales, movement, and any other activities deemed relevant by the executing agencies. Upon scanning, individual cattle information will be automatically uploaded to web based database that will be programed with open source software. The web interface can be viewed or edited at anytime with data available for download. Collectively, this system represents a flexible, low-cost, state-of-the-art traceability system that we will be pilot under diverse conditions across the subject countries as detailed in this implementation plan.

III. Contributions of the LITS Pilot to ADB's Core Agriculture Support Program in the Greater Mekong Sub-region

6. The theatre for LITS implementation will be three countries in the Greater Mekong Sub-region (GMS), a group comprising five of the ten countries that make up the Association of Southeast Asian Nations (ASEAN). The GMS itself is made up of Cambodia, the People's Republic of China (PRC), Lao People's Democratic Republic (Lao PDR), Myanmar, Thailand, and Viet Nam. Our pilot with deploy LITS in Cambodia, Lao PDR, and Myanmar. This activity is part of a larger Asian Development Bank (ADB) assisting all six countries joined a sub-regional economic cooperation program (GMS Program) in 1992 to promote regional cooperation and economic growth. The GMS Program specifically focuses on improving connectivity, competitiveness and community, and has resulted in investments of over $15 billion in infrastructure and urban development.

7. The agricultural industries in the GMS are generally underdeveloped compared to other industries, especially in remote upland and highland areas throughout member countries. This leaves significant opportunities for economic growth through product output, trade, employment, and income generation. Following the increasing regional and global demand for livestock products, GMS member countries have the opportunity to address supply gaps and achieve significant economic gains. There is an immediate need for agricultural production and trade that is resilient to climate change to fill these supply gaps, and one that operates through a modernized trade system in order to supply safe and high-value products.

8. The GMS has a comparative advantage in the food and agriculture sector as a result of the quality of natural resources, fertile agro-ecosystems, and rich biodiversity. Consequently, the GMS continues to gain shares of the global market for key food and agricultural products such as rice, prawns, processed fish, and poultry products. Main drivers behind the GMS agriculture sector include 1) accelerated globalization and trade liberalization, 2) climate change, 3) degradation of the agricultural resource base, and 3) investments in transport infrastructure. As the GMS experiences economic growth and expands its production capacity, it will become increasingly important for the member countries to seek economic development while preserving natural ecosystems.

9. One of the most important comparative advantages of the GMS and its economic development in the food and agriculture sector is the proximity of its member countries. Investments in transport infrastructure facilitate cross-border trade between GMS member countries and have consequently made intraregional agrifood trade one of the fastest growing sectors in the sub-region. Importantly, cross-border agrifood trade is underutilized and has the potential for large growth and spread both direct and indirect economic benefits throughout the region. Enhanced regional cooperation is a key factor in increasing

the region's competitiveness in the agriculture sector and is considered a key priority sector in transitioning the region's transport corridors into economic corridors (Figure 1).

Figure 1:Transport Corridors in the GMS

Source: Progress Report on Transport and Trade Facilitation Initiatives in the Greater Mekong Sub-region. November 2013. ADB, Australian AID

A. The Core Agriculture Support Program (CASP)

10. Regional cooperation of GMS member countries in the agriculture sector has been promoted by the GMS Working Group on Agriculture (WGA) through the Core Agriculture Support Program (CASP). CASP Phase I (2006 – 2010) was supported by ADB and other development partners including the Food and Agriculture Organization (FAO) and the International Fund for Agricultural Development (IFAD). Several initiatives were implemented to promote regional cooperation and strengthen human and institutional capacity for trade, cross-border contract farming, and increased biosafety of agricultural products. Specifically, these initiatives included 1) public-private partnerships (PPPs) such as the GMS Agriculture Information Network Service (GMS-AINS) and the Ayeyawady-Chao Phraya-Mekong Economic Cooperation Strategy, 2) regional emergency response mechanisms, 3) activities to prevent and control trans-boundary invasive species and animal diseases, and 4) customs and quarantine procedures at member country borders. As a result, intraregional trade increased from 5.7% of the total trade with the world in 1992 to 12.6% in 2002 (Table 1).

Table 1: Share of Intraregional Trade to Total Trade of the GMS (percentage of total trade with the world)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Cambodia	20.1	34.5	39.0	36.4	33.6	40.0	31.5	22.0	19.5	27.3	24.5
China**	1.2	1.2	1.3	1.9	1.7	1.8	1.7	1.7	2.1	2.1	1.9
Lao	63.3	48.9	55.8	57.3	61.1	66.8	65.7	70.6	65.5	68.6	67.8
Myanmar	23.4	23.6	22.8	24.1	18.1	17.5	18.5	27.6	28.9	34.0	35.6
Thailand	2.8	2.5	3.4	4.0	4.0	4.6	5.3	6.0	6.8	7.7	8.9
Vietnam	4.7	8.0	9.9	10.4	7.9	8.9	10.9	11.9	14.9	14.6	13.9
Average for GMS#	*5.7*	*6.2*	*7.2*	*7.6*	*6.7*	*7.4*	*8.3*	*9.5*	*10.7*	*12.0*	*12.6*

Notes: * Ratio of total trade with GMS countries to total trade with the world.

** Ratio of the total trade of entire China with GMS countries to total trade of entire China with the world. According to Chinese customs data, the total bilateral trade volume between China and the other five GMS countries in 2004 exceeded US$25bn, double that of 2002. Trade between the two participating Chinese provinces, Yunnan and the Guangxi Autonomous Region, and the five GMS countries of Southeast Asia was worth US$1.87bn in 2004, a 21.4 percent increase over 2003.[3]

Weighted average based on purchasing power parity-gross national income shares.

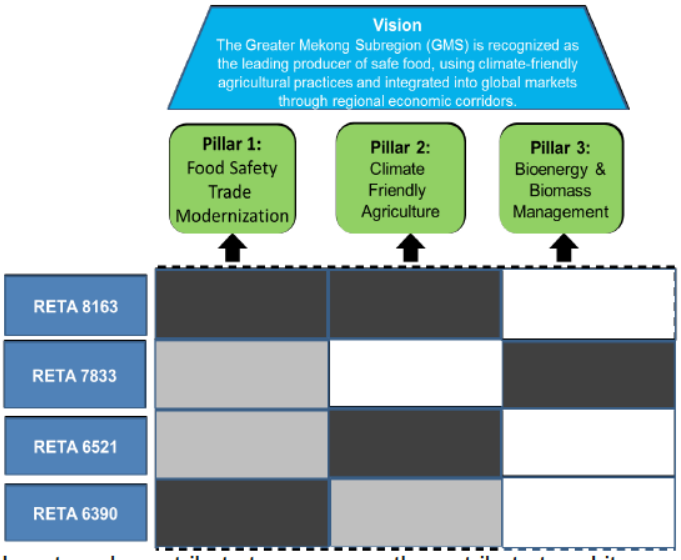
Source: ADB (2004), GMS Regional Economic Cooperation Strategy and Programme

11. Following on the success of CASP Phase I, CASP Phase II (2011 – 2015) was launched to focus on economic development while maintaining and preserving natural resources and ecosystems in the area. Phase II focuses on addressing challenges

associated with expanding cross-border trade and climate change adaptation with the overarching goal of helping the GMS become a leading producer of safe food that is integrated into global markets through regional economic corridors. Many Phase II initiatives build upon Phase I investments to enhance cross-border trade and have helped smallholder farmers in GMS member countries produce agricultural food products that comply with international food safety and quality standards, and improve access to markets both locally and globally.

12. There are three main pillars that lay the foundation for CASP Phase II and its efforts to promote safe food production using climate friendly agricultural practices. The three pillars are: 1) building global competitiveness by promoting food safety and modernizing agricultural trade, 2) promoting climate-friendly agriculture through market-based strategies to ensure food security and rewarding farmers for their ecosystem services, and 3) promoting agriculture as a leader in providing clean energy and eco-friendly cross-border supply chains. Based on these three pillars, Phase II maps new strategic directions to support expanded cross-border trade in food and agricultural products. Highest priority is placed on 1) accelerating the implementation of the Cross-Border Transport Agreement (CBTA) and other transport and trade facilitation initiatives, 2) transforming the GMS transport corridors into economic corridors, and 3) reducing environmental risks of the GMS development plans.

Figure 2: Four Regional Technical Assistance Projects and contributions to CASP



Note: Black = strongly contribute to, gray = partly contribute to, white = not contribute to.

Source: Core Agriculture Support Program, Phase II; Annual Progress Report January – December 2014. ADB.

13. CASP Phase II is financed under four ADB regional technical assistance (RETA) projects, and each contributes to different goals of CASP (Figure 2). These RETA projects

are: 1) RETA 8163: Implementing the GMS Core Agriculture Support Program, 2) RETA 7833: Capacity building for the efficient utilization of biomass for bioenergy and food security in the GMS, 3) RETA 6521: Accelerating the implementation of the core agriculture support program, and 4) RETA 6390: Trans-boundary animal disease control for poverty reduction in the GMS. Highlights of the CASP Phase II achievements can be found in Table 2, and more detailed progress on each of the RETAs and countries can be found in the *Core Agriculture Support Program, Phase II Annual Progress Report – January – December 2014* published by ADB and the GMS CASP.

Table 2: Highlights of CASP Phase II Achievements in 2014

Highlights of CASP Phase II Achievements in 2014
• Inception workshops held in all six GMS countries • Successful establishment of six National Secretariat Support Units (NSSUs) to coordinate implementation of technical assistance (TA) activities • Enhanced regional integration and collaboration in GMS agriculture sector • Progress toward achieving "enhanced market access for environmentally friendly agricultural products produced by smallholders" • CASP Phase II emerged as a knowledge leader in climate-friendly agriculture • Enhanced government ownership and leadership tole through the Letter of Agreement (LOA) mechanism • Building private sector participation through the memorandum of understanding (MOU) instrument • Public private partnership (PPP) on CFA enhanced • Adoption of CASP Phase II activities in current and future investment projects • Collaboration with civil society organizations • Linkages to the Core Environment Program (CEP) and other regional programs • Advanced regional cooperation on knowledge exchange

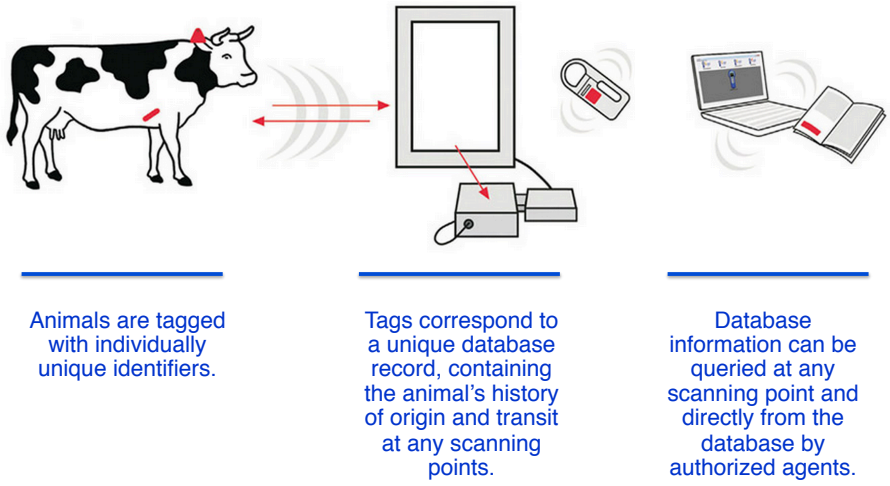
Source: Core Agriculture Support Program, Phase II; Annual Progress Report January – December 2014. ADB.

14. Despite significance advances in CASP Phase II, there is still a need to enhance the sub-region's regional cooperation and productivity. Better policies will be required to allow for effective cross-border trade, as well as innovative methods that improve efficiency of project implementation throughout the entire GMS.

B. What is the Livestock Information and Traceability System (LITS)?

15. The Livestock Information and Traceability System (LITS) is a cost effective method of tracing livestock movement in agrifood supply chains. It is a modern trading system that is able to link regional and global markets, which is critical in increasing agricultural competitiveness in the GMS economic corridors. LITS capitalizes on existing regional incentives and national agricultural development strategies and programs, and disseminates agricultural practices and safety standards that comply with international standards. Importantly, the traceability system plays a key role in developing regional certification and accreditation systems, enhancing community participation, and increasing public and private investment in science and technology for food safety and security.

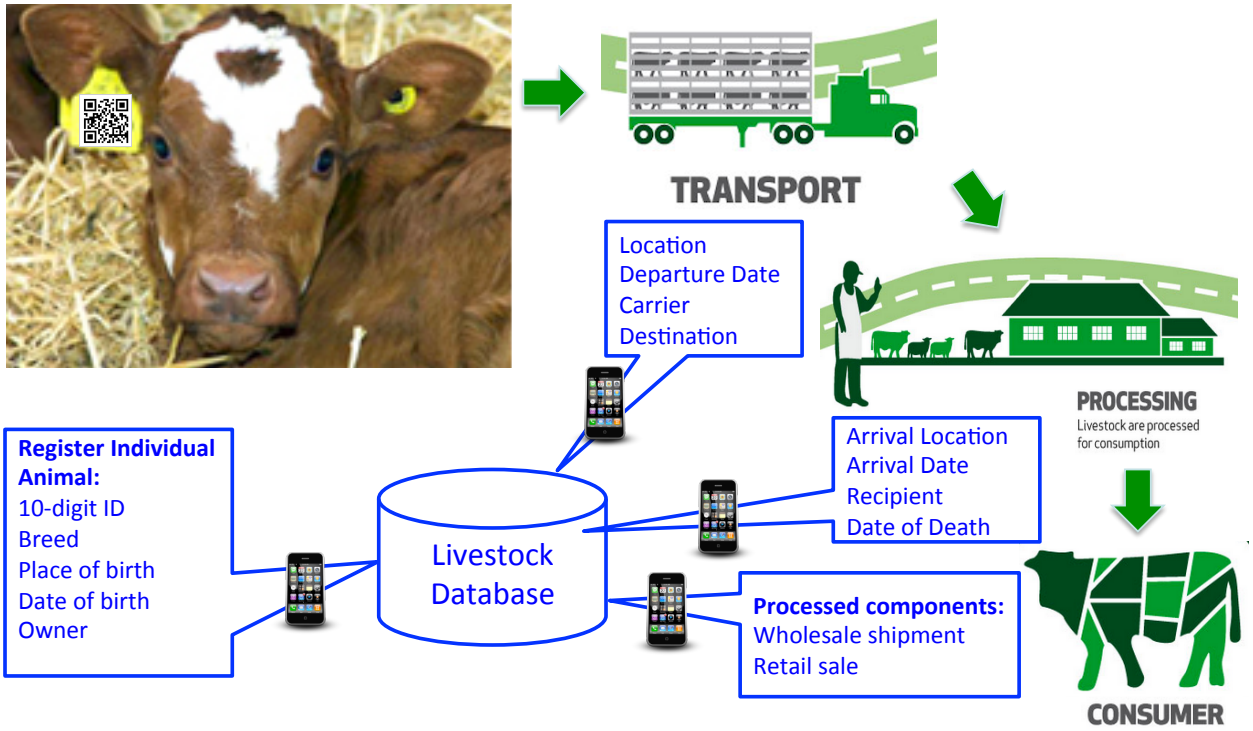
Figure 3: LITS Technology Pathway



Source: Introduction to the LITS Project; Introductory Meeting for Cambodian National Counterparts and the International Implementation Team (2015). Joachim Otte, Ph.D., Berkeley Economic Advising and Research.

