Food and Agriculture Organization

Implementation of a pilot for Animal Identification and Registration System

MONGOLIA

INSTITUT DE L'ELEVAGE idele

Updated recommendations
for Animal Identification and Registration System (AIRS) of Mongolia

FAO contract reference : MTF/MON/0018/STF

Executive Summary

Final report

Realised by

BCTI

Food and Agriculture Organization of the United Nations

STDF | STANDARDS *and* TRADE DEVELOPMENT FACILITY

May 2022

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Project: pilot implementation of an improved AIRS in Mongolia (STDF/PG/534)

Updated recommendations for Animal Identification and Registration System (AIRS) of Mongolia.

May 2022

STDF | STANDARDS *and* TRADE DEVELOPMENT FACILITY

Recommendations for animal identification and registration in Mongolia

Executive summary of recommendations from STDF pilot project in Mongolia

STDF | STANDARDS and TRADE DEVELOPMENT FACILITY

FAO

INSTITUT DE L'ELEVAGE idele

Problem at start of STDF Pilot Project

Animal identification and registration system implemented since 2011

AIRS system in Mongolia:
- not aligned to international (OIE) standards
- not technically, operationally or financially viable
- not sufficient to meet needs of trading partners

Challenges:
- insufficient provision of ear tags
- absence of operational procedures
- inadequate human and financial capacities
- unified database only for breeding programs

STDF Pilot Project

Animal Identification and Registration System (AIRS) (STDF/PG/534)

- Project requested by MoFALI
- Aim: Test the technical feasibility, cost-effectiveness and sustainability of an amended AIRS
- Timeframe: May 2019 – March 2022
- Partners: FAO Mongolia, IDELE
- Field work: INSERT SOUMS

Major findings

Changes to AIRS essential to improve veterinary health and facilitate trade in accordance with government policies

AIRS must expand beyond breeding programs to support two major public policies under implementation to improve:

- Animal health.
- The compliance of livestock products with requirements on quality and food safety standards

Key problems identified

1. In the absence of animal tagging, there is no link between veterinary certificates and animals.

2. Without codes printed on tags, and without a national livestock register, it is not possible to retrieve the herd of origin of moved animals.

3. Without a database, data sharing prerequisite to any operational improvement of the public and private stakeholders is not possible.

4. The current AIRS is not in compliance with international practices for animal traceability.

Context in Mongolia : Specific elements considered

1. The majority of animals are kept in nomadic herds.

2. Most herds include flocks of ovine and caprine, with in addition some bovines, horses and camels in South Mongolia.

3. Most herders own/manage hundreds of herds of animals

4. Tagging large nomadic herders without equipment to restrain animals is a huge and dangerous workload for herders.

5. Veterinarians visit the majority of herds at least once a year, and are the main source of technical information for herders.

6. How can international experiences of successful implementation of AIRS for large nomadic herds inform improvements in Mongolian?

What's needed to improve AIRS?

AIRS should continue supporting breeding programs AND be extended to support national objectives to improve animal health and the compliance of livestock products with requirements on quality and food safety standards.

Improvements should be based on:

- National register of livestock stakeholders including herders, the intensive farms and slaughterhouses
- Inclusion of data on the herd of origin of any animal that is covered by a breeding program or veterinary certificate

What should be avoided?

- To tag all the animals.
- To register all the animals.
- To collect too much data.
- To register all the livestock operators.
- RFID tags for small ruminants.
- A one-year project to implement AIRS.

Main lessons learnt from pilot project

Implementing an AIRS is feasible and sustainable in Mongolia provided that:

- AIRS is focused on herds and animals where it is feasible and relevant.
- Field operations are entrusted to private service units.
- AIRS field operations take place in connection with veterinary or zootechnical visits to limit additional costs and workload for herders.
- Quality tags are available and used.
- Field data collection is streamlined.
- Data sharing takes place.

Main lessons learnt other countries

- Different approaches exist globally for AIRS – there is not a single model.
- AIRS model selected should reflect country specificities (purpose and livestock conditions).
- AIRS needs to be supported by national legislation, organizational arrangements (including clarity on mandates) and IT architecture.
- Achieving a performing AIRS is a long-term project that takes time.
- Monitoring performance of the AIRS is important to take into account changes in objectives and technology.

Prerequisites for AIRS implementation in Mongolia

1. Effective coordination between MoFALI divisions at the highest level.
2. Incentives in order that AIRS deliver value to the herders.
3. Sustainable funding model based on small industry contribution and huge government support.
4. Multi-year budget to implement and operate AIRS.
5. Changes in legislation which was mainly developed for animal breering.
6. New and appropriate organizational setup to operate AIRS on a large scale.
7. Step-by-step long term implementation plan.
8. Appropriate IT infrastructure and developments.

Technical issues to implement AIRS

Technical issues to implement AIRS are addressed in the complete updated recommendations:

- Organization and process.
- IT architecture.
- Identifiers tagging devices.

