GREATER MEKONG SUBREGION CORE AGRICULTURE SUPPORT PROGRAM

Farmer Handbook for the GMS Livestock Information Traceability System

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1 INTRODUCTION

1) This manual introduces the regional Livestock Identification and Traceability System (LITS). With increased cross-border livestock trade in the Greater Mekong Sub-region (GMS), the changing disease landscapes, and increased incidence to tainted meat and meat fraud in the market – a regional livestock identification and traceability system is an important instrument for transboundary disease control and food safety in the GMS.

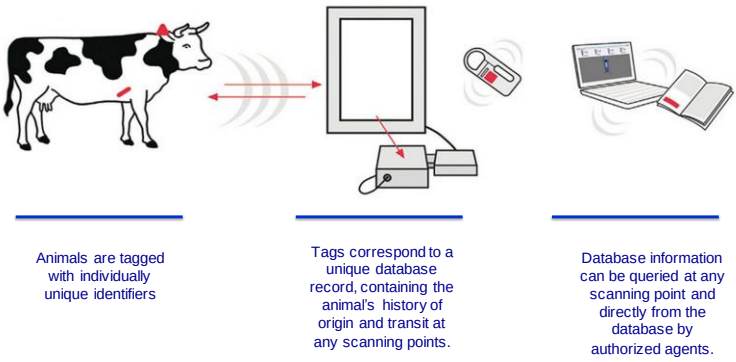
2) This training manual provides the reader with (1) an explanation of LITS objectives and benefits, (2) introduction to LITS technology and practical instruction for implementing agents, (3) a prototype framework for LITS implementation.

1.1 What is the Livestock Identification and Traceability System (LITS)?

3) The livestock identification and traceability system (LITS) is a framework enabling the location and movement of individual livestock to be traced and recorded through all stages of the agrifood supply chain. In this system livestock are registered and tagged at their respective farms of origin, and subsequently scanned at all stops along the market chain prior to slaughter. Scans are conducted

utilizing two types of mobile-based scanners, which send information to a central database. This technology pathway, including livestock tags and their corresponding database records, is illustrated in Figure 1.

Figure 1: 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.

4) LITS has been implemented in various forms in a number of countries around the world. The technology utilized for identification in different systems ranges from non-electronic methods, such as ear-incisions or simple plastic ear tags, to electronic methods, such as livestock tags equipped with chips and transponders. As expected, different methods vary in terms of cost, and in the accuracy and efficiency with which livestock can be traced.

5) What is Traceability? Traceability, in this context, is the ability to follow a food item through specified stages of production, processing and distribution. In the case of livestock, traceability can achieve three key objectives: (1) managing risks related to animal health and disease issues, (2) guaranteeing animal identity and providing reliable information to customers, and (3) improving animal quality and processes. These key objectives and associated benefits are detailed below:

1.1.1 Disease Risk Management & Animal Health:

6) Improved surveillance of food supply chains reduces disease transmission risks by strengthening incentives for producers to invest in animal health. In the event of animal disease outbreaks, traceability facilitates in rapid identification and containment by enabling authorities to trace outbreaks to the source, and immediately eliminate any potentially contaminated animals from the market and supply chain. This targeted elimination avoids the need for widespread culling, which can be devastating to the livelihood of impacted farmers.

1.1.2 Information & Food Safety:

7) Providing reliable information pertaining to animal identity, vaccination history, and health status assists in monitoring potential food contaminants, and protects consumers from purchasing unsafe products. Traceability addresses consumers increasing concern for food safety by closely monitoring animal health and movement, and enables the exchange of information between producers and consumers. This exchange in information allows consumers to make informed purchasing decisions, and gives producers the opportunity to build trust and consumer loyalty.