16. LITS has the capacity to track and record a wide variety of information using digital scanning technology. Animals are given a unique digital tag that has one-dimensional bar codes that are compatible with scanning devices (Figure 3). Metal ear tags, commonly used as an identification mechanism in several countries, are a cost effective, durable, and minimally invasive method for animal surveillance. As the registered animals move along the supply chain, information (e.g., livestock distribution, health status, movement across borders) is entered into an open source database (Figure 4). Individual buyers and sellers across low-income agro-food supply networks are then able to use Short Message Service (SMS) text messaging for livestock product transactions.

Figure 4: Tag and Scan Pathway



Source: Introduction to the LITS Project; Introductory Meeting for Cambodian National Counterparts and the International Implementation Team (2015). Joachim Otte, Ph.D., Berkeley Economic Advising and Research

17. Traceability systems such as LITS allow for effective means of recording and reviewing a large array of information. LITS incorporates prototypes from multilateral and bilateral development partners (i.e., UN FAO, OIE, EU, Australia, Japan, US) that form a system with international best practices that were then adapted to the institutional, geographical, and economic landscape of livestock flows across the GMS. Information that can be collected through LITS in the GMS are listed in Table 3.

Table 3: Information collected open source database

1. Identification information collected for each animal and event	2. Location and Event Information
• Species and breed • Origin • Owner/custodian contact information • Physical location (global positioning system; GPS) • Date of birth • Production category • Sex • Breed • Number of animals of each species • Animal ID of parents • Health status for disease risk management	• Name of establishment • Establishment ID • Name and contact info for person legally responsible for animals • Physical address/GPS coordinates of establishment
3. Salient Events	**4. Movement within country**
• Birth of animal • Slaughter/death of animal • Ownership changes • Observations (e.g., testing, health inspection, health certification, etc.)	• Date of movement • Establishment of animal dispatch • Number of animals moved • Destination establishment • New location where animals are kept (GPS) • Any establishments used in transit • Description of means of transport (e.g., vehicle IDs where possible)
5. Animal export	**6. Animal import**
• Date of export • Number of animals moved • Establishment of animal dispatch • Border crossing • Destination establishment • Any establishments used in transit • Description of means of transport (e.g., vehicle IDs where possible) • Record of animal ID from exporting country to be provided to authority in importing country	• New animal ID assigned at time of import • Record of animal ID from exporting country; to be linked to new animal ID • Date of import • Number of animals moved • Establishment of animal dispatch • Border crossing • Animal identifier lost/replaced • Animal missing, lost, or stolen

Source: Livestock Information and Traceability System; Technical Approach and Methodology. David Roland-Holst, 2015

18. To complement the data that is collected using the LITS digital tagging system, there have been extensive efforts to train smallholder low-income farmers to create a sustainable LITS database. The LITS team developed a detailed training manual targeting smallholder low-income farmers, who are often unwilling to change their practices and use new services. Special efforts were placed on creating a user-friendly training manual that enables low-income farmers to utilize the innovative telephonic trading system. In addition to education efforts, collaborations with partners to create a graphics-intensive local language guide have been critical in the successful adoption of this technology. Furthermore, experiences from developing a training manual for a mobile phone-based poultry trading system in Chiang Mai, Thailand was used to address potential challenges associated with introducing a new technology into a low-tech sector. All teaching materials were provided at no cost, along with meals and refreshments as a means to facilitate sustained participation.

19. LITS is currently undergoing a pilot program in three high-activity cross-border areas in Cambodia, Lao PDR, and Myanmar. Smartphones were provided for veterinary and border officials to scan animals and record relevant events into the LITS database. Despite efforts to work closely with local counterparts and government agencies, there are several challenges that must be addressed: 1) a lack official policies that support a formal trans-boundary surveillance scheme, 2) the need to bring informal animal trade into compliance with LITS, and 3) the need for farmers to recognize the economic potential of LITS. Overall, there is still an urgent need to communicate the sustained social and economic benefits of LITS-type traceability systems to all users for widespread adoption.

C. LITS's contribution to CASP in the GMS

20. LITS contributes in many ways to CASP Phase II and ADB's overall efforts to improve the agriculture sector in the GMS corridors. The contributions are divided into three main criteria: 1) value creation by increasing product quality, 2) disease risk reduction, and 3) improved market access and poverty reduction.

Disease risk reduction

21. Consumers are demonstrating an increasing concern for food safety, which has resulted in an increased demand for agricultural food products grown using more environmentally friendly methods. This creates an incentive for producers to modify or adopt production methods and practices that can enhance product safety and quality. GMS member countries have increased risks related to mycotoxins and bacterial contamination due to the region's year-round high temperatures and humidity. The temperature increases resulting from global warming are expected to increase contamination risks. Thus, methods of limiting disease propagation and food contamination are critical as the GMS member countries expand their agricultural production and grade into the global market.

22. Informal cross-border trade of livestock remains prominent in the GMS, which results in significant challenges to national disease control policies under tropical conditions. Additionally, increased requirements for documentation and reporting to meet international trade standards are challenging for smallholder farmers due to the high cost and complexity of reporting requirements. LITS offers a way through which smallholder farmers can reduce the cost of documentation while seamlessly meeting international trade reporting standards. Importantly, LITS combines certification, labeling, and traceability procedures that are required in international trade into a single step that complies with regional food safety and regulatory standards.

23. Most importantly, LITS offers an effective surveillance method for supply chains and is able to monitor disease propagation and food contamination. Traceability systems facilitate disease identification and containment in the even of outbreaks, creating an efficient method of monitoring and modifying supply chains as needed. Since end users can trace the animals transit route and original producers, LITS creates strong incentives for producers and middlemen to reduce disease transmission risk and improve the quality of the final product. Careful documentation of commercial animal movements through LITS, especially information regarding movements across national borders and health characteristics of animals, help create and maintain a safe supply chain throughout GMS member countries.

Value creation through increasing product quality

24. The information documented by traceability systems is essential in addressing issues in livestock trade that affect product quality and safety. In traditional smallholder livestock supply chains, animals pass through intermediary markets before reaching the final consumer. This leads to problems of moral hazard and adverse selection, where the inability of individual producers to be matched with animals of higher quality results in underinvestment and lower product value. LITS is able to increase the value of livestock production by linking animals to smallholder producers and overcoming these information asymmetries. With proper information exchange between producers and consumers, producers have higher incentives to invest in quality improvements and build a positive reputation.

25. A key component of LITS and its contribution to CASP Phase II initiatives is the ability of LITS to incorporate a certification system and visibly display quality control. In addition to the traceability system, LITS also includes a certification system in which registered animals carry a visible metal tag that is linked to their record within the database. This enables supply chain participants and end users to know the identity, transit history, and safety of animals, thereby confirming that the participating animals are safe and of high quality. Overall, the certification system allows for producers to be clearly recognized for higher quality products, making it more likely for them to invest in increasing product quality and also receive a price premium for higher quality products.

26. In addition to increasing the value of livestock products, LITS contributes to value creation by minimizing the costs associated with system participation. LITS is a cost-effective and simple method to share information and was designed to limit transaction costs. Proper certification not only adds a premium on animal products, but it also facilitates their passage through supply chains, ultimately lowering the cost of market access compared to informal transit methods.

Improved market access and poverty reduction

27. Market access is the primary gateway out of poverty for rural poor smallholder farmers in Asia. LITS creates incentives for smallholder farmers to make investments to increase the quality of their products and sell their products in cross-border trade at premium prices. LITS can increase market access and expand the agrifood sector for the rural poor, supporting ADB and CASP's efforts to improve livelihoods for small farmers and enterprise intermediaries. Additionally, since women allocate more labor to livestock keeping than men, LITS affords opportunities for women who may have been denied educational access. By increasing the production and trade of high quality livestock products and reducing poverty, LITS also helps implement national agricultural development strategies and meet national, social, and economic development targets of GMS member countries.

D. Summary

28. The agricultural industries in the GMS are underdeveloped and present significant opportunities for economic growth. GMS member countries have the comparative advantage of having high quality natural resources, fertile agro-ecosystems, and rich biodiversity, all of which contribute to their ability to meet the increasing demand for livestock products. ADB and other development partners have supported the growth of the GMS agriculture sector through CASP and its associated initiatives to help implement a modernized trade system in order to supply safe and high-value agrifood products.

29. LITS supports the agriculture support efforts in the GMS by ADB and CASP by providing a mechanism to improve livestock product quality, safety, and to improve market access for smallholder farmers. The system uses cost-effective and simple technology that can be adapted to the institutional, geographic, and economic landscape of specific livestock flows throughout the region. LITS and its database can provide proper incentives for farmers to make proper investments to improve product quality and value, limit disease propagation and food contamination, and adhere to international food safety standards for efficient and successful cross-border trade. Continued efforts are in place to train smallholder farmers on how to use LITS, but also to help them recognize the economic potential of the traceability system.

30. Despite the many accomplishments of CASP Phases I/II and LITS, there are several challenges that need to be addressed for the continued economic growth of the GMS agriculture sector. Regional cooperation between member countries tends to be ineffective outside of the projects initiated by multilateral and bilateral organizations.

Consequently, public investments and technology transfer to support the modern market infrastructure are lacking in the GMS member countries. Improving the use of science and technology for agriculture remains a low priority for rural poor smallholder farmers, which slows down agricultural economic progress considerably.

31. In addition to the lack of public investments and interest, information and communication technology (ICT) among GMS member countries continue to be incompatible. While CASP offers support for strengthening regional cooperation, there is an urgent need for GMS governments to improve delivery and hold country-led regional dialogues to effectively develop the regional economic corridors. With the right incentives, the combined efforts of GMS governments, multilateral and bilateral organizations, modern trading systems such as LITS, and smallholder farmers can help facilitate effective cross-border trade facilitation and improve product quality and overall agricultural productivity for successful economic development.

IV. LITS Opportunities and Challenges

32. As the demand for livestock and their products continues to increase in the developing world, livestock traceability is a crucial tool to limit the spread of disease, increase consumer confidence in animal products, and decrease threats to human health. This is especially true in the GMS, which has witnessed a dramatic growth in demand for meat and features a large, informal supply chain that is typically unregulated and frequently moves across borders. Furthermore, our previous research in the GMS has found that sales by smallholders are limited by a myriad of market access barriers, including transportation and search costs, information asymmetries, and limitations on bargaining power (Behnke et al. 2012; Heft-Neal et al. 2012). Smallholders traditionally overcome these access barriers by selling at the farmgate to intermediaries who buy animals and animal products from many farmers and "aggregate" them en route to downstream markets. By blending animals without adequate regard for safety, traders contribute to biocontainment problems and undermine value in three ways. First, is issue of disease risk spill over that occurs from the indiscriminate blending of animals. This blending promotes contagion within and between species and presents a huge risk as animals move further along the supply chain. Second, is the issue of adverse selection as masking producer sources reduces incentives to invest in quality, increasing risk and reducing producer incomes. Finally, the perception of these uncertainties undermines consumer willingness to pay given their perceived low safety standards of animals.

33. Traceability can achieve three key objectives: 1) managing risks related to animal health and disease issues, 2) guaranteeing animal quality/identity and providing reliable information to customers, 3) improve animal quality and processes. The first of these tools is the most important opportunity in the GMS to effectively manage disease risk given the frequent unregulated channels of animal movements. Both the official and unofficial movement of livestock and livestock products is a major risk factor in the spread of disease. The GMS features extensive borders and powerful market forces that move livestock across and within countries, and the potential for trans-boundary spread of disease is great. However, with limited enforcement of regulation and information on these cross-border movements of livestock and their products, several challenges to proper disease management arise. Even though the potential harm of disease spread is significant, there is little consistency in animal health regulations or in the governing of livestock movement within and between countries. In addition, conditions of disease risk vary significantly in a given region, especially with regards to habitat, production and trading practices. Because of this heterogeneity, disease transmission across a particular boundary often occurs in both directions. This persistent source of disease risk is especially true in the GMS, where health standards vary greatly, in addition to the variations in production and movement of livestock between countries. 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 ineffective due to the vast trading networks within the GMS, all member countries can gain from coordinated management of the livestock trade.

34. 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. Furthermore, attempting to formalize animal trade is often restrictive, resulting in behavior that only increases the spread of disease risk as movements are driven through unofficial channels and around legal checkpoints These unofficial movements of animals are not only common but are accepted as an integral part of the supply chain among farmers, traders, and vendors in the region. These unofficial movements will continue as long as price discrepancies exist across borders and actors in the supply chain can capture rents by moving animals. Rather than tightening restrictions and increasing enforcement along border areas which increases animal disease risk, these unofficial movements must be accepted as a legitimate.

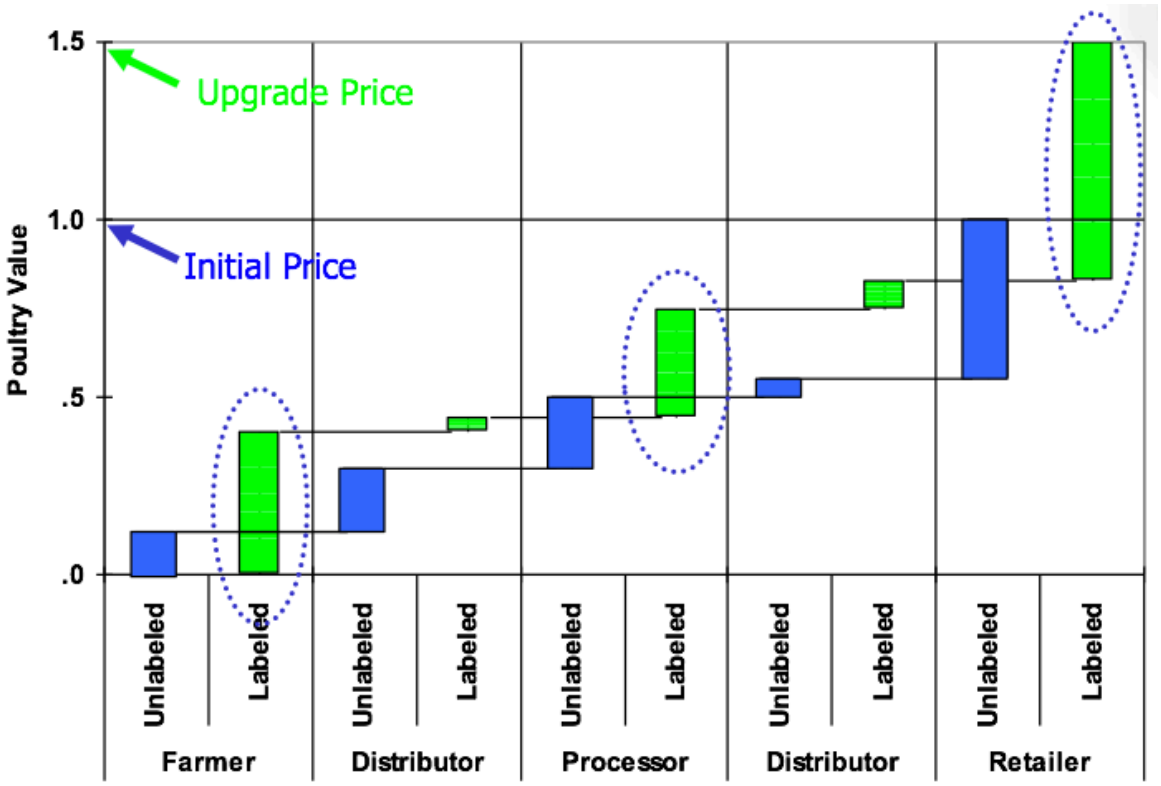
35. A region wide LITS that recognizes both the patterns of legal and illegal movements of animals is a necessary component in the reactive control system of disease risk management. The primary advantage is rapid identification allowing authorities to trace outbreaks to the source, eliminate any potential contaminated animals from the market and supply chain, and eventually contain the outbreak. This not only reduces the costs associated with control but it lowers the mutagenic risk limiting the scale of the outbreak. Traceability also creates incentives for producers to invest in animal health status if penalties are used for disease outbreaks. Furthermore, a LITS can be pro-poor in the sense there is a greatly reduced control cost through more effectively targeting culling. Livestock represents both an important income generating opportunity as well as a wealth of financial services for the poor, and widespread culling can be devastating for livelihoods.