Document identification

Title	Updated recommendations for Animal Identification and Registration System (AIRS) of Mongolia
Editor (s)	Erik Rehben
Creation	28.02.2022
Last version	07.05.2022

Version history

0	28.02.2022	Draft version
1	17.03.2022	Version to be cleared
2	07.04.2022	Including MoFALI comments
3	07.05.2022	Including STDF comments

Acronym

API: Application Programming Interface

AIRS: Animal Identification and Registration System

FAO: Food and Agriculture Organization

GAV: Mongolian veterinary authority

GS1: Global Standards 1

MAHIS: Mongolian Animal Health Information System

ICAR: International Committee for Animal Recording

IDELE: French Livestock Institute

ISO: International Standard Organization

MoFALI: ministry of Food Agriculture and Light Industry

NSO: National Statistical Office

OIE: World Organization for Animal Health

STDF: Standards and Trade Development Facility

Acronym

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Background and purpose of the document

The AIRS pilot project in Mongolia was implemented by FAO, in collaboration with IDELE, with funding from the Standards and Trade Development Facility (STDF). The aim of the project, requested by MoFALI, was to road-test an improved Animal Identification and Registration System (AIRS).[1] Relevant public and private sector stakeholders in Mongolia were consulted and engaged to ensure that the pilot considered and built on relevant existing systems and databases (including MAHIS). Field work took place in four soums to test an amended AIRS approach. This enabled the assumptions for AIRS to be tested, based on the specific context and risks in Mongolia, and practical solutions to be identified.

AIRS is the foundation for addressing and managing animal health issues (including zoonoses). It is also essential to promote export of livestock products. The government in Mongolia has invested substantial resources (financial and human) in developing an AIRS since 2009. However, various challenges have been faced notably insufficient provision of ear tags, absence of operational procedures, inadequate human and financial capacities and a unified database only for breeding programs. This has resulted in a system that is not technically, operationally or financially viable, and which is unable to deliver the AIRS functions required for improved veterinary health and international trade.

This document sets out the recommendations emerging from the pilot project. It is based on work carried out under the pilot project from 2019 until 2022. It draws on initial recommendations issued by IDELE at the beginning of 2021, which were presented virtually by IDELE during a project workshop in Oulan Bator in October 2021.[2]

Due to the COVID-19 pandemic it was not possible to arrange field visits in 2021 before the formulations of these recommendations.
Further to a project extension, a mission was arranged in February 2022 to update the 2021 recommendations.
The current document provides the updated recommendations further to the mission of February 2022 including comments from MoFALI and from a workshop which took place the 11.05.2002 with the participation of GAV and MoFALI representatives.

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[1] See the project website for more information: www.standardsfacility.org/PG-534
[2] See: www.standardsfacility.org/animal-identification-and-registration-systems-airs-mongolia-international-workshop

1 Reminder of the elements to be considered.

Lessons learnt from other countries

The lessons learnt from other countries show that animal identification and registration systems are:

- Very diverse and achieve different objectives under different livestock conditions.
- Evolving in stages, each stage corresponding to specific objectives achieved by a specific organization implementing a specific set of technologies for tagging the animals, data collection and data sharing.

Animal identification and registration system in Mongolia

Mongolia has been registering livestock and compiling a unified database in accordance with international standards since 2011 for breeding program purpose.

Renewing the animal identification and registration system require to address the below issues:

- Is that relevant for the Mongolian animal identification and registration system to evolve?
- What may be relevant objectives of the next stage of the Mongolian animal identification and registration?
- What are the main features of an animal identification and registration system achieving the new objectives feasible and sustainable under the Mongolian livestock conditions?

Specificities of livestock in Mongolia.

- A large number of animals: about 60 million of animals.
- The importance of small ruminants: more than 80 % of the animals are ovine or caprine.
- A large number of herds: there are about 270 000 herders.
- Most of the herders keep simultaneously ovine and caprine with in addition some horses and bovines and camels in the south.
- Large size of herds with more than 100 heads per herd
- The importance of nomadism: apart from some 2 000 intensive farms, all the herders are nomads who typically moved their animals from a unique winter pastureland to one or several summer pasturelands depending on climatic conditions.

An already existing expertise on animal identification registration

- The pilot project on livestock identification and registration which was successfully tested in 4 soums of Uvurkhangai aimag, paves the way to further nationwide developments.
- The Ministry of Food and Agriculture of Mongolia has begun capacity building of local professional organizations and training of specialists in order to extend the system of livestock identification and registration, database creation and tracking within the framework of e-agriculture development.

An already existing legal framework

In the livestock sector, the Law on Animal Genetic Resources and the Law on Animal Health are being implemented, for breeding and animal health programs by relevant organizations.

A private public partnership already well developed.

- **Importance of local private service units**: at the moment there are about 1 300 private veterinary private service units under contract with the public administration to carry out animal health operations for the herders and the preparation of veterinary certificates. There are also about 155 breeding service units whose development is more recent further to the implementation of the new maw four years ago.
- **Local software development companies play a key role in the development of the MAHIS (Mongolian Animal Health Information System) and of the AIRS.**

The importance of veterinary activities.

- About 500 000 veterinary certificates are issued annually.
- The number of veterinarians is about 3 000.
- Animal health seasonal visits concern almost all of the herders either for vaccination or for anti-parasite treatments.

The breeding programs.

- 67.0 million of animals are belonging to 58 certified breeds.
- The breeding program is implemented by about 1,500 zoologists nationwide, with selection breeders and inseminators.
- Although there are few livestock breeding service units, animal production specialist and researchers from all levels of government have improved the quality and breed of livestock, identified and registered livestock, and created a unified database under the responsibility of the genetic resource department. It contains the animals of the breeding programs, less than 10 % of the total amount of animals. Its purpose is to support the genetic selection by providing information about the animal parents and genetic merit.

Unit costs.