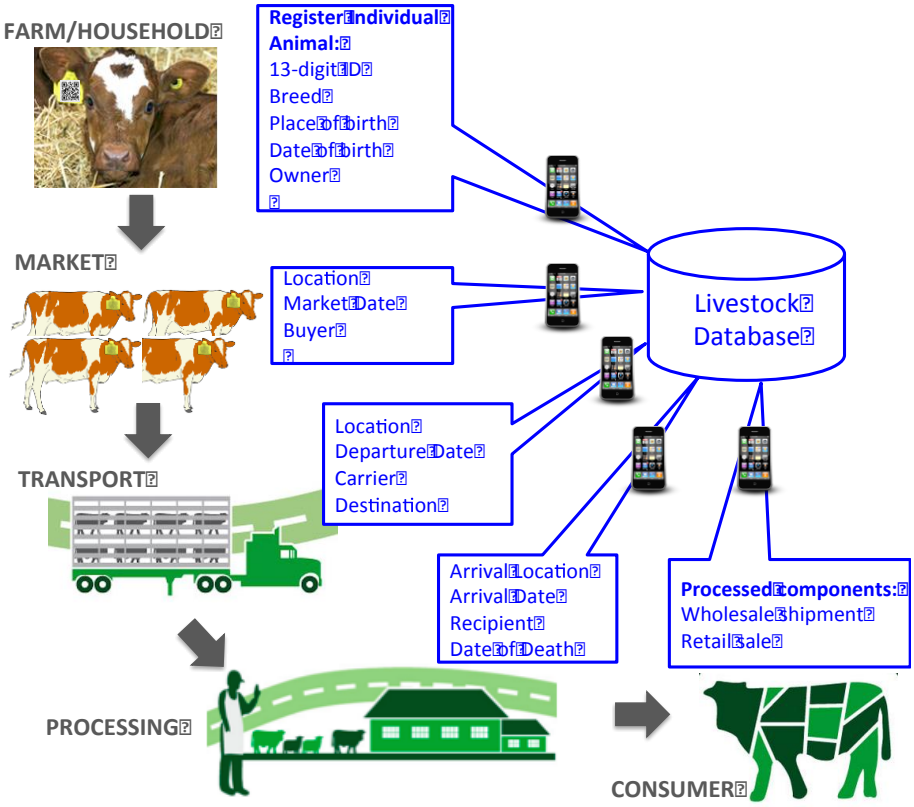
1.1.3 Overall Product Quality:

8) In addition to protecting consumers from unsafe products, guaranteeing animal quality also protects producers from unfair competition, and incentivizes investments in product value. As an instrument for identifying specific production practices and compliance with market standards, traceability allows producers to signal their animals are of high quality, and build a positive reputation, whereas low-quality products will be readily identifiable. This ability to distinguish quality incentivizes investment in production and improves profitability of livestock, benefiting the sector as a whole.

2 LITS TECHNOLOGY

9) LITS uses **livestock tags** to identify individual animals 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. The system uses two types of **mobile-based scanners** and a web interface to provide straightforward access to the **database** from any location. Cattle are tagged with ear tags that include two types of scanning technologies integrated with an online database. Dual integration of these technologies allows for detailed data to be viewed and updated for individual animals, as well as location traceability to be conducted for large groups of animals. The specifications and functionality of the tags, scanning technology, and database are explained in the three following LITS Technology segments. Figure 2 illustrates livestock movement from producer to consumer and the corresponding scans conducted and information gathered.

Figure 2: LITS Tag and Scan Pathway



2.1 Livestock Tags

10) LITS will use a standard 80mm x 70mm yellow tag for all project sites. Each ear tag is custom printed with an individually unique QR code, and equipped with an ultrahigh frequency (UHF) RFID chip. Veterinary officers will conduct tag application during Initial Registration, which is described in Section 3: LITS Implementation.

Figure 3: Livestock Ear tag with printed QR code and embedded RFID chip

11) The RFID technology utilizes a passive H3 chip. Passive means that the tag does not have an internal battery source continuously powering the tag, but

instead relies on energy transferred from the RFID reader to transfer its information. LITS RFID system operates in the 860 – 960 MHz frequency range, and complies with the Ultra High Frequency RFID Class 1 Generation 2 (UHF Class 1 Gen 2) protocol. The UHF Class 1 Gen 2 protocol is the global standard for electronic product code identification across sectors, which assists in global coordination of product quality and performance. The RFID technology will be utilized when there are a large number of animals to scan at once, or if the QR code is inaccessible.

12) The QR code printed on each tag enables anyone with a smartphone to identify a tagged animal, and immediately view its history. This is accomplished by scanning the QR code with a scanning application, which can be readily downloaded for free on any smartphone. QR codes measure roughly 4.5 cm across, enabling up to a ½ meter reading distance in optimal conditions. Lighting and the angle of the scan can both affect the distance required to successfully scan the tag. QR codes are designed to withstand up to 25% damage before disrupting functionality.

13) LITS 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 pilot implementation, the aforementioned tag description will be utilized.

2.2 Scanning Technology on Tags: QR Codes

14) QR codes are printed on the front of the ear tag. The QR code is a widely 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. Any QR scanner can read the code and unpack the link. There are numerous free QR code scanning applications available for mobile smart phones, which can be downloaded in a few minutes.

15) One of the primary benefits of the LITS QR codes is that *anyone* who comes across tagged livestock can access the animal's information by scanning the QR code with a mobile smart phone. Figure 4 displays an example LITS QR code. To demonstrate the QR technology you can scan the QR code using a smart phone, which will link you to a sample animal's

information. It is important to note that although anybody with a smart phone and a tag in front of them can view an animal's information, the ability to edit the animal's information is password protected and restricted to certified personnel.

Figure 4: Example QR Code

16) 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 log in 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.