36. The potential benefits however of a LITS go beyond disease risk identification and containment by reducing the problems associated with adverse selection and improving product quality. Existing supply chains in the GMS lack any salient mechanisms for individual producers to identify high quality, healthy animals. Without a way for individual producers to signal their animals are of high quality, this results in a race to the bottom, and the resulting minimal investments in production reduces the profitability of livestock and reinforces the transboundary disease risk. Therefore, a LITS not only has the direct benefit of limiting disease propagation and food contamination, but it also has far reaching indirect effects that promote beneficial agrifood sector expansion. When producers can be recognized for higher quality, they will make appropriate investments in both market participation and product quality. Because market access is the primary gateway out of poverty for rural poor majorities in the GMS, traceability can be strongly pro-poor, supporting improved livelihoods for small farmers and enterprise intermediaries. Within smallholder households, women allocate more labor to livestock keeping than males, and they in particular can benefit from appreciation of this asset class.

37. By far the biggest challenge of the LITS will be aligning incentives to ensure voluntary participation of producers to not only uptake the system, but also support its sustained

use. Thus, any distortions to the existing producer supply channels must be limited to ensure that producers will not avoid the system. If the system is disruptive from a production standpoint, producers will circumvent the system, further exacerbating the problems of disease risk and low product quality. Given the extremely limited margins in the livestock production system this means a LITS must actively incentive users to uptake the system. Three immediate incentive schemes can serve this purpose while simultaneously providing benefits to users, regulators, and consumers. The first is penalizing users responsible for disease outbreaks. This will naturally encourage farmers to invest in animal health, which subsequently will reduce the disease risk burden. Second, it encouraging producers to invest in higher quality to increase producer value. With a traceability system in place, producers are able to effectively signal their animals are of higher quality, which leads to value creation. As the livestock product is tracked along the supply chain it contributes value along the way (see **Figure 5**). Finally, a LITS allows producers to participate in larger, more advanced supply chains providing the benefit of increased market access and poverty reduction.

Figure @\5: Value Added from Traceability



38. In the long run however, the strongest incentive will come from the possibility of a certification system, much like other premium goods use to designate their origin (such as the French AOC certification system given to specific wine, cheeses and other agriculture products). A certification system that carries an associated brand within a LITS allows end users to know the identity, origin, transit history, and health of animals within the system. Although not all consumers will care to know these features, branding certainly allows a signaling process that animals are of high quality. Certification presents the opportunity to substantially add value, which will ensure sustained uptake and usage of a LITS.

V. Review of LITS Methods and Applications

39. Traceability can be defined as a class of strategies or mechanisms to trace of the movement of agriculture products through the food supply chain. The first step in any LITS is to identify and register the holdings from where animals originate. After this either individual animals or herds of animals can be registered. There is of course a tradeoff between individual animals or herds. Although individual identification is preferred, it can be cost prohibitive in developing countries. Still herd identification is better than none at all and there are tools to make it more effective. This includes dividing the herd into batches on the basis of uniform treatment, origin, or age groups. If disease is detected in an individual animal this allows traceability back to the batch to to which it belongs.

40. Individual traceability is preferred however and where we will focus our attention. This requires technology for basic identification and registration and are a variety of options used that offer different strengths and weaknesses. In general, the technology can be separated into two classes; Visual, non-electronic methods and electronic devices.

41. Visual, non-electronic methods are by far the most common in the developing world and include tools such as fire-branding, ear-incisioning, or simple plastic ear tags. Fire-brands can be effective and easy to read but are prone to concerns about registration and transmission of data as brands can be obscured and require manual recording of information which is prone to error. Plastic ear tags are also quite common, but when they are non-electronic they are prone to tag, loss, breakages or alterations and still have the problem of manual transcription errors and also data-recording.

42. The overarching goal of a LITS calls for clear, easily readable, durable means of identification. Animals should be quickly identifiable at any point of the supply chains with a low possibility of error. These requirements dictate that visual, non-electronic methods are not suitable for a LITS and instead electronic devices are required. There are several competing technologies that have been created to fill the need for reliable livestock traceability. These include: tags with chips and transponders, boluses, microchip implants, DNA fingerprinting and other identification tools (see figure @ for different technology examples).

43. Tags with chips and transponders consist of a tag with a unique identification number than can be read by a transponder. There are many variants of the specific technology, but in general, the transponder will read a code (either bar or QR) which compiles the identification code and stores the data. This facilitates the reading, transmission, and registration of data and ensures fast, accurate and standardized recordings.

Figure 6: Different Identification and Traceability Technologies

A) Tag with Bar Code

B) Electronic Tags

C) Bolus

D) Bull with Ear Tag

E) Transponder

F) Reading the tag

44. Boluses are electronic, intra-ruminal devices that can also be read by transponders. These offer the advantage of hardly any field loses, tamper proof, easy to read, and recyclable. However, the implementation is not without health risks in the animal, especially young animals and is more invasive than tags. Furthermore, recovery of the bolus after slaughter can be time consuming and sometimes difficult.

45. Microchip implants are another related technology, but are more commonly seen in pets and horses. In animals intended for human consumption, implants can present a risk

of migration, either creating a health risk or reducing the quality of meat. As with boluses, microchips can only be removed after slaughter.

46. DNA fingerprinting offers a precise, tamper-proof method of tracing animals but relies on high-tech equipment which carries a significant cost. However, with a system in place, live animals can be easily identified with a sample. Other technologies include blood typing and iris/retina scanning, however these also rely on costly technology.

47. Given the added costs associated with traceability, it should come as no surprise that there is limited examples of LITS in developing country contexts. Although some developed countries, most notably in the EU, have developed mandatory traceability standards for livestock and their products, the standards for production vary significantly between developed and developing countries. Therefore, it is difficult to make comparisons between LITS in developed countries and our focus here will center on examples strictly from developing countries.

48. The six developing countries of Brazil, Argentina, Uruguay, Paraguay, Botswana, and Namibia have significant beef exporting industries and have began implementing varying degrees of LITS in their countries. The need for an LITS in these countries is immediately clear when considering that cattle exports to high value developed markets (such as the EU) are only eligible if they come from part of the country that is declared “FMD-free without vaccination.” As only certain parts of Argentina, Columbia, and Namibia are recognized as FMD free without vaccination, traceability ensures access to high value urban markets for eligible producers. Not only does a lack of traceability standards contribute to the spread of FMD and other diseases, but it can possibly prevent healthy animals from reaching premium markets. In countries such as Namibia, where approximately 70% of the population’s livelihoods depend on the export-oriented meat industry, the ability to effectively signal high quality animals can promote poverty alleviation.

49. Turning to specific country examples it is clear that developing countries have a long way to go achieve the necessary standards required to enjoy the benefits derived from a LITS. Of the cattle exporting countries previously discussed, only Uruguay has successfully implemented a nation-wide, fully digitalized LITS. In fact, Uruguay is now the leading country in the world for fully computerized cattle traceability system. Every single head of cattle in the country is tracked from across the entire supply chain from producer to final consumer. Traceability became mandatory by law in 2006 and the roll-out was completed in 2001. The entire system is financed by the state which consists of two ear tags – one visual and other containing a readable chip. When a farmer needs to add a new head of cattle, they request tags either by internet or phone and tags are delivered within 24 hours. When cattle reach meat processing facilities, they are labeled with bar codes that can be linked to the herd of origination Although the system has cost an estimated $3 million USD to implement, this pales in comparison to the anticipated loss in exports that could be expected from a FMD or other disease outbreak (http://www.bbc.com/news/world-latin-america-30210749).

50. Besides Uruguay, there are few examples to draw from in the developing world. Although the remainder of the cattle exporting countries have implemented traceability measures in recent years, their standards vary widely. For example, Argentina only traces cattle intended for export using plastic ear tags that require manual recording. Although this is an improvement over the previous system of fire branding, it falls below the standards required for a LITS. Paraguay has introduced a system referred to as SITRAP (*Sistema de trazeabilidad del Paraguay*) which uses a system of ear tags bearing the country code PY, a four letter code for the holding, a four letter code for the owner, and an individual six-digit serial number. Some of the tags carry bar codes as well, but a fully digitalized, nationwide system is not currently operational.

51. Brazil's system is referred to as SISBOV and was created in 2001 as a farm-level identification system. Originally designed for mandatory participation to increase food safety and meet international market demands, SISBOV was not warmly received by producers. In September 2006, the system was updated to include the entire supply chain and not just producers. The system is based on ear tags and matches eartags with individual animal certificates, which are overseen by private companies. Participation is voluntary expect for export oriented producers, and as a result the overall usage of the system is limited (Bowling et al. 2008).

52. In regards to the African countries of Namibia and Botswana, both countries have implemented cattle animal traceability programs to access the EU, their primary export market. The Farm Assured Namibian Meat Scheme (FANMS) was introduced in Namibia in 1999, and contains detailed traceability information for cattle intended for export. The system relies on individual ear tags with registered bar codes and individual animal serial numbers. Animals are tracked using a transponder before they leave their origen, and an exit register must be created by the producer. Upon arrival at a new property, an arrival register must also be created and the individual serial number must match the exit register. Abattoirs participate in the system as well, completing arrival registers and serve as the final record (Bowling et al. 2008).

53. Botswana created their LITS in 2001 and relies on boluses with embedded RFID microchips. Each bolus is coded with the owner's name, a unique identification number, the visible fire-brand on the animal, the location of the brand, hide color, sex, the location of the animal, and date. Animals are along allowed to move after a digital movement permit is issued by the agriculture extension officer in the district where the cattle are located. As of 2005, an estimated 1.8 million of the 3 million cattle in Botswana could be individually identified (Bowling et al. 2008).

54. These examples demonstrate the difficulty of successfully implementing a fully digitalized, nationwide LITS. Although each of the six countries previously discussed has large, export-oriented cattle industries, there are many challenges to operating a LITS. It is clear however that ear tags with codes and transponders are the preferred system. We draw on the success of these systems and propose an innovate approach that uses the

best practices seen here but relies on less expensive and open source technology ensuring the system is flexible and cost effective for targeted country use.

VI. Specification of LITS Technology

55. The proposed Livestock Identification and Traceability System uses livestock tags to identify individual cattle and track their information, event history, and movement. These livestock tags can be scanned in order to view or (with password access) enter new information about a particular animal(s). The system uses two types of mobile-based scanners and a web interface to provide straightforward access to the database from the field. The (password protected) web interface can also be used to view, edit, or add database information from a computer (for example in a government office). Logging into the web interface will allow officials to download all of the tracking data in Excel files. Collectively, this system represents a flexible low-cost state-of-the-art traceability system that will be piloted under various circumstances across countries.

56. Cattle will be tagged with ear tags that include two types of scanning technologies integrated with an online database. Dual integration of these technologies allows for both detailed data viewing and data entry as well as batch location traceability for large groups of animals. Scanning the tags will occur (1) when the tag is initially registered to the cattle and (2) when an event occurs. Events will include veterinary visits, sales, movement, and any other activities deemed relevant by the executing agencies. All of the livestock information will be contained in a central project database that is programmed with open-source software. Ultimately the national databases will be controlled by each respective livestock office. However, for the purpose of this pilot BEAR will manage the database. The tags, scanning technologies, central database, hardware, and other equipment associated with the proposed system are described in detail in this section.

57. Figure 7 illustrates the communication channels within the LITS. A web interface connects the underlying database with users through mobile phones and computers. Mobile phones can access and/or enter information about a particular animal by using either type of scanner. The scanners receive the identification number from the livestock tags and the web interface queries the database for the history of the animal(s) with the entered tag information. There are two levels of security in the system. The first level, with no security, allows anybody to view the animal's history by scanning the QR code on the livestock tag. The second level of security, which requires password login, allows data entry into the system. Parties deemed trustworthy by the governments (customs officials, licensed veterinarians, etc) can be granted access to the data entry level of the system. Potential buyers, farmers, etc can view all of the animal's history without editing or adding information.

58. Subsequent sections detail the specifications of the hardware and software involved in the system and the mechanisms for communication across technologies.

Figure 7: System Communication Channels

A. Tags

59. The proposed scanning technology is flexible enough to be implemented with any type of ear tag that has sufficient surface area to print a QR code. For widespread implementation, each country could choose the ear tag specification most suitable for local conditions (color, shape, material, etc). However, for the purpose of simplicity in implementing this research pilot across three countries, we will use a standard tag for all project sites. We propose using yellow tags (80 mm x 70 mm) equipped with a single passive H3 chip following the ultra high frequency RFID Class 1 Generation 2 (UHF Class 1 Gen 2) protocol operating in the 860 – 960 MHz frequency range. The UHF Class 1 Gen 2 protocol is considered the global standard for electronic product code identification across sectors. Proposed tags will be produced by Chengdu Mind Golden Card System Co., Ltd (MND®), a leading manufacture specializing in RFID product design, research and production. Tags will be custom printed with individually unique QR codes linking each tag to the database. QR codes will measure 5cm wide to enable up to a ½ meter reading distance, and QR generation will utilize the Reed-Solomon Error Correction algorithm to withstand up to 25% damage before disrupting functionality. QR Codes will be generated using the service offered by qrstuff.com. The generation technology is standard and, in future systems, QR codes could be generated by any number of different sources.

Figure 8: Livestock Ear Tags with QR Codes and RFID Sensors

Notes: Livestock tags have the QR codes printed directly on them to ensure durability. RFID sensors are also embedded in the plastic tags.

60. There have been some concerns expressed by national counterparts regarding farmers' resistance to tagging their cattle for fear of reducing its value. While this is certainly an issue that needs to be taken under consideration, ear tags are commonly used for livestock identification and traceability systems across the world. Likely, as tagging animals becomes more common, farmers will become accustomed to the practice. Moreover, there is some precedent for ear tag use in each project country. Site visits to farms in potential pilot locations revealed the use of ear tags in every project country, however, utilization was limited in many cases. Observed tags were used to identify the owner of the livestock since groups of cattle from several owners often graze together. Anecdotal evidence suggests that resistance to tagging is greater among small farmers than the commercial farmers that this pilot will be targeting. Nonetheless, farmer resistance to the technology is a potential obstacle that will need to be overcome in order to ensure farmer participation in the pilot. Implementation teams should work closely with farmers to ensure that the benefits of the ear tags are understood and that participants are comfortable with officials tagging their livestock.

B. Scanning Technology on Tags

QR Codes

61. QR codes will be printed on the ear tags.[2] The QR code is an established technology commonly used for a variety of applications around the world. This technology is a 3-dimensional version of the traditional barcode. In both the 2 and 3 dimensional versions, barcodes store information efficiently so that any compatible scanner can read and display the stored information. In recent years, it has become common to use QR codes to store URLs that link to websites. Any QR scanner can read the code and unpack the link. Due to the proliferation of mobile smart phones, and the numerous free QR code scanning apps available, QR codes are now commonly used for advertising purposes. By imbedding

[2] In the UK, some farmers have recently taken to imprinting QR code brands onto cattle with traditional branding methods.

a QR code into an advertisement, companies provide convenient access to their websites for anyone that sees the ad and has a smart phone. In the context of a livestock traceability system, QR codes provide a way for people that come across tagged cattle to access the animal's information by scanning the code. In fact, one of the primary benefits of QR codes is that *anybody* that has a smart phone and the tag in front of them can view (but not edit) the cattle's information.