- The number of animals per livestock breeding unit and veterinary units as well as the number of animals by specialist, from 30 000 to 40 000, zootechnician or veterinarian, is approved and followed.
- The cost of animal ear-tag is 1,100-1150 MNT for small animals and 1,200-1,250 MNT for large animals, and the cost of ear tagging for one animal is 1,200 MNT.
- Support work for livestock such as catching is required for identifying and registering livestock, and the daily wage of a support worker is MNT 1,500 per animal.

Cost and workload

- According to the assessment carried out for the '2021 Recommendations to improve animal identification in Mongolia" the major part of overall cost is for the tags (66 %), followed by field operations (30 %), with the rest for the support and the information system (4%).
- The herder workload to catch the animals without crush cage is very important and should be limited as much as possible by limiting the animals to be tagged to the minimum and by a coordination with the veterinary visits.

Information systems background.

- Livestock Husbandry Information System is a MoFALI orientation to integrate different information systems: animal identification and registration, breeding value

evaluation, herd movements, herd tracking veterinary certification, veterinary laboratories, forage…
- An application to be used by herders on their smartphones has been developed by the MoFALI.
- Almost all the veterinarians are using an application for smartphones.
- A low-cost software was developed for the purpose of the pilot implementation, with limited functionalities for a limited number of users and animals. Some modifications (i.e., stakeholder management, tag management and animal departure registration….) would need to be made to this software before it could be operationalized at scale in Mongolia.

2 Recommendations.

2.1 International compliance

The hereinafter recommendations are in compliance with:
- General principles on identification and traceability of live animals from OIE
- The FAO guideline for the development of integrated multipurpose animal recording systems
- ICAR recommendations for animal identification devices.

2.2 Objectives

2.2.1 General objectives.

Background

In addition to the breeding programs which will be continuing, two major axes of the government policy for livestock are being implemented:
- Improvement of animal health.
- Improvement of the value of the animal products.

The efficiency of these programs is widely depending on an animal identification and registration system meeting their needs and the specificities of livestock production in Mongolia.

Recommendation

Considering the existing public policies for livestock, an animal identification and registration system in Mongolia should be multipurpose:
1. Providing animal health improvement programs with tagged and traced animals.
2. Improving the compliance of livestock products with requirements on quality and food safety standards through tagged and traced animals.
3. Providing breeding programs with tagged animals.

In addition, it should be able to contribute to secondary purposes which may be:
- Fight against the animal theft.
- Pastureland management.
- Herd management.

2.2.2 Specific objectives

To contribute to the primary above objectives, the animal identification and registration system should ensure the live animal traceability by providing:
1. The herd of origin of any animal covered by a veterinary certificate i) through codes printed on tags affixed to the relevant animals, ii) by requesting the animal identification and registration system data base through the animal codes.

2. The inventory of the identified animals of the relevant herds by requesting the animal identification and registration system data base through a unified herd identification code.
3. A national register of all the livestock stakeholders including herders, intensive farms and slaughterhouses.

2.2.3 Target populations

In Mongolia, because of the large number of animals, because of the size of the herds and because of the importance of small ruminants, a sustainable nation-wide animal identification and registration system requires an efficient use of human and financial resources much more than in other countries. Consequently, the target population must be strictly limited to what is necessary to achieve the objectives. In particular, a mandatory animal identification and registration system (i.e., covering all individual animals) as it is the case in many countries is not adapted to the Mongolian context. For these reasons, the target should be limited as much as possible.

Herds

The animal identification and registration system should not be mandatory for all herds but limited to herds of:
- Herders participating in a breeding program and / or concerned by the veterinary certificates for animal movements.
- Intensive farms located near cities for dairy and / or beef production from bovine.

Animals

The lessons learnt from the pilot implementation have shown that tagging all animals is:
1. Not feasible because a lack of human resources.
2. Not going to be accepted by herders because of the workload to catch the animals to be tagged.
3. Not sustainable because of the cost.
4. Not useful given since:
   - Breeding programs currently cover less than 10% of all animals.
   - The traceability of animals moved and covered by a veterinary certificate that means less than 1/3 of the animals of a herd.

Based on the situation and needs in Mongolia, the priority should be to tag animals that are either covered by a veterinary certificate or that are part of a breeding program. This means tagging less than 25% of the total number of animals in Mongolia.

Slaughterhouses

A distinction should be made between the facilities where animals are slaughtered (so-called 'Slaughterhouses') whose outputs are carcasses and facilities where carcasses are cut (so-called 'Meat factories') even if the two facilities are located in the same place or belong to the same company.

Only slaughterhouses should be considered as a stakeholder for the purpose of animal identification and registration. Meat factories are not relevant because they may be not slaughterhouses when their main activity is meat processing from carcasses even some of them are both slaughterhouses and meat processing plant.
 At slaughter, the herd of origin of the animal should be retrieved and linked to the carcass, and the data transmitted to other systems: MAHIS, breeding data base, trade partner….

The slaughterhouses registered should be limited to facilities where the animals are slaughtered, and which receive animals covered by a veterinary certificate.

2.3   Identifiers.

2.3.1   General

The basics of any animal identification and registration system are identifiers, not only for the animals but also for the herds. In addition, the use of RFID requires specific animal identifiers different from the visual ones.

The current organization deals only with animal visual identifiers.

Other types of identifiers are necessary to operate the AIRS:
- Herd identification.
- Herd marking codes for small ruminants as a short alias for the long herd identifier.
- Animal RFID identifiers for horses.

