



GREATER MEKONG
SUBREGION
CORE AGRICULTURE
SUPPORT PROGRAM

ADB Project Document



TRAINING MANUAL ON LITS

Livestock Information Traceability System

November 2015

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1 INTRODUCTION

1.1 Purpose of the LITS Training Manual

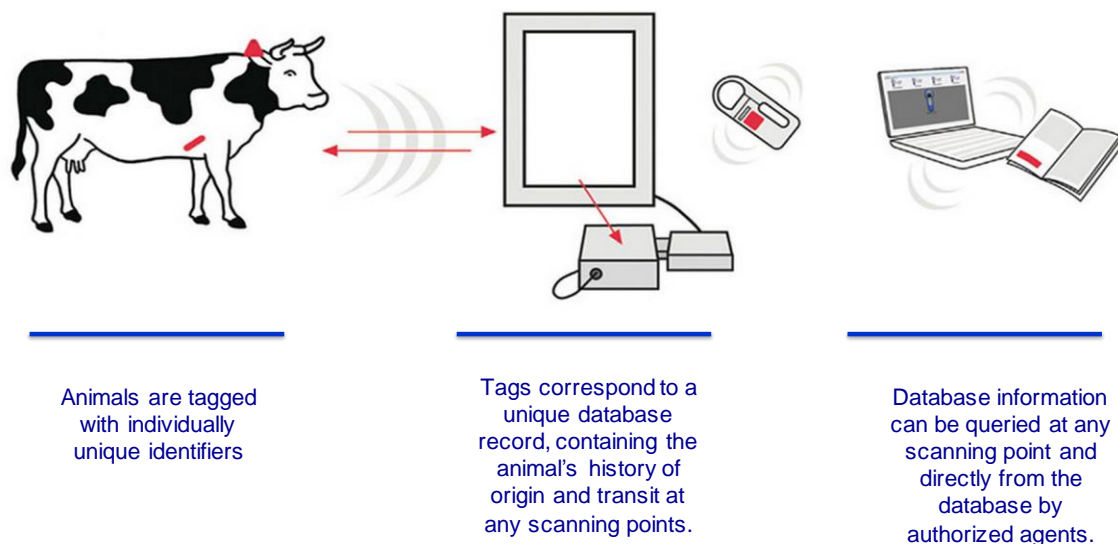
1) This manual introduces the regional Livestock Identification and Traceability System (LITS). With increased cross-border livestock trade in the Greater Mekong Sub-region (GMS), the changing disease landscapes, and increased incidence to tainted meat and meat fraud in the market – a regional livestock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

2) LITS is an important initiative under the Asia Development Bank's (ADB) GMS Core Agricultural Support Program, Phase II (CASP 2), since it will expand market access for smallholder farmers and provide an effective mechanism for transboundary disease risk management across the GMS. LITS is funded under ADB's Regional Technical Assistance (RETA) 6390: Transboundary Animal Disease Control for Poverty Reduction in the GMS, and is currently being implemented as a pilot study by Berkeley Economic Advising and Research (BEAR) in three GMS countries: Cambodia, Lao PDR, and Myanmar.

3) 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.

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

4) 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.

5) 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.

6) *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:

1.2.1 Disease Risk Management & Animal Health:

7) 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.

1.2.2 Information & Food Safety:

8) 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.

1.2.3 Overall Product Quality:

9) 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.

1.3 LITS Regional Context

10) 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.

11) As the demand for livestock and their products continues to increase in the GMS, 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 features a large, informal supply chain that is typically unregulated and frequently moves across borders. Both the official and unofficial movement of livestock and livestock products is a major risk factor in the spread of disease. A region wide LITS is a necessary component in the reactive control system of disease risk management.

12) The potential regional benefits of LITS, however, go beyond disease risk identification and containment by contributing to higher value agrifood trade and regional poverty reduction. 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.