62. The primary drawback of QR code tags is that one needs to be directly in front of the tag to scan it and the tag for each animal needs to scanned individually which may impractical for large groups of cattle. Recently this technology has been applied to different traceability applications, including tracking livestock in the United States and Europe.

Figure 9: Example QR Code

***Notes**: Example of scannable QR code. Any free smart phone app can be used to read the QR code, which contains a URL. For the LITS the URL will link the tag to the animal database. In order to illustrate the technology here, the reader can use their smart phone to scan the above QR code, which will direct to the BEAR website.*

Radio-frequency Identification (RFID)

63. In addition to QR codes, the livestock tags with also be equipped with RFID chips. For large batches of cattle, or for situations where individual QR codes cannot be conveniently scanned, RFID technology will be used to record the location and time of an event. The RFID component in the tag emits a radio signal with associated data that can be read by RFID scanners (including smart phones equipped with RFID reading technology).

Figure 10: Example RFID Tag

***Notes**: Example of RFID chip embedded in livestock tag. The RFID chips will be built into the tags that also display QR codes. The chips are contained inside the plastic casing to maintain the tag's durability.*

C. Scanners

64. Smart phones will be used to scan both QR tags and RFID tags at registrations sites, checkpoints, and other monitoring locations.

QR Code Scanner

65. Any smart phone equipped with a camera and access to the internet can be used as a QR scanner. Popular free apps for enabling QR scanning include *QR Code Reader, QR Droid Scanner, Barcode Scanner*, etc. However, any app that scans QR codes would suffice. The apps read the QR code and allow the user to follow the encoded URL to the website interface. Upon accessing the website the user can simply view the data associated with the scanned tag or they can login to enter additional data about the scanned animal. The date and time of all scans of the tag will be automatically recorded, regardless of whether the user enters new data or just views the animal's information.

RFID Scanner

66. Select smart phones will also be equipped with RFID scanners and provided to relevant authorities (e.g., checkpoint officials). By attaching an external device to the phone, called *U Grok It,* smart phones can become equipped to read RFID signals. This device turns the phone into a standard RFID scanner with the added benefit of an interactive screen connected to the internet. By enabling RFID scanning, officials can batch scan animals without scanning each tag individually. This saves time and is a necessary feature of any system striving for scalability.

The device is compatible with a wide range of both Android and iOS mobile phones:

Apple iOS device compatibility

Supported Apple iOS devices have these specifications:

a iOS phones and tablets running 6.0 or higher

b iPhone 4 or higher, iPod Touch 4 or higher, iPad 2 or higher

Android device compatibility

Supported Android devices have these specifications:

- Android 3.0 (Honeycomb) or higher
- A standard 3.5 mm audio port that supports both speaker and mic
- Devices without audio enhancement technology such as modified audio sound or microphone modulation Samsung Galaxy Tab 4 - While the Galaxy Tab 4 is supported, you will need to update your Grokker to the latest firmware (v1.9.5 or later) in order to use the Galaxy Tab 4. You most do this with a non-Tab4 device (iOS or Android) and either the *Discover Grok* or *Send Grok* app.

67. The *U Grok It* device comes with an app that allows the device to interface with a website. The user turns the scanning feature on, then holds the device within 5M of the livestock tags. The scanner records the date/time, location, and ID number of all tags within range. Additional fields can be specified as needed to send additional data.

Scanning can be turned off once all tags have been scanned. At any time the user can open the *U Send It* app and send all of the previously unsent scanning data by pushing the “Send” button. This process sends the data to the website which organizes and stores it in the database. A given livestock tag can have an unlimited number of entries from both QR code scans and RFID scans.

Figure 11: Smart Phone

Notes: *Any recent smart phone that has internet access would be compatible with the system.*

Figure 12: RFID Scanner Attachment for Smart Phone

Notes: *The U Grok It device connects to the smart phone via the audio port so it is not platform dependent. The device comes with an app (U Send It) that facilitates communication with the database.*

D. Other Equipment

68. Tagging pliers are used to apply ear tags to cattle. These will be provided to all veterinary offices that will be registering and tagging cattle. This is a standard technology and veterinarians will be trained as needed to apply tags correctly for maximum durability. If deemed necessary by local veterinary offices, restraining equipment for holding the cattle during the application of an ear tag may also be provided.

Figure 13: Tagging Pliers

Notes: *Tagging pliers will be provided on an as-needed basis to the relevant authorities for fastening the tags to the cattle ears.*

E. Event Recording

69. Events constitute actions that trigger data entry into the database and they include the following four categories:

(1) Initial registration (QR Code Scan): When a tag is assigned to an animal for the first time, the QR code on the tag will be scanned and the relevant registration information will be entered via registration form viewed on the mobile phone.

(2) Scans taken during animal movements (QR Code Scan or RFID Scan): When an animal is being moved and arrives at a checkpoint or other location where they will be tracked, QR code scans or RFID scans can be used to record the current location of the animal as well as additional information deemed relevant.

(3) Scans taken during animal observation (QR Code Scan or RFID Scan): When a veterinarian or other relevant authority carries out any activities with the animal, they can record the activity via either QR code (if there are a small number of animals acted upon) or RFID code (if there are many animals).

(4) Passive scans viewing animal information (QR Code Scan): When a non-registered individual scans the livestock tag to view the animals information, the location and time of the scan is automatically recorded even if the user does not manually enter any information. Examples of these types of passive scans include the farmer scanning his own cattle to show his friends, potential buyers scanning the tag to see the animal's history, etc. These scans will be done using the QR codes since passive users are unlikely to have access to an RFID scanner.

70. An example of the type of information that will be recorded in the database for each type of event is displayed below in Figure 14. A more detailed description of OIE guidelines for animal tracking information is detailed in Annex I.

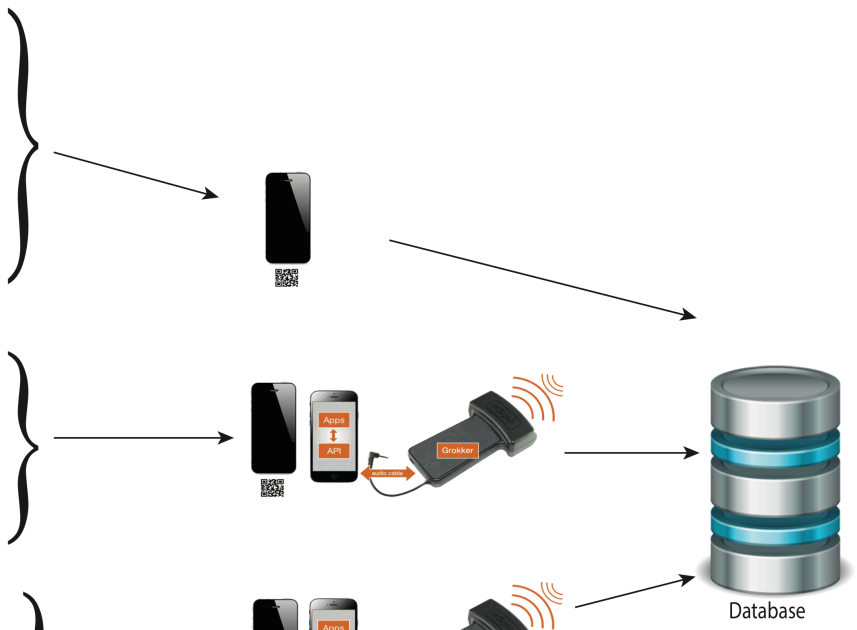
Figure 14: Schematic of Database Record for Individual Animals

Initial Registration
- Cattle ID (Tag ID)
- Current location (GPS)
- Current date/time
- Species and breed of cattle
- Origin city
- Owner System ID
- Owner contact information
- Animal date of Birth
- Production category (draught, beef, etc)
- Sex
- Breed
- Health status

Event Type I - Animal Movement in Process
- Cattle ID (Tag ID)
- Current location (GPS)
- Current date/time
- Name of party moving animals
- System ID of party moving animals
- Purpose of movement (sale, relocation, etc)
- Transportation method (Truck, boat, etc)

Event Type II - Observation of Animal
- Cattle ID (Tag ID)
- Current location (GPS)
- Current date/time
- Name of person observing animals
- System ID of observing party
- Type of observation (vaccine, test, certification etc)
- Result of observation (if any)

Event Type III - Passive Scans
- Cattle ID (Tag ID)
- Current location (GPS)
- Current date/time



F. Central Database

71. The central database will host the records of livestock in the system. For the pilot, each country will have its own database that will be managed by BEAR. For a permanent system, each country would have control of its own database with a shared component so that the information revealed from scanning an animal with foreign origins is possible.

72. Each animal will have its own record, indexed by animal/tag ID. The information associated with each animal/tag will include registration information and all subsequent events. Every scan of the animal's tag will constitute an event that adds information to the database. However, once registration data is entered, the primary data cannot be amended without password access to the database.

73. In addition to being accessed by scanning livestock, officials in each country will have access to the database so that they can view tagged cattle information, monitor cattle movement, and edit information for individual entries as required. Information associated with a single cow can be looked up by searching for the tag/animal ID. Records can be downloaded into an Excel spreadsheet for analysis.

Figure 15: Example of Database Observations Structure

Tag ID/Cattle ID	..... (Registration Info).....	.....(Event I Info).....	.....(Event II Info).....	.....(Event III Info).....
1	Info	.....	.....	.....
1	.....	Event Info	.....	.....
1	.....	Event Info	.....	.....
1	.....	Event Info	.....	.....
1	.....	.....	Event Info	.....
1	.....	Event Info	.....	.....
2	Info	.....	.....	.....
3	.....	.....	.....	Event Info
4	Info	.....	.....	.....
4	.....	Event Info	.....	.....
5	Info	.....	.....	.....
5	.....	Event Info	.....	.....
5	.....	.....	Event Info	.....

Table 4: Overall Project Schedule

TASK	TARGET COMPLETION DATE
1. Submission of Project Inception Report	
2. Submission of Rapid Assessment of Initial Conditions of GMS Livestock Industry and proposed framework and design of the LITS to be piloted	**August 26 2015**
• Rapid Assessment Report • Proposed framework and design of the LITS to be piloted	
3. Finalize pilot implantation plan	**September 7 2015**
• Revise and finalize Cambodia pilot implementation plan (DAHP, ADB, BEAR) • Revise and finalize Myanmar pilot implementation plan (LBVD, ADB, BEAR) • Revise and finalize Lao PDR pilot implementation plan (DLF, ADB, BEAR)	
4. Finalize technological design for LITS implementation	**September 18 2015**
• Develop online database • Procure tagging equipment • Test scanning technology in pilot setting	• 1st – 2nd week of September • 2nd week of September • 3rd week of September
5. Design training material for implementation	**October 2 1015**
• Develop LITS Training Manual • Develop Online Training Manual • Develop User-Friendly Traceability Handbook for Farmers • Translate training material into three pilot country languages (Khmer, Burmese, Lao)	• 1st – 2nd week of September • 3rd week of September • 3rd and 4th week of September • 4th and 5th week of September
7. Lao PDR Pilot	**October – November 2015**
• Recruit farmer participants and local implementation staff • Conduct central training in Vientiane • Trained staff hosts local training at respective posts for traders and other local staff • Pilot implementation • Project conclusion	• Sep 11-18 2015 • October 5 –6 2015 • October 7 - 10 2015 • October 12 – November 8 2015 • November 15 2015
6. Cambodia Pilot	**October – November 2015**
• Recruit farmer participants and local implementation staff • Conduct central training in Phnom Penh • Trained staff hosts local training at respective posts for traders and other local staff • Pilot implementation • Project conclusion	• October 1-15 2015 • October 27 – 28 2015 • October 29 – 30 2015 • November 1 – December 1 2015 • December 1 2015
7. Myanmar Pilot	**October – November 2015**
• Recruit commercial farmer participation and local implementation staff • Conduct central training in Mandalay • Conduct regional farmer training • Pilot implementation • Project conclusion	• October 15-26 2015 • November 2 – 4 • November 5 - 8 • November 9 - December 4 2015 • December 31 2015
9. Project Completion	**December 31 2015**
• Policy brief summarizing results • Final Assessment Report • Project Completion Report	• December 11th 2015 • December 25th 2015 • December 28th 2015

VII. Pilot Plan for Cambodia

A. Pilot Locations

74. Cross-border cattle trade in Cambodia is partly driven by the pull of high demand for beef products in Vietnam and, in particular, Ho Chi Minh City. There are two overlapping types of cross-border cattle transportation networks involved in exporting cattle to Vietnam. Cattle originating in Cambodia are sold through a domestic market chain while cattle originating in Lao PDR and Thailand are transported through the country for export to Vietnam. However, at some points along the market chain, both Cambodian and foreign cattle may be held and moved together.

75. Transit cattle often enter Cambodia through Thailand (primary provinces of cattle entrance identified during the inception meeting as Bantey Meanchey and Oddar Meanchy), are transported across the country, and exit Cambodia to be slaughtered and sold in Vietnam (Kampot, Takeo, Svang Rieng, and Kampong Cham are common exit points). Domestically, cattle raised in Cambodia may be consumed locally, sold for consumption in Phnom Penh or exported through similar networks to Vietnam.

Figure 16: Cross-Border Cattle Movement in Cambodia

***Notes**: Entry and exit points for cross-border cattle trade. (Source: FAO-ADB-OAE 2009)*

76. During the project inception meeting Dr. Sothoen pointed out that Cambodia's role as a transporter country complicates implementation of an LITS because even tagging every animal born in Cambodia (which is itself impractical) would be insufficient for monitoring much of the cross-country cattle movement associated with increased risk of FMD and other livestock diseases.

77. In light of this important point, we propose piloting an LITS that tracks both domestic and transit market chains.

78. We propose implementing pilot LITS in two locations:

1. **Transit Network** - Checkpoints along route from Thailand to Vietnam

   Scanning sites will include entry checkpoints (2) midway checkpoint (1) and exit checkpoints (2) as well as holding depots near exit checkpoints.

2. **Domestic Network** - Domestic market chain around Phnom Penh

   Scanning sites will include farm, midway point (if necessary) and slaughterhouse

79. 1. Transit Network

80. In order to monitor trans-national movement of livestock, Cambodia has checkpoints at the Cambodia-Thai and Cambodia-Vietnam borders and at the midway point in Kampong Cham province. Official regulation states that livestock transported from Thailand to Vietnam should only stop three times; entry point from Thailand, midway checkpoint in Kampong Cham, and exit point to Vietnam [Cocks et al 2009b]. However, it is acknowledged that this regulation is not always followed and trucks may stop elsewhere along the route. A previous study found that cattle are often transported rapidly between countries in groups of 40-50 animals, sometimes even entering from Thailand and exiting to Vietnam within a day [Cocks et al 2009b]. However, Dr. Sothoen noted during the inception meeting that many of these animals are housed for several months in Cambodia before being transported to Vietnam. In light of the short project timeframe, selecting animals for tagging that are being transported through Cambodia will have to be done carefully to ensure the tagged animals will be moved during the project timeframe. Dr. Sothoen expressed concern that animals could be tagged in transit and then housed in a single location for the duration of the project deeming the traceability feature of the tags irrelevant. In order to address this issue, we will have to confirm cattle are bound for transit in the short-run.