The animal identification and registration system should be based on four types of identifiers:
1. Animal visual identifiers allocated by the AIRS.
2. Animal RFID identifiers allocated by the AIRS
3. Herd marking codes allocated by the AIRS from herd identifiers.
4. Herd identifiers as the household identifiers allocated buy the NSO.

2.3.2   Visual animal identifier

Background

As the current 14 characters animal identifier includes the soum and the bagh identifiers, the animals of a given bagh, should be tagged only with tags printed for the bagh. As a result, the forecast for tag manufacturing as well as their distribution to the soums are complex. A forecast error for a bagh, results in a lack of tags which slows down the tagging process.

Recommendation

The current visual animal identifier should be changed to include:
- 'MN',
- two digits for the aimag.
- ten digits for the animal.

2.3.3   RFID animal identifier.

The RFID animal identifier should follow the ISO standard 11 784 which requires a 15 digits identifier without letters. The widely spread practice is that the visual identifiers should be as much as possible similar to the RFID ones.

The RFID identifier should include:
- Three digits for the ISO country code for Mongolia: 496.
- Two digits for the aimag similar to the visual identifier.
- Ten digits for the animal similar to the visual identifier.

2.4   Identification devices.

2.4.1   General

The current system is based on two types of plastic tags: one for small animals; and the other for large animals. The implementation of RFID for horses as well as the marking codes require to add other identification devices.

The AIRS should be based on four types of identification devices:
1. Short life cycle tags for caprine and ovine to be printed with a marking code.
2. Large lifetime tags for bovine and camelids to be printed with a visual animal identifier.
3. Small lifetime tags for small ruminants to be printed with a visual animal identifier.
4. Lifetime RFIFD inserts for horses with a RFID animal identifier

2.4.2 Short life cycle tag for caprine and ovine with a marking code

Tags printed with a marking code for small ruminants to be moved do not need to be affixed to the animal for a long duration of time, only for the duration of the movement. For that purpose, it is possible to use low-cost tags that have a short life cycle. The impact of this provision on the overall cost of the AIRS in Mongolia would be a cost reduction of at least 10%.

Low-cost short life cycle tag should be used to tag market sale small ruminants with a marking code (see example hereinafter).

2.4.3 Lifetime tag for bovine and camelids with a visual animal identifier

At the moment all the characters printed on the tags have the same size. The animal identifier is printed in two parts of six digits. Under on field conditions it is difficult to read and collect this type of identifier. In addition, there is no digit (check digit) to be tested against the identifier to detect error at data entry.

To facilitate the on-field use, the last four digits should be separated from the rest of the animal identifier with a size of at least of 20 mmm with a check digit which can be calculated in accordance with the GS1 widely used method (see example hereinafter).

As most of the provinces complain about quality, the tag quality should be ensured by their compliance with the standards of the International Committee of Animal Recording (ICAR), either through an ICAR certificate or by passing the tests specified by the standards.

2.4.4 RFID inserts for horses.

The specifications would be the following:
1. The inserts are to be used for horses.
2. The indicative size is 2 mm x 12 mm.

3. The insert should encapsulate a RFID transponder in a glass compatible for implant devices.
4. The transponders should be passive devices whose communication protocol is either HDX or FDX-A or FDX-B, operating on a frequency of 134,20 kHz in compliance with the following ISO standards:
   - 11 784: specifications for the structure of the code transmitted by the transponder.
   - 11 785: specifications of the activation of the transponder and of the communication protocol between the transponder and the reader.
5. A certificate of conformance should be provided for the insert according to the ISO 24631-1 procedure issued by the official ISO Registration Authority, ICAR – The International committee of animal recording, with the manufacturer code and the product code allocated by ICAR.
6. An animal identification code should be printed in each insert by the manufacturer in accordance with the ISO 11 784 specifications using its manufacturer code for the three first digits of the animal identification code.

2.5 AIRS organization

2.5.1 General

Effectively implementing the AIRS outputs, the MoFALI needs requires setting up a specific organization independent from animal breeding and animal health specified by:
1. The outputs delivered by the organization.
2. The organization chart.
3. The processes implemented to deliver the outputs.

2.5.2 AIRS organization outputs

As it is currently done in other countries, the outputs may be distributed in three categories:
1. The stakeholder registers.
2. The tags.
3. The animal registers.

The diagram below provides an overall view of the outputs and of their beneficiaries.

The outputs of the stakeholder register may be distributed throughout two categories:
1. Those provided by the National Statistic Office:
   - A **herd identification code** which should be the NSO household identifier to:

- ✓ Register data at the herd level, for example the status in regards with contagious diseases, vaccination, involvement in a livestock program (breeding, health improvement…) …
- ✓ Retrieve already registered data at the herd level.
- ✓ Select herds having specified characteristics.
- The **animal census per herd and per specie** from the annual NSO census to:
  - ✓ Optimize herd visit.
  - ✓ Optimize material procurement: tags, vaccines, tubes for blood sample….
  - ✓ Improve the accuracy of the disease surveillance.
2. Those provided by the AIRS:
   - The **herd localization**, at the **bagh level** and if possible, by the **geographic coordinates** to:
     - ✓ Optimize the visits of the field technicians.
     - ✓ Define accurately security parameters in case of disease outbreak.
     - ✓ Compare the number of animals in a zone against its forage capacity.
   - **Means to contact** (mail, phone…) the person responsible for the herd.
   - The **marking codes** to be printed on the tags for small ruminants to retrieve the flock of origin to ensure the animal traceability.