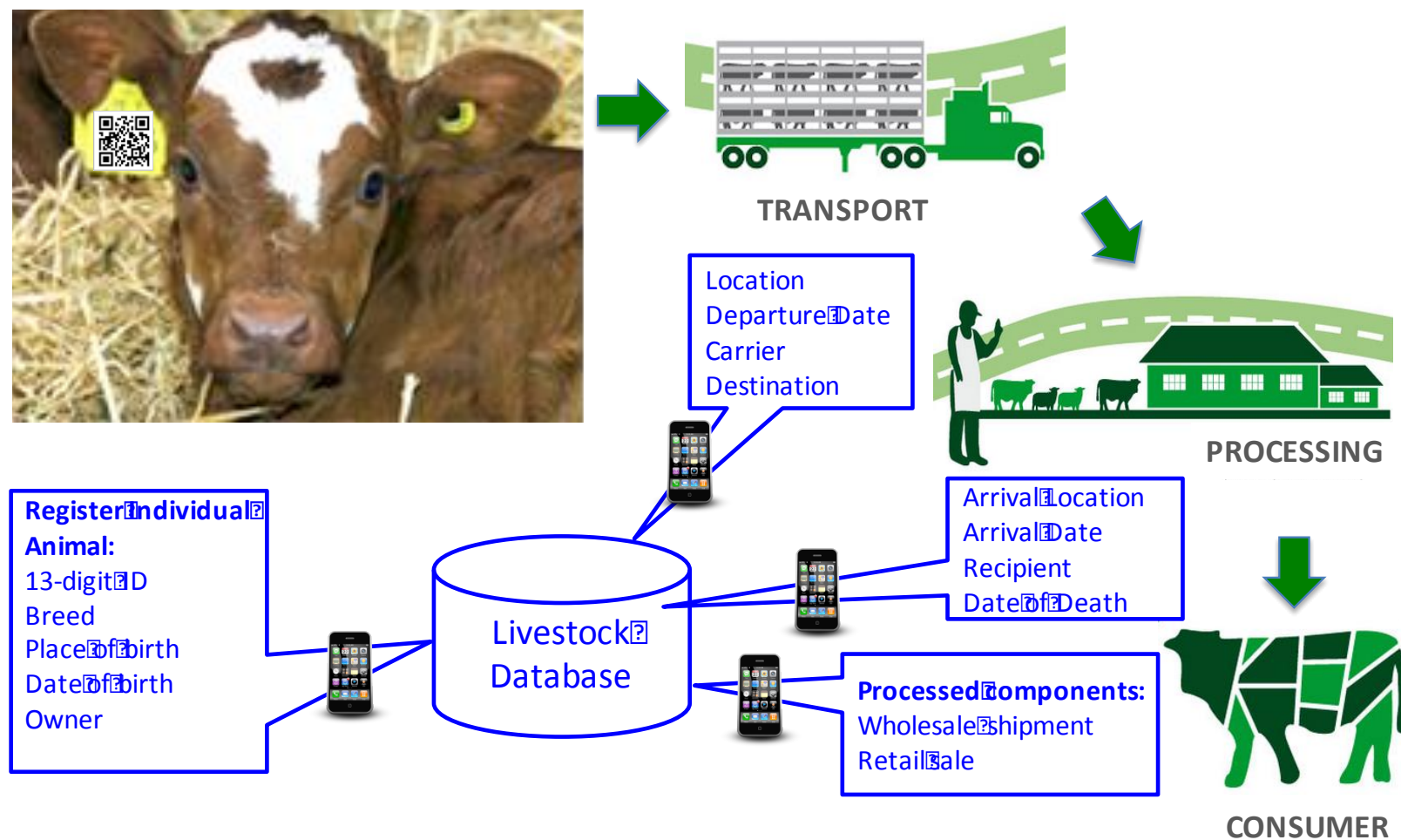
13) When producers can be recognized for higher quality, they will make appropriate investments in both market participation and product quality. Because market access is the primary gateway out of poverty for rural poor majorities in the GMS, traceability can be strongly pro-poor, supporting improved 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.

2 LITS TECHNOLOGY

14) 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

15) 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 ultra high 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



16) 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.

17) 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.

18) 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

19) Smart phones will be used to scan both QR codes and RFID codes. Scanning 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.

2.2.1 QR Codes

20) 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.

21) 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**QR Code Scanner**

22) 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.**

2.2.2 RFID Codes

23) In addition to QR codes, the livestock tags are also 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 chip is built into the tag, and emits a radio signal with associated data that can be read by RFID scanners.

RFID Scanner

24) Select smart phones will 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.

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

Apple iOS device compatibility

Supported Apple iOS devices have following specifications:

- iOS phones and tablets running 6.0 or higher
- iPhone 4 or higher, iPod Touch 4 or higher, iPad 2 or higher

Android device compatibility

Supported Android devices have following 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 must do this with a non-Tab4 device (iOS or Android)

26) The *U Grok It* device comes with a smartphone app *Send Grok*, which enables the device to interface with the database. To use the device, the user turns the scanning feature on, and holds the device within 1-3 meters of the livestock tags. The scanner records the date, time, location, and ID number of all tags within range. Scanning can be turned off once all tags have been scanned. At any time the user can open the *Send Grok* 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 5: Send Grok Application Icon**Steps for using the U Grok It device:¹**

Refer to Grok It Configuration Handout for instructions on how to configure the Send Grok App.