81. For the transit network pilot, approximately 300 cattle will be registered and tagged at the entry checkpoint near the Thai-Cambodia border (Bantey Meanchey and Oddar Meanchy). Cattle will be tagged in groups of 10-50 animals.[3] The tagged animals will then be scanned with project provided mobile phone based RFID scanners at the midway checkpoint (Kampong Chnnang) and again at third checkpoints near the Cambodia-Vietnam border (Takeo and Svang Rieng). A fourth scan could also occur at holding depots near the Cambodia-Vietnam border. While cattle being held at depots may not have moved far since their last scan, re-scanning the same animals at a later date provides

[3] Cocks et al 2009b report observing transit cattle being moved in groups of 40-50 cattle.

evidence that animals are being held for an extended period, which can be useful information for officials. Incorporating transit networks into the LITS allows the government to monitor the movement of these animals and ensure that proper protocol is followed.

82. 2. Domestic Network

83. The second component of the proposed LITS will tag approximately 200 cattle bound for the Phnom Penh market. Cattle will be tagged in groups of approximately 10 cattle. Dr. Sothoen manages an ACIAR project that promotes enhanced bio-security on commercial cattle farms and he suggested that it could be possible to work with project farms to implement the pilot. Consequently, we propose working with project farmers in Takeo since there are many commercial farmers there and there are established domestic networks for supplying cattle to Phnom Penh slaughterhouses. If logistic difficulties prohibit us from working with farms involved in Dr. Sothoen's current project then we will recruit new commercial farmers that supply Phnom Penh with cattle.

84. Cattle will be registered and tagged on farm by veterinary staff prior to sale then tracked through the (known) supply chain. The cattle will be scanned at subsequent stops along the market chain prior to slaughter. Benefits of this approach include that DAHP has existing relationships with project farmers and that farmers sell cattle through known networks.

B. Pilot Staffing and Training

85. In consultation with BEAR, DAHP staff will manage direct implementation of the LITS including tag application, registration, and scanning. BEAR will provide technological training for all relevant staff, technology support during the pilot, and BEAR and DAHP will jointly provide training for participant farmers. Implementation staff will include monitors working at the checkpoints as well as local veterinarians for tagging and registration. One central training will take place in Phnom Penh with the project covering the travel costs for 40 local staff to travel and stay in Phom Penh. The 40 trainees, in turn, will then return to their posts and train an average 5 people each.

86. Dr. Sothoen and his team noted that limited technological capacity among potential project participants is one possible barrier to successful implementation. Consequently, training materials will have to be carefully designed by BEAR in close consultation with DAHP to maximize the chance of capacity uptake. DAHP's extensive experience with capacity building will be crucial to effectively designing the training program.

87. Implementation staff will include:

- 6 DAHP staff
- 1 district and 1 provincial staff each from Phnom Penh, Bantey Meanchey, Oddar Meanchy, Takeo, Svang Rieng, Kampong Chnnang (12 people)

- 2 district veterinarian each from Phnom Penh, Bantey Meanchey, Oddar Meanchy, Takeo, Svang Rieng, Kampong Chnnang (12 people)
- 2 officials per checkpoint in Bantey Meanchey, Oddar Meanchy, Kampong Chnnang, Takeo, Svang Rieng (10 people)

Total approximately 40 people

Table 5: Proposed Implementation Schedule for Cambodia

Pilot Activities	Description	Dates
Finalize Pilot Plan • Consultative Meeting with TFPs	Work with the DAHP, ADB to finalize pilot plan including site location, implementation staff, and selection of traders and farmers for pilot participation.	24 Aug 2015 – 30 Sept 2015
Site Visit Request	Upon finalization of pilot locations, BEAR team will request site visits with TFPs to evaluate current market conditions and identify persons for pilot participation.	1 Oct 2015 – 15 Oct 2015
Finalize technology design and training material for LITS Implementation	Develop online database, test scanning technology in pilot setting, and develop Khmer language training material, including LITS Training Manual, Online Training Manual, and User-Friendly Traceability Handbook for Farmers	24 Aug 2015 – 15 Oct 2015
Central Training followed by subsequent local trainings conducted at respective trainer posts.	Conduct central training in Phnom Penh on: • LITS implementation (including cattle tagging, scanning, and QR and RFID tag technology) • Online database use and management (accessing, entering and updating cattle information) • Briefing on User-Friendly Traceability Handbook for Farmers and Traders.	27 Oct 2015 – 28 Oct 2015 (Central Training) 29 Oct 2015 - 30 Oct 2015 (Subsequent Local Trainings)
LITS implementation	Pilot implementation will begin for transit network followed by implementation in Phnom Penh.	1 Nov 2015 – 1 Dec 2015
LITS Pilot Completion	Upon project completion in all three countries BEAR will produce the following • Policy brief summarizing results • Final Assessment report • Project Completion report	1 Dec 2015 – 31 Dec 2015

Table 6: Budget Plan for Proposed Activities

Activity/Item	*Qty*	*Unit Price*	*Amount (USD)*
1. Site Visit			**$2,000.00**
2. Equipment			
1000 Ear Tags + Shipping			$1,500.00
RFID scanner	5	$500.00	$2,500.00
Tagger Applicator	6	$30.00	$180.00
Database Server			$1,000.00
Software Licenses			$1,000.00
Data plans for participating farmers			$1,000.00
		Total	**$7,180.00**
3. Training Material			
Training Material Production & Translation			$1,000.00
		Total	**$1,000.00**
4. Central Training (40 people) & Subsequent local trainings			**$10,000.00**
5. LITS Implementation			**$12,000.00**

VIII. Pilot Plan for Lao PDR

A. Pilot Locations

88. Cross-border cattle trade in Lao PDR is driven by high demand for beef products in Vietnam and China markets, and domestic cattle trade is driven by Vientiane Capital's steady demand for fresh meat. In order to capture movement in both supply chains we propose implementing pilot LITS in two locations:We propose implementing pilot LITS in two locations:

1. **Domestic Network –** Vientiane Capital market chain

   Scanning sites will include farm, subsequent Naxaythong and Pakgnam district traders, and Nongduan and Dondu slaughterhouses.

2. **Cross-border Network** – market chain along route from Lao PDR to Vietnam

   Scanning sites will include farm, subsequent Pak and Nonghad district traders, and final DOLF checkpoint prior to border crossing.

89. Targeting cattle movement in Vientiane Capital and Xieng Khouang locations will be valuable for piloting LITS technology on both Vientiane's growing domestic cattle market and also a primary objective of the ADB's regional initiative - transboundary movement of cattle. Tracking the movement of cattle in both domestic and regional supply chains will contribute to the project's overall priority of improving capacity to protect food safety, enhancing higher value market access for smallholder farmers, and limiting regional propagation of animal disease risk.

90. Because of very limited time available for the pilot implementation, we will be restricted to a total of 500 - 1,000 animals in each subject country, scanned at up to three locations in their transit from origin to destination point. The destination point could be a processing facility (Vientiane) or the DOLF checkpoint at the Xieng Khouang/Vietnam border. Proposed scanning locations and activities respective to each pilot site are described below.

91. 1. Vientiane Capital Location

92. LITS implementation in Vientiane Capital will tag approximately 300 locally bred cattle that are ready for transit to processing in one of the capital's abattoirs. Site visits conducted with DOLF identified Naxaythong District and Pakgnam District as two critical locations for animals moving into the Capital for processing at one of the two major facilities: Dondu and Nongduang Slaughterhouse. All livestock in transit to the Capital must pass through a checkpoint located in one of these two districts, depending on respective direction of movement. Generally, livestock coming from the south passes

through Pakgnam District, and livestock coming from the north passes through Naxaythong District. Regulatory licensing procedures in place require that the destination of livestock being moved be identified.

93. In both Naxaythong and Pakgnam districts there are a number of official traders who purchase cattle from smallholder farmers located throughout the country's southern and northern provinces. Traders procure movement permits from Vientiane Province, and make one or two trips a month to collect cattle from farmers and households throughout the region to sell to the capital slaughterhouses. It was verified during the site visit that minimal movement occurs during September and October due to rainy season and low domestic demand, however, trade picks up again in November and December.

94. Identifying farmer origin for cattle is crucial both for establishing a credible traceability system, and for transferring value to smallholder farmers to ultimately achieve greater market access and increased profits from high product quality. In coordination with the Vientiane Province Department of Livestock and Fisheries, LITS pilot will work with District Veterinarians and official traders to register cattle at farms of origin, and track cattle movement along the market chain prior to slaughter. Cattle will be tagged and registered during the month of October, when minimal movement occurs. This initial stage will entail traveling to a geographically feasible sample of smallholder cattle farmers raising cattle to be moved by licensed traders for Dondu or Nongduang Slaughterhouse. The farmers visited will be based on the predetermined routes used by participating traders. In November, when trade is expected to resume, tagged cattle will be scanned at subsequent points along the supply chain including trader holding grounds, District checkpoints, and the slaughterhouse endpoint.

95. 2. Xieng Khouang Location

96. In addition to Lao PDR's large domestic market, a significant number of domestic cattle are exported to Vietnam. In order to develop a LITS system that effectively tracks GMS regional livestock movement across, it is necessary to include this supply chain in the pilot. In coordination with Xieng Khouang Province's Department of Livestock and Fisheries, we propose working with district veterinarian officers and the Xieng Khouang's Trader Association to implement LITS pilot in Xieng Khouang Province.

97. There are a large number of traders and farmers of varying sizes operating in Xieng Khouang Province. Figure X illustrates cattle trade movement and the numerous stakeholders identified during the pilot site visit. Xieng Khouang's Trader Association is an extensive and high-functioning network of farmers and traders sourcing domestically bred cattle for export predominately to Vietnam (70%), and to a lesser extent, Vientiane Province (30%). The Trader Association exhibited interest and willingness to participate in the pilot during the site visit, and is already working closely with Xieng Khouang's DOLF. Association Members include: (i) farmers who typically hold cattle purchased from a number of smallholders throughout the province for 3-6 months before trade, and (ii) traders who purchase livestock from smallholder farmers in their respective locations for

a quick turn around (1-7 days). The Association pools cattle from members to fill up truckloads for export. Each truckload holds 16-18 cows. Similar to Vientiane, cattle movement in Xieng Khouang is lower during rainy season months, when the roads for accessing farmers are difficult to travel on. In October and November the Association moves on average one truck a week, however, in December and January 3-4 trucks are moved everyday.

98. The final checkpoint before crossing the border is located in Nonghad District in Ban Din Dam Village. Paperwork is issued for all livestock crossing the border at this checkpoint, and this is where the final scan will occur. After this point, livestock are walked across the border utilizing unofficial routes and entry points. Vietnamese traders purchase livestock at these subsequent locations.

99. Reflective of the reduced seasonal trade, LITS Xieng Khouang pilot will tag approximately 300 cattle at origin farm locations. District veterinary staff will work with traders to identify farmer locations for registering and tagging cattle. The site visit confirmed a large number of smallholder farmers raising locally bred cattle located throughout Pak and Nonghad Districts. Cattle will be rescanned at subsequent stops along the market chain, including purchases by traders and/or Association Members. The final scan will occur at the pre-border checkpoint in Nonghad District (roughly 20km from the border), and will be conducted by DOLF officers stationed at the checkpoint. In the event that some of the cattle tagged are transported to Vientiane for processing, subsequent scans will be conducted at respective slaughterhouse locations where scanning infrastructure will already be in place for the Vientiane component of the pilot.

B. Pilot Staffing and Training

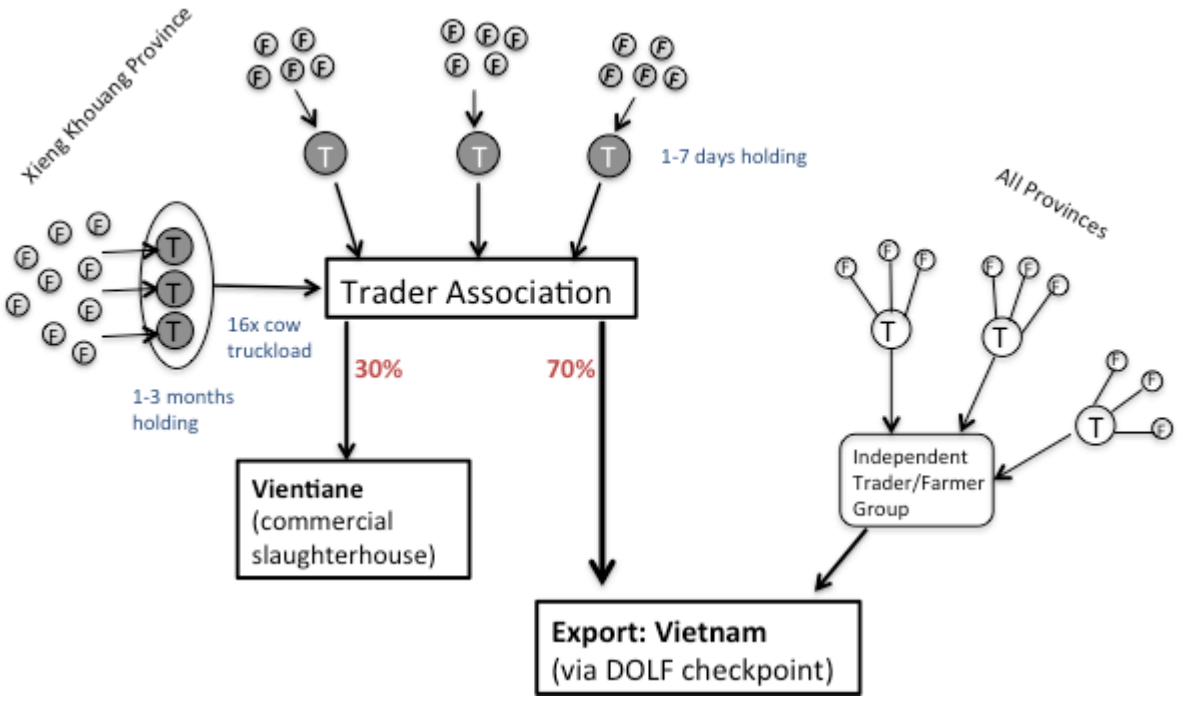
100. BEAR will work with selected field trainers and staff to manage direct implementation of the LITS including tag application, registration, and scanning. BEAR will provide technological training for all relevant staff, and technology support during the pilot. Training will take place in Vientiane Capital with the project covering the travel costs for up to 36 local staff to travel and stay in Vientiane Capital. The 36 trainees, in turn, will return to their posts and train an average of 5 people each.

101. Implementation staff will include:

- 4 DOLF staff
- 2 Vientiane Capital Municipality Office staff
- 13 Vientiane Capital District Office staff
- 1-2 Vientiane Capital Veterinary staff
- 2 Xieng Khouang Municipality staff
- 13 Xieng Khouang District Office staff
- 1-2 Xieng Khouang Veterinary Staff

Total: 36 – 38 people

Figure 16: Xieng Khouang Cattle Movement



Key

Association Member (trader): each trader collects cattle from smallholder farmers in respective region, and holds animals up to a week until they have a full load to sell to the Association (7-8 cows at a time).

Association Member (trader/farmer): each individual trader/farmer purchases a small number of cattle from various smallholder farmers located throughout the outskirts and isolated regions of Pak District. These traders hold cattle for up to several months, until the Association comes to collect cattle from the entire group in order to fill up a truck (~16 cows).

Independent traders/farmers raising and purchasing cattle to export to Vietnam.