The tag outputs should be:
1. **Codes affixed to the animals** to retrieve the herd to which the animal belongs either by requesting the animal register through an animal identification code or through a marking code corresponding to a given herd.
2. **Animal identification codes affixed to the animals** to:
   - Register data at the level of the animal, for example vaccination, tissue sample, parentage…
   - Retrieve already registered data.
   - Select animals having specified characteristics.
3. For horses, a **secure animal identification**, through RFID inserts.

The output of the animal register should be:
1. Animal traceability from an animal identifier.
2. An **animal register** per herd to:
   - Carry out an efficient and reliable on field data collection.
   - Localize the animals.
   - Retrieve the herd to which the animal belongs or has belonged.
3. **Animal core data** (specie, breed, sex and birth date) to:
   - Secure animal registration through the comparison of the animal features against data already registered.
   - Optimize operational activities, for example number of vaccinations according to the specie, the sex, and the age of the animals.

The tables hereinafter summarize per AIRS output their beneficiaries.

Stakeholder register.

	Herd management	Animal health	Animal breeding	Fight against theft	Pastureland management	Animal product value
Herd identification						
Animal census						
Herd responsible						
Herd localization						
Person contact						

Animal tagging

	Herd management	Animal health	Animal breeding	Fight against theft	Pastureland management	Product labelling
Animal identification						
Marking code						
Secure identification						

Animal register

	Herd management	Animal health	Animal breeding	Fight against theft	Certification	Product labelling
Animal inventory						
Animal core data						

2.5.3   AIRS organization chart and main positions

The lessons drawn from the pilot in Mongolia indicate that the reporting line should remain the MoFALI one with three levels: national, aimag and soum. At each level, specific positions dedicated to the AIRS should be set up, so called 'AIRS officer'. To avoid any commitment confusion and any conflict in resource allocation. they should not be included in other assignment such as animal breeding or animal health.

The diagram hereinafter provides an overall view of what might be the AIRS organization. The national AIRS officer should be subordinated to high level body under MoFALI.

MAIRS

Support   National   Government body   Private body   Advisory body

National team   MoFALI   High level body   National technical advisory committee   National MAIRS officer   Tag provider

Aimag   Aimag MAIRS officer   Regional technical advisory committee

Herder   IT service provider   Soum   Soum MAIRS officer   Local service provider

The national AIRS officer should achieve the hereinafter tasks:
- Representation of the competent authority for animal identification and registration.
- Responsible for the legislation implementation and for the analysis of any proposal of evolution of the regulation.
- Responsible for the implementation and of the monitoring of the national contracts with private bodies for tag procurement and for support.

The aimag AIRS officers should achieve the hereinafter tasks:
- Communication.
- Field technician and herder training and approval.
- Slaughterhouse registration and monitoring.
- Soum AIRS officer monitoring.
- Local service providers selection and contract.

The soum AIRS officer should achieve the hereinafter tasks:
- Populate the stakeholder register with herd contact person and herd localization.
- Entrust the field operations to the herders and to the field technicians employed by the local service providers.
- Monitor the herders and the field technicians.
- Manage the right of access in the information system of the herders and of the field technicians.
- Distribute the tags.
- Provide the herders and the field technicians with support.

In support to the AIRS officers, the support body should achieve the hereinafter tasks.
- Communication and training material.
- Manual of standard operating procedures.
- Quality monitoring.
- Software maintenance monitoring.
- Information system hosting monitoring.
- National functional administration of the information system.

2.5.4   AIRS workflows to deliver the expected output.

The AIRS outputs are delivered through the hereinafter workflows:
1.   Stakeholder management.
2.   Animal management.
3.   Information system management.
4.   Identification device management.
5.   Slaughter registration.
6.   IT infrastructure operation.
7.   Support.

Workflow stakeholder management.

Background

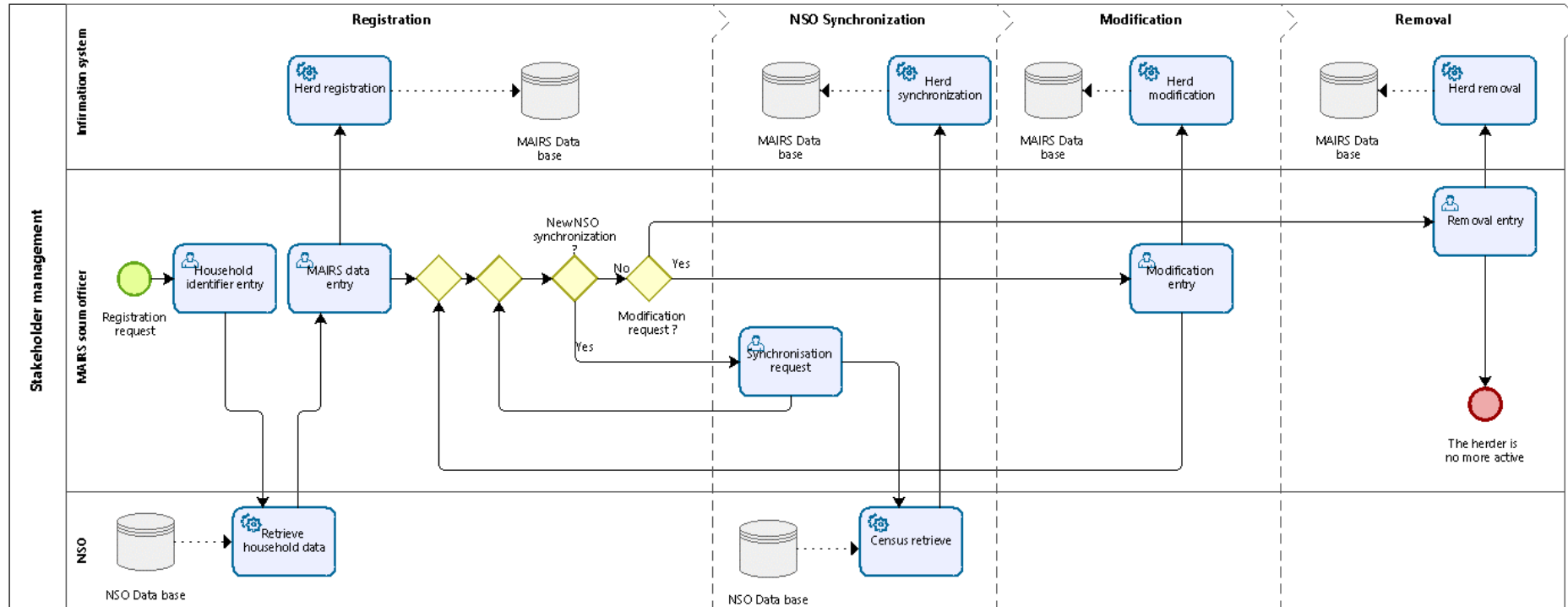The lessons drawn from the pilot implementation in Mongolia indicates that the NSO already allocates a:

- thirteen digits identifier to each household
- eight digits identifier to each person

In addition, every year, the NSO carries out a census of the animals per herd and specie.

Overall view

The diagram hereinafter provides an overall vision what might be the workflow implemented for the stakeholder management.

Diagram labels (BPMN process):

Lanes (Stakeholder management):
- Infirmation system
- MAIRS soum officer
- NSO

Phases: Registration | NSO Synchronization | Modification | Removal

Information system lane:
- Herd registration → MAIRS Data base
- Herd synchronization → MAIRS Data base
- Herd modification → MAIRS Data base
- Herd removal → MAIRS Data base

MAIRS soum officer lane:
- Registration request (start)
- Household identifier entry
- MAIRS data entry
- New NSO synchronization ?
- Modification request ?
- No / Yes
- Synchronisation request
- Modification entry
- Removal entry
- The herder is no more active (end)

NSO lane:
- NSO Data base → Retrieve household data
- NSO Data base → Census retrieve

Legend:

On the diagram, the tasks are depicted by :

Different type of tasks are depicted by :
- **Manual task,** achieved by a person without a software.
- **Service task,** achieved by a software.
- **User task,** an interaction between an application and its user.

The workflow would start with a registration request and ends with the herd removal.
A similar and simpler workflow should be developed for slaughterhouse registration at the level of the aimag.
The actors of the workflow would be:

- The **AIRS soum officers**.
- The **information system**.
- The **NSO.**

For a given herd, the workflow should consist in:

1. **Registration** of the herd.
2. **NSO Synchronization** with the NSO data base at least once per year.
3. **Modification** of the herd data when some change occurs in herd data.
4. **Removal** when the herd is no more active.

The workflow should use the hereinafter software:

1. An AIRS web application connected to the information system to be used by the AIRS soum officers whose main functionalities would be:
   - Household identifier entry to retrieve NSO data.
   - AIRS data entry.
   - Modification entry.
   - Synchronization request
   - Removal entry.
2. Information system components connected to the AIRS data base services:
   - Herd registration.
   - Herd synchronization.
   - Herd modification.
   - Herd removal.
3. NSO components to connected to the NSO data base services:
   - Retrieve household data.
   - Census retrieve.

These tasks should be achieved with the support of:

- The **Manual of standard operating procedures for stakeholder registration**.
- The **User manual of the web application for stakeholder registration.**

Registration

It starts with a registration request to the AIRS soum officer who enters the NSO household identifier (see **Household identifier entry** on the diagram) of the applicant through the AIRS web application which requests the NSO database (see **Retrieve household data** on the diagram) to retrieve and to send:

- Household contact identifier
- Household contact name
- Animal census

Through the web application, (see **AIRS data entry** on the diagram) the AIRS soum officer provides additional data:

- The contact person for the herd.
- The means of contact.
- The marking code.

Then, the web application through the software component (see **Herd registration** on diagram) triggers the herd registration.

NSO synchronization

At least once per year, the AIRS soum officer should synchronize the AIRS data with the NSO one:

- To avoid any differences between the AIRS data base and the NSO one.
- To retrieve the annual animal census carried out in December by the NSO.

The AIRS soum officer should enter the NSO household identifier (see **Synchronization request** on the diagram), trough the AIRS web application which sends the request to the NSO application (see **Census retrieve** on the diagram). The NSO application send data directly to the information system (see **Herd synchronization** on the diagram).

Modification.