2.3 Database

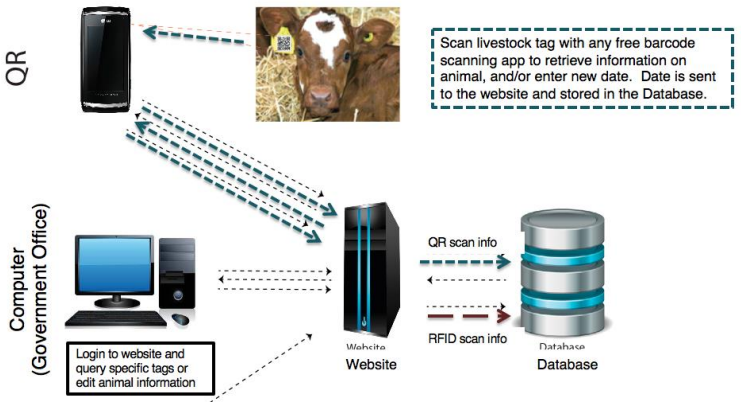
An internet interface connects the underlying database with users through mobile phones and computers. Figure 9 illustrates the communication channels within the LITS. Mobile phones can access and/or enter information about a particular animal by using either type of scanner. The scanners receive the 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. Authorized personnel (customs officials, licensed veterinarians, etc) will 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.

17) The central database hosts the records of livestock in the system. Each animal has its own record, indexed by country and Animal ID (AID). The

information associated with each animal includes registration information and all subsequent events, detailed in section 3. LITS Implementation. Every scan of an 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.

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 the animal's unique Animal ID. Records can be downloaded into an Excel spreadsheet for analysis.

Figure 9: LITS System Communication Channels



3 LITS TAG APPLICATION

18) Correct tag positioning is key for tag retention, and will provide the least discomfort to the animal. It is important to take the necessary time and care during the initial placement of tags. Following the simple recommended instructions can assist in optimal tag application.[1]

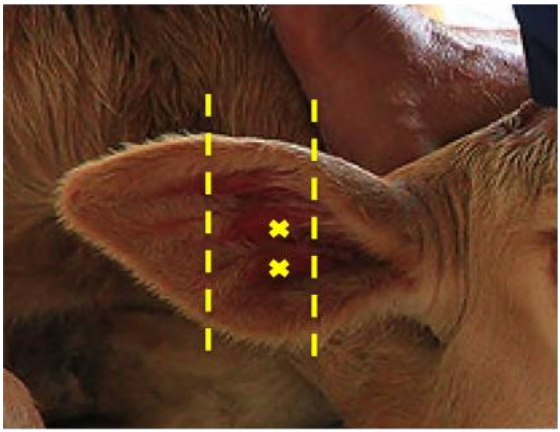
- *Keep the applicator clean to prevent infection. Use rubbing alcohol or other disinfectant to clean the jaw and pin portion*

[1] Instructions adapted from http://www.shearwell.co.uk/t/cattletagging

of the applicator before and after use. Also disinfect the tag.

- *Properly secure the animal to apply the tag. Movement of the animal's head could create an undesirable situation when trying to properly apply a tag or button. This could result in injury to either the person or animal or both, and may also result in improper tagging of the animal.*
- *Identify the tagging site on the animal's ear. Tags should be applied in the middle third of the ear between the upper and lower veins. Refer to Figure 10 to determine correct positioning.*

Figure 10: Image identifying correct placement for tag



- *Clean the tagging area of the animal's ear.*
- *Load the tag by placing each half of the tag into the applicator. Refer to Figure 11 to see a tag correctly loaded.*
- *It is important to check the alignment of the tagger before you tag. To do this simply close the jaw of the applicator to the point where the two halves just meet. The stud should be in line with the hole of the tag.*
- *Position the applicator in the identified tagging site on the animal's ear. Firmly and quickly close the applicator and release. You will hear a loud click when the stud goes completely into the hole, and upon releasing the tagger the tag will have stayed in place.*
- *Ear taggers should be cleaned with alcohol or other disinfectant before use on a different animal to avoid the spread of germs.*

Figure 11: Image showing tag correctly loaded into Applicator

3.1 Animal Identification

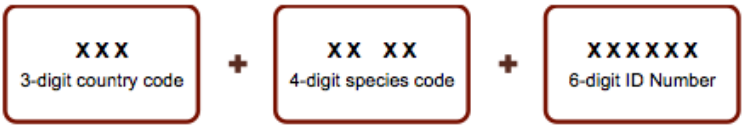
19) All tagged livestock will receive a 13-digit alphanumeric Animal Identification (AID) number. Each AID is individually unique, and is encrypted in the animal's respective QR and RFID code. The AID code structure includes three components:

- A three character (ISO-3166-1-Alpha-3) country of origin code
- A four digit product code (species in the case of live animals)
- A six digit animal identification number

AID Examples:

- KHM 0001 0000001 (Cambodia, Live Cattle, No. 000001)
- LAO 0001 0000012 (Lao PDR, Live Buffalo, No. 000012)
- MMR 0001 0000102 (Myanmar, Live Cattle, No. 000102)

Figure 12: Animal Identification (AID) Number Construction



3-Digit Country Code	
Code	*Country*
KHM	Cambodia
LAO	Lao PDR
MMR	Myanmar

4-Digit Species Code			
Code	*Live/Fresh*	*Animals*	
0001	00	01	Cattle
0002	00	02	Buffalo
0003	00	03	Pig
0004	00	04	Chicken

6-Digit ID Number
ID Number
000001
000002
⋮
999999

3.2 Initial Registration

20) Initial Registration will take place at the farm locations where livestock originate. Implementation staff will work with district veterinarian officers to identify and visit farmer locations and register livestock. All farmer/household participating in LITS will be assigned an Owner ID for use in animal registration This ID will be part of the tagged animal's information and visible during all future scans. Veterinary Officers will administer the tagging and registration process.

21) During the registration process the QR code will be used to access the database (password protected) registration form, and the following information will be collected and entered:

- Animal ID
- Current location (GPS)
- Current date/time
- Owner Name
- Owner Mobile
- Species

- Breed
- Production Category (Meat, Dairy, Egg, Breeding, Traction)
- Sex
- Animal date of birth

22) Any device with an internet/network connection, such as a smartphone, tablet, or computer, can be used to enter the registration information. In the chance that network access is not available at the site of registration, information will be manually recorded, and entered as soon as a network connection is available. Initial Registration Forms will be provided at all project sites in case manual entry is required.

3.3 Event Recording

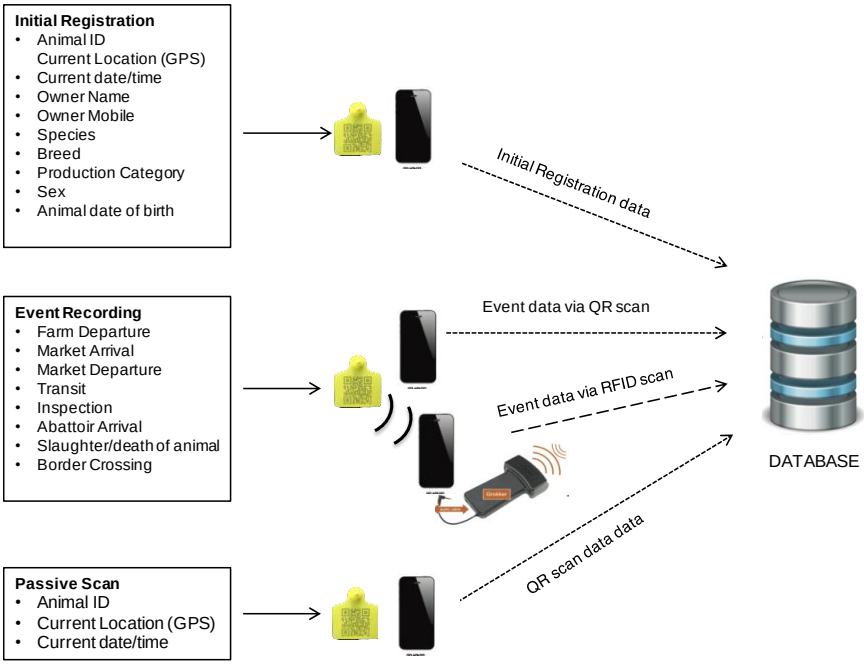
23) Events constitute actions that trigger data entry into the database, such as the movement or inspection of a tagged animal. After an animal has been registered, that animal will be rescanned during an event. An event can include any of the following activities:

- *Farm Departure*
- *Market Arrival*
- *Market Departure*
- *Transit*
- *Inspection*
- *Abattoir Arrival*
- *Slaughter/death of animal*
- *Border Crossing*

24) To conduct a scan during an event the scanning agent will follow two steps:

- *Enter event information on the database Event Page for that animal and save as Default*
- *Scan the animal's tag to access the database, and press the Scan menu button to record the event*

Figure 13: Schematic of Database Record for Individual Animals



25) 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.

Information Collected during an event:

26) When an animal is being moved or 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 including

- *Current Manager*
- *Manger Mobile*
- *Means of Arrival (Walk, Truck, Car, etc)*
- *Means of Departure (Walk, Truck, Car, etc)*

Passive scans viewing animal information (QR Code Scan)

27) When a non-registered individual scans the livestock tag to view the animal's 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 are more likely to be done using the QR codes since passive users are unlikely to have access to an RFID scanner. The information stored during a passive scan includes the location, date, and time that the scan was

conducted. Event data cannot be edited or entered by a non-registered individual.