Smallholder farmer sells cows to trader/middlemen

Table 7: Proposed Implementation Schedule for Lao PDR

Pilot Activities	Description	Dates
Finalize Pilot Plan • Consultative Meeting with TFPs	Work with the Department of Livestock and Fisheries, Ministry of Agriculture and Forestry TFPs to finalize pilot plan including site location, implementation staff, and selection of traders and farmers for pilot participation. This will include a consultative meeting with TFPs, tentatively schedule for September 10, 2015.	24 Aug 2015 – 25 Sept 2015 • 10 Sept 2015 (tentative)
Site Visit Request	Upon finalization of pilot locations, BEAR team will request site visits with TFPs to evaluate current market conditions and identify traders and farmers for pilot participation.	11 Sept 2015 – 18 Sept 2015
Finalize technology design and training material for LITS Implementation	Develop online database, test scanning technology in pilot setting, and develop Lao language training material, including LITS Training Manual, Online Training Manual, and User-Friendly Traceability Handbook for Farmers	24 Aug 2015 – 30 Sept 2015
Central Training followed by subsequent local trainings conducted at respective trainer posts.	Conduct central training in Vientiane Capital on: • LITS implementation (including cattle tagging, scanning, and QR and RFID tag technology) • Online database use and management (accessing, entering and updating cattle information) • Briefing on User-Friendly Traceability Handbook for Farmers and Traders.	5 Oct 2015 – 6 Oct 2015 (Central Training) 7 Oct 2015 - 10 Oct 2015 (Subsequent Local Trainings)
LITS implementation	Pilot implementation will begin in Vientiane Capital location with cattle tagging and registration, followed by implementation in Xieng Khouang Province.	12 Oct 2015 – 8 Nov 2015
LITS Pilot Completion	Upon project completion in all three countries BEAR will produce the following • Policy brief summarizing results • Final Assessment report • Project Completion report	1 Dec 2015 – 31 Dec 2015

Table 8: Budget Plan for Proposed Activities

Activity/Item	*Qty*	*Unit Price*	*Amount (USD)*
1. Site Visit (Vientiane Capital and Xieng Khouang Province)			**$2,000.00**
2. Equipment			
1000 Ear Tags + Shipping			$1,500.00
RFID scanner	5	$500.00	$2,500.00
Tagger Applicator	6	$30.00	$180.00
Database Server			$1,000.00
Software Licenses			$1,000.00
Data plans for participating farmers			$1,000.00
		Total	**$7,180.00**
3. Training Material			
Training Material Production & Translation			$1,000.00
		Total	**$1,000.00**
4. Central Training (36 people) & Subsequent local trainings			**$10,000.00**
5. LITS Implementation			**$12,000.00**

IX. Pilot Plan for Myanmar

A. Pilot Locations

102. Two districts, Yangon District and Mandalay District, have been nominated for Myanmar pilot locations due to their significant number of commercial farmers and substantial trading activities. Discussion at the project inception meeting revealed that unregulated cattle trade and movement occur throughout Myanmar and across national borders. It would be prohibitively difficult to engage actors involved in illicit trade for the LITS pilot. Commercial farmers, on the other hand, appear to have an interest in collaborating with the LBVD to improve the technological capacity of their supply chains, and once the technology has been tested, there will be a greater opportunity down the road to engage smallholder farmers in capturing the added value a LITS provides. Commercial farmers are already registered under the Myanmar Livestock Federation (MLF), an organization working closely with LBVD engaged in livestock sector development and management. As Dr. Tun and Dr. Khin suggested at the project inception meeting, pilot participants will be selected from the pool of commercial farmers that work with the MLF. In order to continue to draw on the expertise of LBVD, communications with MLF will be channeled through LBVD (Dr. Khin, technical focal point).

103. There are three primary types of cattle in Myanmar: dairy, draught, and beef. Movement of dairy cattle is limited while draught and beef cattle move frequently, and thus are better suited for the pilot timeframe and objectives. In addition to labor, draught cattle is also used for beef production when animals are considered too old to work.

104. Three townships in the Mandalay Region (Meiktila, Pyawbwe, and Sintgaing) were identified in the inception meeting for selecting commercial farmers producing draught cattle to be moved by official traders, and one township in the Yangon Region (Taikkyi) was identified for commercial beef producers intending to export cattle to China or Thailand. Targeting cattle movement in both supply chains will be valuable for piloting LITS technology on a variety of breeds, and for capturing both domestic and regional trade. A total of 500 cattle (beef and draught) of selected commercial farmers in the Yangon and Mandalay regions will be tagged by township veterinary officers, and rescanned at respective destination points. Since there are no checkpoints in the interior of Myanmar, there is limited opportunity for testing a mid-transit scan. However, intermediary scans will be collected when possible as specified in the following overview detailing the LITS implementation components of the Pilot.

1. **Yangon District: Taikkyi Township** – Regional and Domestic Network

   Scanning sites will include farm, midway point (if necessary) and slaughterhouse or quarantine station near exit checkpoints.
2. **Mandalay District: Meikhtila, Pyawbwe, and Sintgaing Townships** – Domestic Network

Scanning sites will include farm, cattle market (if applicable) and slaughter house.

Yangon District

3. The Yangon District component of the proposed LITS will target selected commercial beef producers from Taikkyi Township, registered under the Yangon MLF Division, raising cattle intended for cattle market, or export. Dr. Tun and Dr. Kin identified interest among select Yangon farmers in exporting cattle. For these cattle intended for export, a final scan would be conducted at the border checkpoint, if feasible. If this is not logistically feasible, a final scan could be conducted at Meikhtilar's Quarantine Station where the animal would be held for 21 days. For cattle in transit to domestic markets, movement would be tracked from farm of origin to slaughterhouse. It was verified in the inception meeting that all cattle movement is conducted by licensed traders, which will assist in organizing when and where scans will occur.

4. For the Yangon District pilot, two cohorts of approximately 100 cattle each (200 cattle in total) will be registered at their respective farm of origin. In cooperation with LBVD and MLF, the Taikkyi Township Veterinary Officer will work with selected commercial farmers to administer tagging and complete cattle registration. Each commercial farmer has an existing registration number, which will be used in identification data. Initial registration information will be entered via the registration form viewed on the mobile phone, at which point the tag will be activated. Cattle will be rescanned at subsequent transit points and/or destination points based on the traders' intended market. Potential subsequent scan points, drawn from the National Inception meeting and shared National Livestock Supply Chain Study presentation include:

1. Okkan Cattle Market: scan would be conducted by LBVD staff and/or Yangon City Development Committee Veterinary and Slaughter House Department (YCDCs). Approximately 300 cattle are traded in every Saturday, with roughly 80% for meat purpose, and 20% for draught power. Okkan is a main market for Yangon's slaughter house.
2. Slaughterhouse: scan would be conducted by YCDCs
3. Meikhtilar Quarantine Station: scan would be conducted by LBVD staff
4. Border check point (if feasible)

Mandalay District

5. The Mandalay District component of the proposed LITS will run in up to three townships (Meikhtila, Pyawbwe and Sintgaing), and target selected commercial draught cattle farmers raising cattle to be moved by licensed traders for domestic markets. Approximately 300 cattle will be tagged and tracked throughout Mandalay's cattle supply

chain from farm to slaughterhouse. The three Township Veterinary Officers will work with selected commercial farmers to administer tagging and complete cattle registration for approximately 100 cattle each. Farmer identification numbers will again be used for cattle registration. Cattle will be rescanned at subsequent transit points and/or destination points based on the traders' intended market. The National Livestock Supply Chain Study Presentation shared by LBVD with BEAR identifies cattle markets identifies cattle markets in Meikhtilar and Pyawbwe Townships, from which traders purchase live cattle. LBVD staff issues movement permits, and Ministry of Border Affairs (MBA) issues slaughtering licenses, which will jointly direct cattle movement. Dr. Tun and Dr. Khin identified Mandalay's MLF to be a strong Division to work with, further benefiting LITS implementation in this location.

B. Pilot Staffing and Training

6. BEAR will work in collaboration with LBVD and MLF to implement LITS including tag application, cattle registration, and scanning. BEAR will provide training for all relevant staff and BEAR, LBVD staff, and district MLF will jointly provide district training for participant farmers and traders. Implementation staff will include the following:

- 4 Veterinary officers (1 per township to administer tagging as well as animal health inspections and issuing of PC3 Pass Certificates)
- 4 Township Livestock Association Representatives (1 per Township)
- 2 District Livestock Association Representatives (1 per District)
- 8 LBVD staff (2 – Yangon District, 6 – Mandalay District)
- 10 CDC staff (4 - YCDC, 6 - MCDC)

Total 28 people

7. A central training will take place in Mandalay District. The project will cover the travel costs for up to 28 local staff (including township veterinary officers and local authorities) to travel and stay in central Mandalay region and receive the following training:

- LITS implementation (including cattle tagging, subsequent scanning, and QR and RFID tag technology)
- Online database use and management (accessing, entering and updating cattle information)
- Briefing on User-Friendly Traceability Handbook for Farmers for distribution to participant farmers and traders

8. After completion of the central training, BEAR, LBVD staff, and district Myanmar Livestock Federation representatives will jointly provide training for participant farmers and traders in the two respective districts. District trainings will include the following:

- User-Friendly Traceability Handbook for Farmers
- LITS implementation (including cattle tagging, subsequent scanning, and QR and RFID tag technology)

- Briefing on online database (how data and cattle information will be entering and updated)

Table 9: Proposed Implementation Schedule for Myanmar

Pilot Activities	Description	Dates
Finalize Pilot Plan • Consultative Meeting with TFPs	Work with LBVD, ADB to finalize pilot plan including site location, implementation staff, and selection of traders and farmers for pilot participation.	24 Aug 2015 – 5 Oct 2015
Site Visit Request	Upon finalization of pilot locations, BEAR team will request site visits with TFPs to evaluate current market conditions and identify persons for pilot participation.	15 Oct 2015 – 26 Oct 2015
Finalize technology design and training material for LITS Implementation	Develop online database, test scanning technology in pilot setting, and develop Khmer language training material, including LITS Training Manual, Online Training Manual, and User-Friendly Traceability Handbook for Farmers	24 Aug 2015 – 30 Oct 2015
Central Training followed by subsequent district trainings	Conduct central training in Mandalay on: • LITS implementation (including cattle tagging, scanning, and QR and RFID tag technology) • Online database use and management (accessing, entering and updating cattle information) • Briefing on User-Friendly Traceability Handbook for Farmers and Traders.	2 Nov 2015 – 4 Nov 2015 (Central Training) 5 Nov 2015 - 8 Nov 2015 (Subsequent District Trainings)
LITS implementation	Pilot implementation will begin in Mandalay District followed by implementation in Yangon District.	9 Nov 2015 – 4 Dec 2015
LITS Pilot Completion	Upon project completion in all three countries BEAR will produce the following • Policy brief summarizing results • Final Assessment report • Project Completion report	4 Dec 2015 – 31 Dec 2015

Table 10: Budget Plan for Proposed Activities

Budget for Proposed Activities

Activity/Item	*Qty*	*Unit Price*	*Amount (USD)*
1. Site Visit			**$2,000.00**
2. Equipment			
800 Ear Tags + Shipping			$1,200.00
RFID scanner	5	$500.00	$2,500.00
Tagger Applicator	6	$30.00	$180.00
Database Server			$1,000.00
Software Licenses			$1,000.00
Data plans - participating farmers?			$1,000.00
		Total	**$6,880.00**
3. Training Material			
Training Material Production & Translation			$1,000.00
		Total	**$1,000.00**
4. Traning			
Central Mandalay Training (28 people)			$8,000.00
Yangon District Training			$2,000.00
Mandalay District Training			$4,000.00
		Total	**$14,000.00**
5. LITS Implementation			**$12,000.00**

Table 11: International Issues in Animal Health Risk Management

1. Animal populations species distribution herd management
2. Farming and industry structures, production systems, and location
3. Animal health status, capacity for testing and record keeping
4. Public health status, services, and infrastructure
5. Trade issues - practices, policies, and infrastructure
6. Aspects of animal husbandry
7. Zoning and schematics for compartmentalization
8. Animal movement patterns (including transhumance)
9. Information management and communication, infrastructure and practices
10. Availability of resources (human and financial)
11. Social and cultural aspects
12. Stakeholder knowledge of the issues and expectations
13. Gaps between current enabling legislation and what is needed long term
14. International experience
15. National experience
16. Existing and available technology options
17. Existing identification, testing, and registration system(s)
18. Expected benefits and costs from the *animal identification systems* and *animal traceability* and to whom they accrue
19. Issues pertaining to data management, ownership, and access rights
20. Reporting requirements.

Source: http://www.oie.int/index.php?id=169&L=0&htmfile=chapitre_ident_design.htm

9. The LITS system we propose represents a synthesis of international best practices in agrifood supply chain traceability, adapted to the institutional, geographic, and economic realities of livestock flows across the GMS. In particular, we draw upon prototypes for LITS from a variety of multilateral and bilateral development partners, including UN FAO, OIE, the European Union, Australia, Japan, and the United States (references and source material available upon request).

C. Design and Development of a Livestock Identification and Traceability System (LITS)

10. The database supporting LITS should comprise any and all information relevant to commercial animal movements in the sub-region. While it may not be feasible to detail every animal's movements during their lifecycle, particular attention should be focused on movements across national borders and information bearing on market and health characteristics of animals being moved in response to commercial incentives. In this section we summarize this information as it would be incorporated into an online database, updated by scanning technologies applied to animals at their points of origin, transit, and processing.

11. Procedures need to be incorporated into the design of the program in order to ensure that relevant information and events are registered in a timely and accurate manner. Depending on the scope, performance criteria and desired outcomes, database records should specify, *at a minimum*, the species, unique animal or group identifiers, the date/time of the event, an identifier of the establishment where the event took place, and a standardized code for the event itself. Ideally, the information recorded would include the following:

Table 12: Identification Information Collected For Each Animal And Event

- Species and breed
- Origin
- Owner/custodian contact information
- Physical location where animals are kept (GPS)
- Date of Birth
- Production category
- Sex
- Breed
- Number of animals of each species
- Animal id of parents
- Health status - although the TOR does not call for (e.g. FMD) health testing in the pilot, we plan to design a system that can accommodate this because disease risk management is a primary goal for traceability in livestock trade

Location and Event Information

Standards for location and event information are straightforward.
Location information should include:

- Name of establishment
- Establishment ID
- Name and contact info for person legally responsible for animals
- Physical address or GPS coordinates of the establishment

Salient events that occur should be recorded in the LITS, including:

- Birth of animal
- Slaughter/death of animal
- Ownership changes
- Attachment of unique identifier to animal
- Observation of an animal (testing, health inspection, health certification, etc)
- Movement within country
  - Date of movement
  - Establishment which animal group was dispatched from
  - Number of animals moved
  - Destination establishment
  - New location where animals are kept (lat-lon)
  - Any establishments used in transit

    - Description of means of transport (including vehicle ID where possible)
- Animal export:
    - Date of export
    - Number of animals moved
    - Establishment which animal group was dispatched from
    - Border crossing
    - Destination establishment
    - Any establishments used in transit
    - Description of means of transport (including vehicle ID where possible)
    - Record of animal id from exporting country should be provided to authority in importing country
- Animal import:
    - Animal id should be assigned to imported animal
    - Record of animal id from exporting country should be recorded and linked with the animal id provided by exporting country
    - Date of import
    - Number of animals moved
    - Establishment which animal group was dispatched from
    - Border crossing
- Animal identifier lost or replaced
- Animal missing (lost/stolen)

X. Annex 1: OIE Recommendations for LITS

12. Procedures need to be incorporated into the design of the program in order to ensure that relevant events and information are registered in a timely and accurate manner. Depending on the scope, performance criteria and desired outcomes, records as described below should specify, *at a minimum*, **the species, the unique animal or group identifier, the date of the event, the identifier of the establishment where the event took place, and the code for the event itself**. Ideally, the information recorded will include the following:

(I) Livestock Identification System:

Identification information collected for animals should include:

- Species
- Owner contact info
- Physical location where animals are kept (lat-lon)
- DOB
- Production category
- Sex
- Breed
- Number of animals of each species
- Animal id of the parents

(II) Livestock traceability system:

Information should be collected on establishments involved in the supply chain and on relevant events that occur throughout the animals lives.