During the period of activity of a herder it may be necessary to modify some data: the contact person for the herd, the means of contact…

From a request of modification sent by the herder, the AIRS soum officer enters the modification through the AIRS web application (see **Modification entry** on the diagram) which triggers its registration by the information system (see **Herd modification** on the diagram).
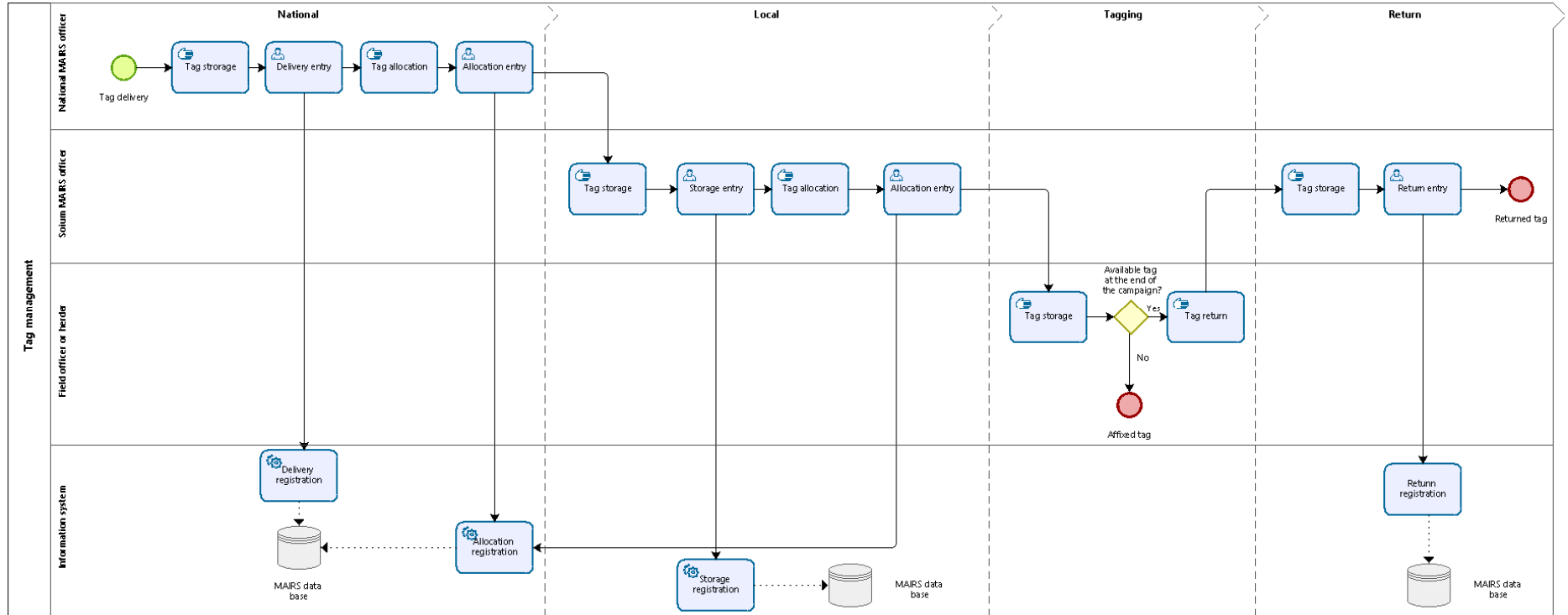
Removal.

At the end of his activity period, a removal request should be sent to the AIRS soum officer who enters the removal through the AIRS web application (see **Removal entry** on the diagram) which triggers its registration by the information (see **Herd** removal on the diagram) and closes the workflow.

Workflow tag management.

Overall view.

The lessons drawn from the pilot implementation indicate that the worflow should remain similar to the existing one with some changes to take into account the AIRS data base.
The diagram hereinafter provides an overall view of what might be the improved workflow.

On the diagram, the tasks are depicted by :

Different type of tasks are depicted by :
Manual task, achieved by a person without a software.

Service task, achieved by a software.

User task, an interaction between an application and its user.

The workflow does not include the tag procurement which is achieved by other MoFALI bodies.

The actors of the workflow would be (see on diagram):
- The **national AIRS officer**.
- The **information system**.
- The **soum AIRS officers.**
- The **field technicians or the herders** in charge of animal tagging.

For a given tag, the workflow should consist in the below steps (see on diagram):
1. **National**.
2. **Local**.
3. **Tagging**.
4. **Return**.

The workflow should need:
1. An AIRS web application connected to the information system to be used by the AIRS soum officers. The main functionalities (see on diagram) would be:
   - Delivery entry.
   - Allocation entry.
   - Storage entry.
   - Return entry.
2. Information system components connected to the AIRS data base (see diagram):
   - Delivery registration.
   - Allocation registration.
   - Storage registration.
   - Return registration.

The workflow starts with a tag delivery and ends with a tag affixation or a tag return.

The tasks should be achieved with the support of:
- The **Manual of standard operating procedures for tag management**.
- The **User manual of the web application for tag management.**

National step.
When the tag is delivered by the manufacturer, the national AIRS officer stores the tag (see **Tag storage** on the diagram) and through the web application enters the delivery data (delivery date, type of tag, manufacturer…) (see **Delivery enter** on the diagram) which are registered by the software component **Delivery registration** (see on the diagram).
The national AIRS officer allocates the tag to a soum (see **Tag allocation** on the diagram). The allocation is entered through the web application (see **Allocation entry** on the diagram) and registered by the component **Allocation registration** (see on diagram).

Local step.
The soum AIRS officer stores the tag (see **Tag storage** on the diagram) and enters the storage data through the web application (see **Storage entry** on the diagram) which are registered by the software component **Storage registration** (see on the diagram).

The AIRS soum officer allocates the tag to a field technician or to a herder (see **Tag allocation** on the diagram). The tag allocation is registered by the **Allocation registration** (see on diagram).

Tagging step.