Be sure the U Grok It is fully charged before use. To charge the device use the mini-USB port located on the bottom of the device's handle. The Grokker comes with a USB charging cable and wall charger.

Leave the device plugged in for at least 2 hours to ensure full charge. Once fully charged, disconnect the charger.

Place your smartphone on the U Grok It device with the audio port on the bottom. You may optionally secure your smartphone to the device with the rubber band.

Connect the U Grok It's audio cable to the smartphone's audio port. For some smartphones (iPhone 4, Samsung Galaxy S), this means putting the smartphone upside down. Do not worry; the app will flip when you start so everything will be right side up. If the screen does not flip, just hold the smartphone vertically for a second so it knows which way is up, and the screen will flip.

Start the Send Grok App on your smartphone

¹ A complete user manual can be accessed at: <http://ugrokit.com/support.html>

When scanning for tags, move the device gently while you walk around. Move your arm up and down and side to side and also turn your wrist some. This will maximize the device's ability to find tags at all orientations.

NOTE: The U Grok It device has its own battery power, which means it will not run down the power on your phone. It turns on when you connect the audio jack. Remove the jack from the phone's audio port when you are not using the reader to improve battery life of the device.

Figure 6: Correct Way to use U Grok It device



Figure 7: Smart Phone



Notes: Any recent smart phone that has internet access is compatible with the system.

Figure 8: 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.

2.3 Database

A web 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.