Establishment information to be recorded-

Information on establishments where animals are kept in the system should be recorded. Examples of relevant establishments are slaughterhouses, farms, assembly centers, markets, dead stock collection points, border posts, quarantine stations.

Information should include:

- Name of establishment
- Establishment ID
- Name and contact info for person *legally* responsible for animals
- Physical address or lat-lon of establishment

Events to be recorded:

Events that occur should be recorded in the LITS, including:

- Birth of animal
- Slaughter/death of animal
- Ownership changes
- Attachment of unique identifier to animal
- Observation of an animal (testing, health inspection, health certification, etc)
- Movement within country
    - Date of movement
    - Establishment which animal group was dispatched from

- Number of animals moved
- Destination establishment
- New location where animals are kept (lat-lon)
- Any establishments used in transit
- Description of means of transport (including vehicle ID where possible)

- Animal export:
  - Date of export
  - Number of animals moved
  - Establishment which animal group was dispatched from
  - Border crossing
  - Destination establishment
  - Any establishments used in transit
  - Description of means of transport (including vehicle ID where possible)
  - Record of animal id from exporting country should be provided to authority in importing country
- Animal import:
  - Animal id should be assigned to imported animal
  - Record of animal id from exporting country should be recorded and linked with the animal id provided by exporting country
  - Date of import
  - Number of animals moved
  - Establishment which animal group was dispatched from
  - Border crossing
- Animal identifier lost or replaced
- Animal missing (lost/stolen)

Model veterinary certificate for international trade in live animals and hatching eggs

http://www.oie.int/index.php?id=169&L=0&htmfile=chapitre_certif_live_animals.htm

Part I: Details of dispatched consignment	I.1. Consignor: Name: Address:	I.2. Certificate reference number: I.3. Veterinary Authority:
	I.4. Consignee: Name: Address:	
	I.5. Country of origin: ISO Code*:	I.6. Zone or compartment of origin**:
	I.7. Country of destination: ISO Code*:	I.8. Zone or compartment of destination**:
	I.9. Place of origin: Name: Address:	
	I.10. Place of shipment:	I.11. Date of departure:
	I.12. Means of transport: Aeroplane □ Ship □ Railway wagon □ Road vehicle □ Other □ Identification:	I.13. Expected border post: I.14. CITES permit No(s)**:
	I.15. Description of commodity:	I.16. Commodity code (HS code): I.17. Total quantity:
	I.18.	I.19. Total number of packages:
	I.20. Identification of container/seal number:	I.21.
	I.22. Commodities intended for use as: Breeding/rearing □ Competition □ Slaughter □ Wildlife management □ Pets □ Exhibition/education □ Other □	
	I.23. For import or admission: Definitive import □ Re-entry □ Temporary admission □	
	I.24. Identification of commodities: Species (Scientific name): Breed*/Category*: Identification system: Identification number/details: Age*: Sex*: Quantity:	

Part II: Zoosanitary information		II.a. Certificate reference number:
	The undersigned Official Veterinarian certifies that the animal(s)/hatching egg(s) described above satisfy(ies) the following requirements: Official Veterinarian: Name and address (in capital letters): Official position: Date: Signature: Stamp:	

Guidelines and considerations for designing an LITS:

http://www.oie.int/index.php?id=169&L=0&htmfile=chapitre_ident_design.htm

System should include procedures for:
i) the *establishment* of birth, and time period within which an *animal* is born;
ii) actions to be taken when *animals* are introduced into an *establishment*;
iii) actions to be taken when an *animal* loses its identification or the identifier becomes unusable;
iv) arrangements and rules for the destruction and/or reuse of identifiers;
v) penalties for the tampering and/or removal of official animal identification devices.

Where group identification without a physical identifier is adequate, documentation should be created specifying at least the number of *animals* in the group, the species, the date of identification, the person legally responsible for the *animals* and/or *establishment*. This documentation constitutes a unique group identifier and it should be updated to be traceable if there are any changes.

Where all *animals* in the group are physically identified with a group identifier, documentation should also specify the unique group identifier.

OIE guidelines for conducting preliminary studies before implementing an LITS:

http://www.oie.int/index.php?id=169&L=0&htmfile=chapitre_ident_design.htm

In designing *animal identification systems* it is useful to conduct preliminary studies, which should take into account:

1. animal populations, species, distribution, *herd* management,
2. farming and industry structures, production and location,
3. animal health,
4. public health,
5. trade issues,
6. aspects of animal husbandry,
7. zoning and compartmentalisation,
8. animal movement patterns (including transhumance),
9. information management and communication,
10. availability of resources (human and financial),
11. social and cultural aspects,
12. stakeholder knowledge of the issues and expectations,
13. gaps between current enabling legislation and what is needed long term,
14. international experience,
15. national experience,
16. available technology options,
17. existing *identification system(s)*,
18. expected benefits from the *animal identification systems* and *animal traceability* and to whom they accrue,
19. issues pertaining to data ownership and access rights,
20. reporting requirements.

Pilot projects may form part of the preliminary study to test the *animal identification system* and *animal traceability* and to gather information for the design and the implementation of the programme.

Economic analysis may consider costs, benefits, funding mechanisms and sustainability.

Other potentially useful info:
Table of Contents for all guidelines:
http://www.oie.int/en/international-standard-setting/terrestrial-code/access-online/

Process for certifying veterinarians
http://www.oie.int/index.php?id=169&L=0&htmfile=chapitre_certification_procedures.htm
Animal health steps to take prior to export
http://www.oie.int/index.php?id=169&L=0&htmfile=chapitre_aahm_before_and_at_departure.htm
Animal health steps to take prior to import
http://www.oie.int/index.php?id=169&L=0&htmfile=chapitre_aahm_arrival.htm
Approaches to disease surveillance
http://www.oie.int/index.php?id=169&L=0&htmfile=chapitre_surveillance_general.htm

XI. Annex 2 – Timetable and Deliverables

Table A2.1:Proposed Project Timetable

N°	Activity	Months (March 1, 2015 – November 30, 2015)								
		1	2	3	4	5	6	7	8	9
Project Inception – 2 weeks										
1	Deliverable 1-1 - Project Inception Report									
2	Finalize three border regions									
i. Rapid Assessment of Initial Conditions – 4 weeks										
3	Conduct rapid assessment initial on conditions									
4	Deliverable 2 – Rapid assessment report									
ii. Design and Development of a Livestock Identification and Traceability System (LITS) – 8 weeks										
5	Design LITS framework									
6	Deliverable 1-2 – Quarterly progress report									
7	Deliverable 3 – LITS design/implement plan									
iii. Training Manual on LITS – 6 weeks										
8	Design training manual on LITS									
9	Deliverable 4 – Training manual									
10	Deliverable 5 – Online training materials									
iv. User-Friendly Traceability Handbook for Farmers – 6 weeks										
11	Design handbook for farmers									
12	Deliverable 6 – Traceability handbook									
v. Conduct Training of Trainers on the Implementation of LITS – 6 weeks										
13	Design training of trainers									
14	Conduct training of trainers									
vi. Implementation Plan and Pilot Test the LITS in Cambodia, Lao PDR, and Myanmar – 16 weeks										
15	Draft implementation plan									
16	Pilot Implementation							*		
17	Deliverable 1-3 Quarterly progress report									
18	Deliverable 7 – LITS deployment evaluation									
vii. Roadmap for GMS Harmonization of LITS Standards and Regulatory Frameworks – 4 weeks										
19	Develop roadmap									
20	Deliverable 8 – Roadmap for harmonizing LITS regulatory framework									
viii. Regional Policy Forum – 5 weeks										
21	Draft plan for regional policy forum									
22	Hold regional policy forum									
23	Deliverable 9 – Regional policy forum summary									
Project Completion – 4 weeks										
24	Deliverable 10 – Policy brief summarizing results									
25	Deliverable 1-4 – Final assessment report									
26	Finalize project completion report									

TABLE A2.2: THE FINAL DOCUMENTS (DELIVERABLES):**

Deliverable	Description
1	Quarterly Progress Reports. Final report on the assignment (Deliverable 1-4), including the status of the pilot, stakeholder training, and other activities
2	Rapid assessment report will be submitted 1 month after inception.
3	Proposed framework and design of the LITS to be piloted using suitable technologies for the GMS, and the corresponding implementation plan for the pilot in Cambodia, Lao PDR, and Myanmar will be submitted 2 months after inception.
4	E-file or soft copy of the training manual on LITS in English, Khmer, Lao, and Burmese will be submitted 2 weeks before the training.
5	Online training materials will supplement Deliverable 4.
6	Handbook of guidelines for famers to fulfill the requirements of traceability systems in English, Khmer, Lao, and Burmese will be submitted 2 weeks before the training.
7	Progress report describing the implementation of the three pilots and the in-country training each for Cambodia, Lao PDR, and Myanmar will be submitted 3 months after the commencement of the pilot.
8	A roadmap for harmonizing regulatory frameworks for LITS, including policy options for the GMS will be submitted 7 months after inception.
9	A report on the regional policy forum will be submitted 2 weeks after the event.
10	Non-technical policy briefs summarizing results of the LITS deployment will be submitted in conjunction with the Final Report.

** Extra time is allotted for piloting in the event that unforeseen issues delay piloting activities*

*** List corresponds to items 1-10 on page 3-12 of the project proposal TECH-1.*

XII. REFERENCES AND SOURCE MATERIAL

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XIII. Glossary of Terms

ACCEPTABLE RISK - a risk level judged by each Member Country to be compatible with the protection of animal and public health within its territory.

ANIMAL - a mammal, bird or bee.

ANIMAL FOR BREEDING OR REARING - a domesticated or confined animal which is not intended for slaughter within a short time.

ANIMAL FOR SLAUGHTER - an animal intended for slaughter within a short time, under the control of the relevant Veterinary Authority.

ANIMAL HANDLER - a person with a knowledge of the behaviour and needs of animals who, with appropriate experience and a professional and positive response to an animal's needs, can achieve effective management and good welfare. Competence should be gained through formal training and/or practical experience.

ANIMAL HEALTH MANAGEMENT - a system designed to optimise the physical and behavioural health and welfare of animals. It includes the prevention, treatment and control of diseases and conditions affecting the individual animal and herd, including the recording of illness, injuries, mortalities and medical treatments where appropriate.

ANIMAL HEALTH STATUS - the status of a country or a zone with respect to an animaldisease in accordance with the criteria listed in the relevant chapter of the Terrestrial Code dealing with the disease.

ANIMAL IDENTIFICATION - the combination of the identification and registration of an animal individually, with a unique identifier, or collectively by its epidemiological unit or group, with a unique group identifier.

ANIMAL IDENTIFICATION SYSTEM - the inclusion and linking of components such as identification of establishments/owners, the person(s) responsible for the animal(s), movements and other records with animal identification.

ANIMAL TRACEABILITY - the ability to follow an animal or group of animals during all stages of its life.

ANIMAL WELFARE - how an animal is coping with the conditions in which it lives. An animal is in a good state of welfare if (as indicated by scientific evidence) it is healthy, comfortable, well nourished, safe, able to express innate behaviour, and if it is not suffering from unpleasant states such as pain, fear and distress. Good animal welfare requires disease prevention and veterinary treatment, appropriate shelter, management, nutrition, humane handling and human slaughter/killing. Animal welfare refers to the state of the animal; the treatment that an animal receives is covered by other terms such as animal care, animal husbandry, and humane treatment.

ANTIMICROBIAL AGENT - a naturally occurring, semi-synthetic or synthetic substance that exhibits antimicrobial activity (kill or inhibit the growth of micro-organisms) at concentrations

attainable in vivo. Anthelmintics and substances classed as disinfectants or antiseptics are excluded from this definition.

APIARY - a beehive or group of beehives whose management allows them to be considered as a single epidemiological unit.

APPROPRIATE LEVEL OF PROTECTION - the level of protection deemed appropriate by the country establishing a sanitary measure to protect human or animal life or health within its territory.

APPROVED - officially approved, accredited or registered by the Veterinary Authority.

ARTIFICIAL INSEMINATION CENTRE - a facility approved by the Veterinary Authority and which meets the conditions set out in the Terrestrial Code for the collection, processing and/or storage of semen.

BEEHIVE - a structure for the keeping of honey bee colonies that is being used for that purpose, including frameless hives, fixed frame hives and all designs of moveable frame hives (including nucleus hives), but not including packages or cages used to confine bees for the purpose of transport or isolation.

BIOSECURITY - a set of management and physical measures designed to reduce the risk of introduction, establishment and spread of animal diseases, infections or infestations to, from and within an animal population.

BIOSECURITY PLAN - a plan that identifies potential pathways for the introduction and spread of disease in a zone or compartment, and describes the measures which are being or will be applied to mitigate the diseaserisks, if applicable, in accordance with the recommendations in the Terrestrial Code.

BORDER POST - any airport, or any port, railway station or road check-point open to international trade of commodities, where import veterinary inspections can be performed.

CAPTIVE WILD ANIMAL - an animal that has a phenotype not significantly affected by human selection but that is captive or otherwise lives under direct human supervision or control, including zoo animals and pets.

CASE - an individual animal infected by a pathogenic agent, with or without clinical signs.

COLLECTION CENTRE - a facility approved by the Veterinary Authority for the collection of embryos/ova and used exclusively for donor animals which meet the conditions of the Terrestrial Code.

COMMODITY - live animals, products of animal origin, animal genetic material, biological products and pathological material.

COMPARTMENT - an animal subpopulation contained in one or more establishments under a common biosecurity management system with a distinct health status with respect to a specific disease or specific diseases for which required surveillance, control and biosecurity measures have been applied for the purpose of international trade.

COMPETENT AUTHORITY - the Veterinary Authority or other Governmental Authority of a Member Country having the responsibility and competence for ensuring or supervising the implementation of animal health and welfare measures, international veterinary certification and other standards and recommendations in the Terrestrial Code and in the OIE Aquatic Animal Health Code in the whole territory.

CONTAINER - a non-self-propelled receptacle or other rigid structure for holding animals during a journey by one or several means of transport.

CONTAINMENT ZONE - a defined zone around and including suspected or infected establishments, taking into account the epidemiological factors and results of investigations, where control measures to prevent the spread of the infection are applied.

DAY-OLD BIRDS - birds aged not more than 72 hours after hatching.

DEATH - the irreversible loss of brain activity demonstrable by the loss of brain stem reflexes.

DISEASE - the clinical or pathological manifestation of infection or infestation.

DISINFECTION - the application, after thorough cleansing, of procedures intended to destroy the infectious or parasitic agents of animal diseases, including zoonoses; this applies to premises, vehicles and different objects which may have been directly or indirectly contaminated.

DISINFESTATION - the application of procedures intended to eliminate infestation.

EARLY DETECTION SYSTEM - a system for the timely detection and identification of an incursion or emergence of diseases/infections in a country, zone or compartment. An early detection system should be under the control of the Veterinary Services and should include the following characteristics:representative coverage of target animal populations by field services;ability to undertake effective disease investigation and reporting; access to laboratories capable of diagnosing and differentiating relevant diseases; a training programme for veterinarians, veterinary para-professionals, livestock owners/keepers and others involved in handling animals for detecting and reporting unusual animal health incidents; the legal obligation of private veterinarians to report to the Veterinary Authority; a national chain command.

EMERGING DISEASE - a new occurrence in an animal of a disease, infection or infestation, causing a significant impact on animal or public health resulting from: a change of a known pathogenic agent or its spread to a new geographic area or species; or a previously unrecognised pathogenic agent or disease diagnosed for the first time.

EPIDEMIOLOGICAL UNIT - a group of animals with a defined epidemiological relationship that share approximately the same likelihood of exposure to a pathogen. This may be because they share a common environment (e.g. animals in a pen), or because of common management practices. Usually, this is a herd or a flock. However, an epidemiological unit may also refer to groups such as animals belonging to residents of a village, or animals sharing a communal animal handling facility. The epidemiological relationship may differ from disease to disease, or even strain to strain of the pathogen.

EQUIVALENCE OF SANITARY MEASURES - the state wherein the sanitary measure(s) proposed by the exporting country as an alternative to those of the importing country, achieve(s) the same level of protection.

ERADICATION - the elimination of a pathogenic agent from a country or zone.

ESTABLISHMENT - the premises in which animals are kept.

EUTHANASIA - the act of inducing death using a method that causes a rapid and irreversible loss of consciousness with minimum pain and distress to animal.

EXPORTING COUNTRY - a country from which commodities are sent to another country.

FERAL ANIMAL - an animal of a domesticated species that now lives without direct human supervision or control.

FLOCK - a number of animals of one kind kept together under human control or a congregation of gregarious wild animals. For the purposes of the Terrestrial Code, a flock is usually regarded as an epidemiological unit.

FREE COMPARTMENT - a compartment in which the absence of the animal pathogen causing the disease under consideration has been demonstrated by all requirements specified in the Terrestrial Code for free status being met.

FREE ZONE - a zone in which the absence of the disease under consideration has been demonstrated by the requirements specified in the Terrestrial Code for free status being met. Within the zone and at its borders, appropriate official veterinary control is effectively applied for animals and animal products, and their transportation.

FRESH MEAT - meat that has not been subjected to any treatment irreversibly modifying its organoleptic and physicochemical characteristics. This includes frozen meat, chilled meat, minced meat and mechanically recovered meat.

GOOD MANUFACTURING PRACTICE - a production and testing practice recognised by the Competent Authority to ensure the quality of a product.

GREAVES - the protein-containing residue obtained after the partial separation of fat and water during the process of rendering.

HATCHING EGGS - fertilised bird eggs, suitable for incubation and hatching.

HAZARD - a biological, chemical or physical agent in, or a condition of, an animal or animal product with the potential to cause an adverse health effect.

HERD - a number of animals of one kind kept together under human control or a congregation of gregarious wild animals. For the purposes of the Terrestrial Code, a herd is usually regarded as an epidemiological unit.

IMPORTING COUNTRY - a country that is the final destination to which commodities are sent.

INCIDENCE - the number of new cases or outbreaks of a disease that occur in a population at risk in a particular geographical area within a defined time interval.

INCUBATION PERIOD - the longest period which elapses between the introduction of the pathogen into the animal and the occurrence of the first clinical signs of the disease.

INFECTED ZONE - a zone in which a disease has been diagnosed.

INFECTION - the entry and development or multiplication of an infectious agent in the body of humans or animals.

INFECTIVE PERIOD - the longest period during which an affected animal can be a source of infection.

INFESTATION - the external invasion or colonisation of animals or their immediate surroundings by arthropods, which may cause disease or are potential vectors of infectious agents.

INTERNATIONAL TRADE - importation, exportation and transit of commodities.

INTERNATIONAL VETERINARY CERTIFICATE - a certificate, issued in accordance with Chapter 5.2., describing the animal health and/or public health requirements which are fulfilled by the exported commodities.

JOURNEY

An animal transport journey commences when the first animal is loaded onto a vehicle/vessel or into a container and ends when the last animal is unloaded, and includes any stationary resting/holding periods. The same animals do not commence a new journey until after a suitable period for rest and recuperation, with adequate feed and water.

KILLING - any procedure which causes the death of an animal.

LABORATORY - a properly equipped institution staffed by technically competent personnel under the control of a specialist in veterinary diagnostic methods, who is responsible for the validity of the results. The Veterinary Authority approves and monitors such laboratories with regard to the diagnostic tests required for international trade.

LAIRAGE - pens, yards and other holding areas used for accommodating animals in order to give them necessary attention (such as water, feed, rest) before they are moved on or used for specific purposes including slaughter.

LISTED DISEASE - a disease, infection or infestation listed in Article 1.2.3. after adoption by the World Assembly of OIE Delegates.

LOADING/UNLOADING - Loading means the procedure of moving animals onto a vehicle/vessel or into a container for transport purposes, while unloading means the procedure of moving animals off a vehicle/vessel or out of a container.

MARKET - a place where animals are assembled for the purpose of trade or sale.

MEAT - all edible parts of an animal.

MEAT-AND-BONE MEAL - the solid protein products obtained when animal tissues are rendered, and includes any intermediate protein product other than peptides of a molecular weight less than 10,000 daltons and amino-acids.

MEAT PRODUCTS - meat that has been subjected to a treatment irreversibly modifying its organoleptic and physicochemical characteristics.

MILK - the normal mammary secretion of milking animals obtained from one or more milkings without either addition to it or extraction from it.

MILK PRODUCT - the product obtained by any processing of milk.

MONITORING - the intermittent performance and analysis of routine measurements and observations, aimed at detecting changes in the environment or health status of a population.

NOTIFIABLE DISEASE - a disease listed by the Veterinary Authority, and that, as soon as detected or suspected, should be brought to the attention of this Authority, in accordance with national regulations.

NOTIFICATION - the procedure by which: the Veterinary Authority informs the Headquarters, the Headquarters inform the Veterinary Authority, of the occurrence of an outbreak of disease or infection

OFFICIAL CONTROL PROGRAMME - a programme which is approved, and managed or supervised by the Veterinary Authority of a Member Country for the purpose of controlling a vector, pathogen or disease by specific measures applied throughout that Member Country, or within a zone or compartment of that Member Country.

OFFICIAL VETERINARIAN - a veterinarian authorised by the Veterinary Authority of the country to perform certain designated official tasks associated with animal health and/or public health and inspections of commodities and, when appropriate, to certify in accordance with Chapters 5.1. and 5.2.

OFFICIAL VETERINARY CONTROL - the operations whereby the Veterinary Services, knowing the location of the animals and after taking appropriate actions to identify their owner or responsible keeper, are able to apply appropriate animal health measures, as required. This does not exclude other responsibilities of the Veterinary Services e.g. food safety.

OUTBREAK - the occurrence of one or more cases in an epidemiological unit.

OWNED DOG - a dog for which a person claims responsibility.

PATHOLOGICAL MATERIAL - samples obtained from live or dead animals, containing or suspected of containing infectious or parasitic agents, to be sent to a laboratory.

PLACE OF SHIPMENT - the place where the commodities are loaded into the vehicle or handed to the agency that will transport them to another country.

POPULATION - a group of units sharing a common defined characteristic.

POST-JOURNEY PERIOD - the period between unloading and either recovery from the effects of the journey or slaughter (if this occurs before recovery).

POULTRY - all domesticated birds, including backyard poultry, used for the production of meat or eggs for consumption, for the production of other commercial products, for restocking supplies of game, or for breeding these categories of birds, as well as fighting cocks used for any purpose.

Birds that are kept in captivity for any reason other than those reasons referred to in the preceding paragraph, including those that are kept for shows, races, exhibitions, competitions or for breeding or selling these categories of birds as well as pet birds, are not considered to be poultry.

PRE-JOURNEY PERIOD - the period during which animals are identified, and often assembled for the purpose of loading them.

PREVALENCE - the total number of cases or outbreaks of a disease that are present in a population at risk, in a particular geographical area, at one specified time or during a given period.

PROTECTION ZONE - a zone established to protect the health status of animals in a free country or free zone, from those in a country or zone of a different animal health status, using measures based on the epidemiology of the disease under consideration to prevent spread of the causative pathogenic agent into a free country or free zone. These measures may include, but are not limited to, vaccination, movement control and an intensified degree of surveillance.

QUALITATIVE RISK ASSESSMENT - an assessment where the outputs on the likelihood of the outcome or the magnitude of the consequences are expressed in qualitative terms such as ‘high’, ‘medium’, ‘low’ or ‘negligible’.

QUALITY - defined by International Standard ISO 8402 as ‘the totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs’.

QUANTITATIVE RISK ASSESSMENT - an assessment where the outputs of the risk assessment are expressed numerically.

QUARANTINE STATION - an establishment under the control of the Veterinary Authority where animals are maintained in isolation with no direct or indirect contact with other animals, to ensure that there is no transmission of specified pathogen(s) outside the establishment while the animals are undergoing observation for a specified length of time and, if appropriate, testing and treatment.

REGISTRATION - the action by which information on animals (such as identification, animal health, movement, certification, epidemiology, establishments) is collected, recorded, securely stored and made appropriately accessible and able to be utilised by the Competent Authority.

RESPONSIBLE DOG OWNERSHIP - the situation whereby a person (as defined above) accepts and commits to perform various duties in accordance with the legislation in place and focused on the satisfaction of the behavioural, environmental and physical needs of a dog and to the prevention of risks (aggression, disease transmission or injuries) that the dog may pose to the community, other animals or the environment.

RESTING POINT - a place where the journey is interrupted to rest, feed or water the animals; the animals may remain in the vehicle/vessel or container, or be unloaded for these purposes.

RESTRAINT - the application to an animal of any procedure designed to restrict its movements.

RISK - the likelihood of the occurrence and the likely magnitude of the biological and economic consequences of an adverse event or effect to animal or human health.

RISK ANALYSIS - the process composed of hazard identification, risk assessment, risk management and risk communication.

RISK ASSESSMENT - the evaluation of the likelihood and the biological and economic consequences of entry, establishment and spread of a hazard.

RISK COMMUNICATION - the interactive transmission and exchange of information and opinions throughout the risk analysis process concerning risk, risk-related factors and risk perceptions among risk assessors, risk managers, risk communicators, the general public and other interested parties.

RISK MANAGEMENT - the process of identifying, selecting and implementing measures that can be applied to reduce the level of risk.

SAFE COMMODITY - a commodity which can be traded without the need for risk mitigation measures specifically directed against a particular listed disease, infection or infestation and regardless of the status of the country or zone of origin for that disease, infection or infestation.

SANITARY MEASURE - a measure, such as those described in various chapters of the Terrestrial Code, destined to protect animal or human health or life within the territory of the Member Country from risks arising from the entry, establishment and/or spread of a hazard.

SLAUGHTER - any procedure which causes the death of an animal by bleeding.

SLAUGHTERHOUSE/ABATTOIR - premises, including facilities for moving or lairaging animals, used for the slaughter of animals to produce animal products and approved by the Veterinary Services or other Competent Authority.

SPACE ALLOWANCE - the measure of the floor area and height allocated per individual or body weight of animals.

SPECIFIC SURVEILLANCE - the surveillance targeted to a specific disease or infection.

STAMPING-OUT POLICY - a policy designed to eliminate an outbreak by carrying out under the authority of the Veterinary Authority the following:

the killing of the animals which are affected and those suspected of being affected in the herd and, where appropriate, those in other herds which have been exposed to infection by direct animal to animal contact, or by indirect contact with the causal pathogen; this includes all susceptible animals, vaccinated or unvaccinated, on infected establishments; animals should be killed in accordance with Chapter 7.6.;

the destruction of their carcasses by rendering, burning or burial, or by any other method described in Chapter 4.12.;

the cleansing and disinfection of establishments through procedures defined in Chapter 4.13.

STOCKING DENSITY - the number or body weight of animals per unit area on a vehicle/vessel or container.

STRAY DOG - any dog not under direct control by a person or not prevented from roaming. Types of stray dog:

free-roaming owned dog not under direct control or restriction at a particular time,

free-roaming dog with no owner,

feral dog: domestic dog that has reverted to the wild state and is no longer directly dependent upon humans.

STUNNING - any mechanical, electrical, chemical or other procedure which causes immediate loss of consciousness; when used before slaughter, the loss of consciousness lasts until death from the slaughter process; in the absence of slaughter, the procedure would allow the animal to recover consciousness.

SUBPOPULATION - a distinct part of a population identifiable in accordance with specific common animal health characteristics.

SURVEILLANCE - the systematic ongoing collection, collation, and analysis of information related to animal health and the timely dissemination of information so that action can be taken.

TERRESTRIAL CODE - the OIE Terrestrial Animal Health Code.

TERRESTRIAL MANUAL - the OIE Manual of Diagnostic Tests and Vaccines for Terrestrial Animals.

TRANSIT COUNTRY - a country through which commodities destined for an importing country are transported or in which a stopover is made at a border post.

TRANSPARENCY - the comprehensive documentation of all data, information, assumptions, methods, results, discussion and conclusions used in the risk analysis. Conclusions should be supported by an objective and logical discussion and the document should be fully referenced.

TRANSPORT - the procedures associated with the carrying of animals for commercial purposes from one location to another by any means.

TRANSPORTER - the person licensed by the Competent Authority to transport animals.

TRAVEL - the movement of a vehicle/vessel or container carrying animals from one location to another.

UNIT - an individually identifiable element used to describe, for example, the members of a population or the elements selected when sampling; examples of units include individual animals, herds, flocks and apiaries.

VACCINATION - the successful immunisation of susceptible animals through the administration in accordance with the manufacturer's instructions and the Terrestrial Manual, where relevant, of a vaccine comprising antigens appropriate to the disease to be controlled.

VECTOR - an insect or any living carrier that transports an infectious agent from an infected individual to a susceptible individual or its food or immediate surroundings. The organism may or may not pass through a development cycle within the vector.

VEHICLE/VESSEL - any means of conveyance including train, truck, aircraft or ship that is used for carrying animal(s).

VETERINARIAN - a person with appropriate education, registered or licensed by the relevant veterinary statutory body of a country to practice veterinary medicine/science in that country.

VETERINARY AUTHORITY - the Governmental Authority of a Member Country, comprising veterinarians, other professionals and para-professionals, having the responsibility and competence for ensuring or supervising the implementation of animal health and welfare measures, international veterinary certification and other standards and recommendations in the Terrestrial Code in the whole territory.

VETERINARY LEGISLATION - laws, regulations and all associated legal instruments that pertain to the veterinary domain.

VETERINARY MEDICINAL PRODUCT - any product with approved claim(s) to having a prophylactic, therapeutic or diagnostic effect or to alter physiological functions when administered or applied to an animal.

VETERINARY PARA-PROFESSIONAL - a person who, for the purposes of the Terrestrial Code, is authorised by the veterinary statutory body to carry out certain designated tasks (dependent upon the category of veterinary para-professional) in a territory, and delegated to them under the responsibility and direction of a veterinarian. The tasks for each category of veterinary para-professional should be defined by the veterinary statutory body depending on qualifications and training, and in accordance with need.

VETERINARY SERVICES - the governmental and non-governmental organisations that implement animal health and welfare measures and other standards and recommendations in the Terrestrial Code and the OIE Aquatic Animal Health Code in the territory. The Veterinary Services are under the overall control and direction of the Veterinary Authority. Private sector organisations, veterinarians, veterinary paraprofessionals or aquatic animal health professionals are normally accredited or approved by the Veterinary Authority to deliver the delegated functions.

VETERINARY STATUTORY BODY - an autonomous regulatory body for veterinarians and veterinary para-professionals.

WILD ANIMAL - an animal that has a phenotype unaffected by human selection and lives independent of direct human supervision or control.

WILDLIFE - feral animals, captive wild animals and wild animals.

ZONE/REGION - a clearly defined part of a territory containing an animal subpopulation with a distinct health status with respect to a specific disease for which required surveillance, control and biosecurity measures have been applied for the purpose of international trade.

ZOONOSIS - any disease or infection which is naturally transmissible from animals to humans.