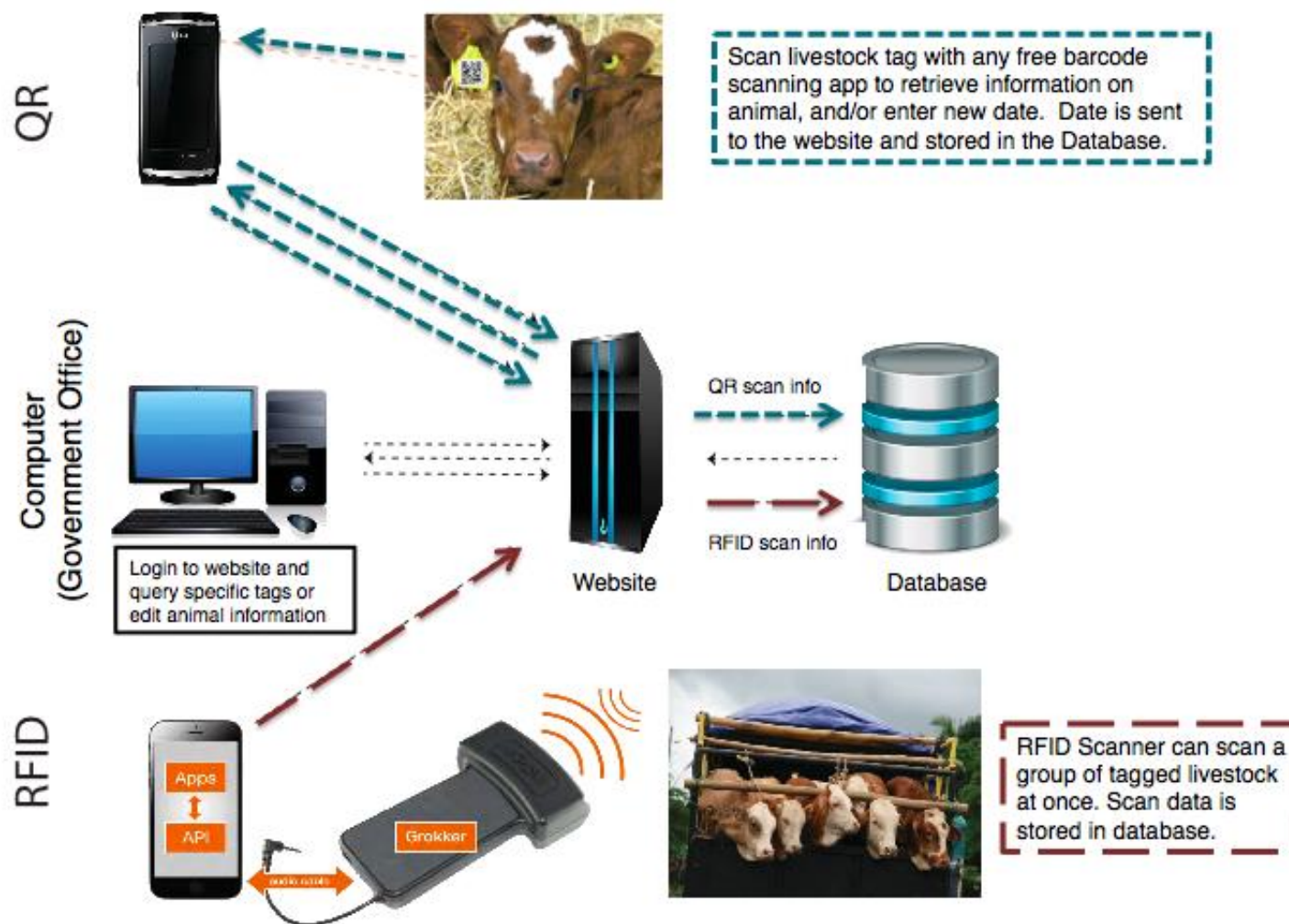
2.3.1 Central Database

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 IMPLEMENTATION

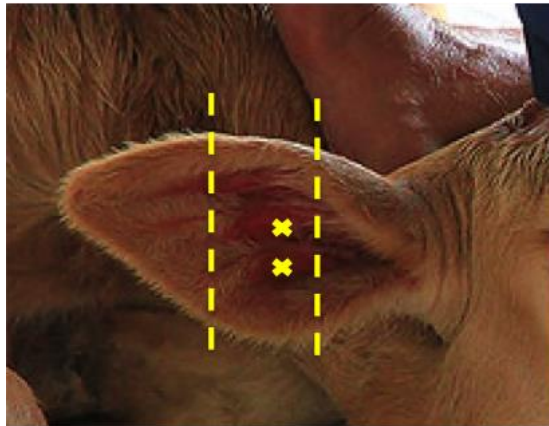
3.1 Tag Application

27) 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.²

- 1) *Keep the applicator clean to prevent infection. Use rubbing alcohol or other disinfectant to clean the jaw and pin portion of the applicator before and after use. Also disinfect the tag.*
- 2) *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.*
- 3) *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.*

² Instructions adapted from <http://www.shearwell.co.uk/t/cattletagging>

Figure 10: Image identifying correct placement for tag



- 4) *Clean the tagging area of the animal's ear.*
- 5) *Load the tag by placing each half of the tag into the applicator. Refer to Figure 11 to see a tag correctly loaded.*
- 6) *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.*
- 7) *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.*
- 8) *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



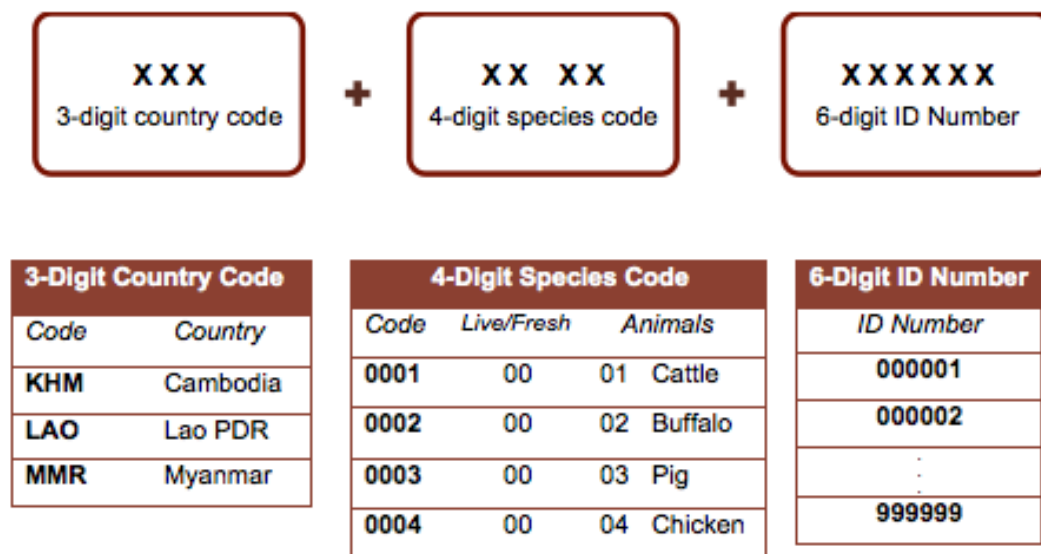
3.2 Animal Identification

28) 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:

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

3.3 Initial Registration

29) 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.

30) 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

31) 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.

3.4 LITS Event Recording

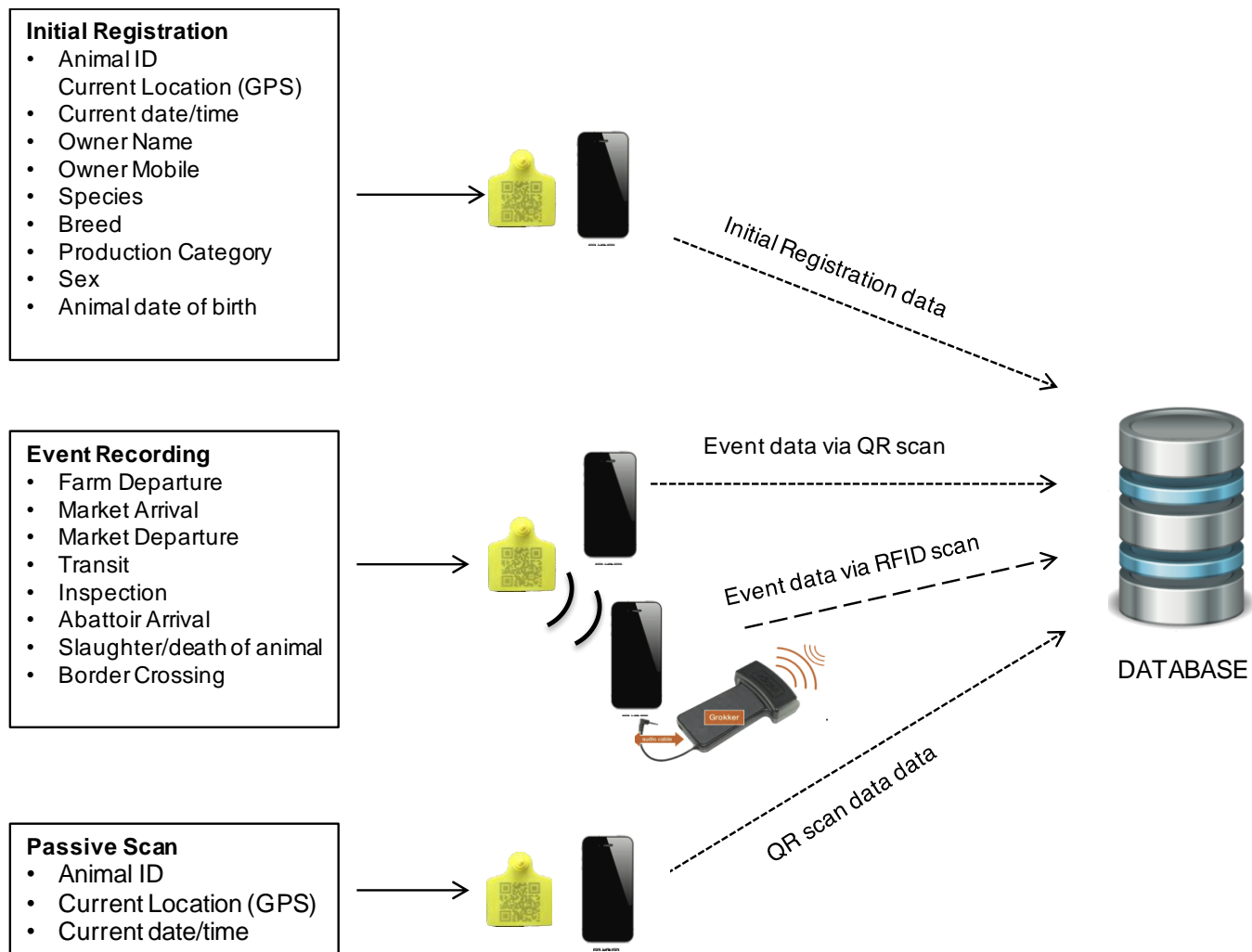
32) Events constitute actions that trigger data entry into the database, such as the movement or inspection of a tagged animal. After an animal has been registered, that animal will be rescanned during an event. An event can include any of the following activities:

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

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

- 1) *Enter event information on the database Event Page for that animal and save as Default*
- 2) *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



Initial registration (QR Code Scan):

34) 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:

35) 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)

36) 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.