The herder or the field technician stores the tag (see **Tag storage** on the diagram). At the end of the tagging campaign if the tag has been affixed the workflow is closed otherwise if the tag is still available, it should be returned to the soum AIRS officer (see **Tag return** on the diagram).

Return step.

The soum AIRS officer stores the tags which have been returned (see **Tag storage** on the diagram) enters the tag return through the web application which is registered by the component **Return registration** (see on diagram).

Workflow animal review

General

The lessons drawn from the pilot in Mongolia show that:
- The field technicians can use a mobile application to register data.
- This workflow can be achieved only by a field technician or the herder and the information system without administrative staff for data entry.

Current practices of other countries indicates that animal identification and registration and movement registration may be considered as two separate tasks which may be carried out by two different persons.
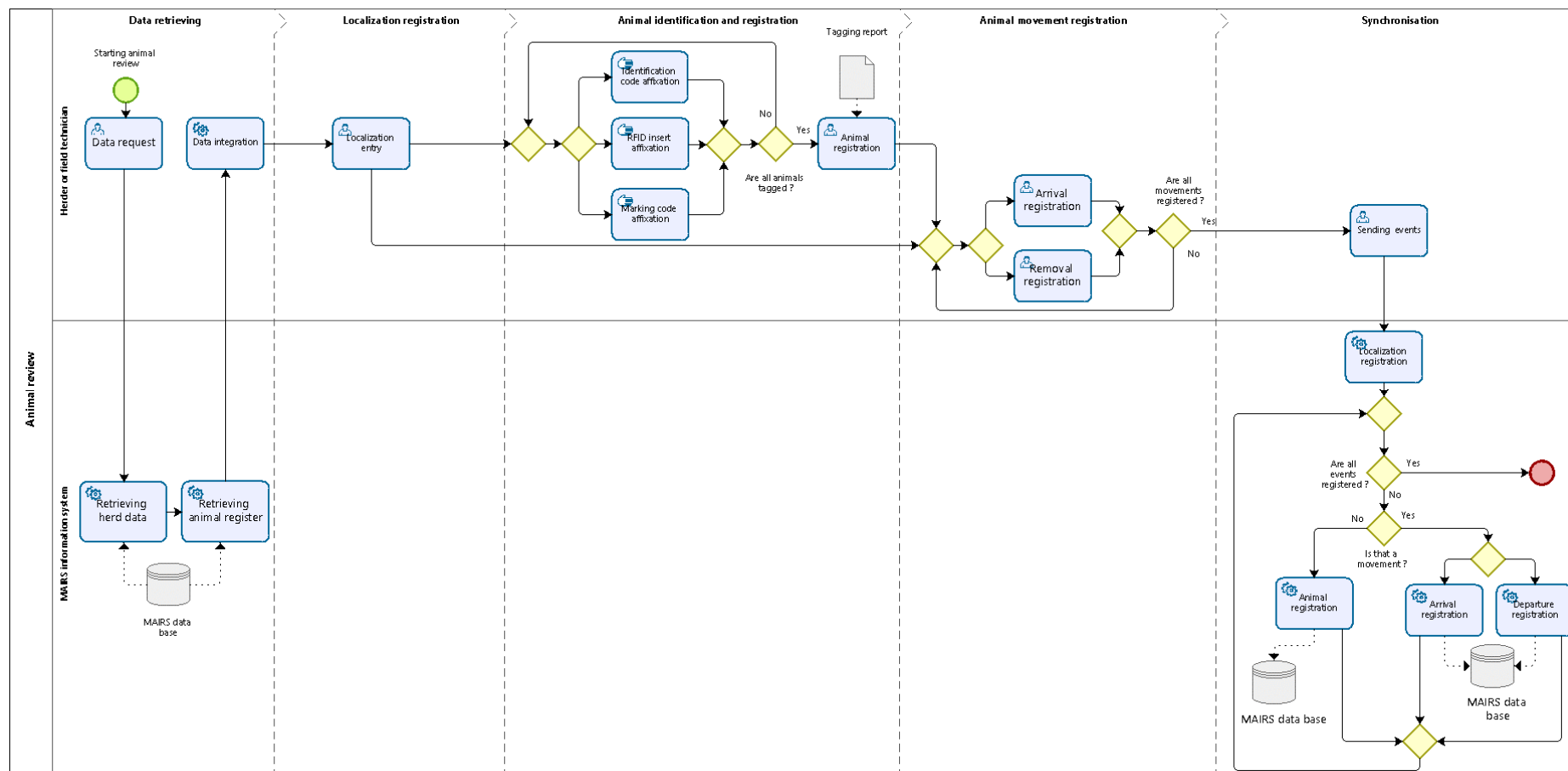
To achieve an optimum flexibility and to involve the herders as much as possible, for a given herd, the soum AIRS officer should select one of the below options:
- Entrust the **movement registration** to the herder and the **animal identification and registration** to a field technician.
- Entrust the **movement registration** and the **animal identification and registration** to a field technician.
- Entrust the **movement registration** and the **animal identification and registration** to the herder except for RFID inserts which require a trained field technician.

The lessons drawn from the pilot in Mongolia show that these tasks should be achieved only by people trained and licensed by the aimag AIRS officer.

Overall view

An overall view of the recommended workflow is provided by the diagram hereinafter.

The workflow starts with a new animal review and ends when the animal review is completed.

The actors of the workflow would be (see on diagram):
- The **information system**.
- The **field technician or the herder.**

An animal review would consist in (see on diagram):
1. Data retrieving.
2. Localization registration.
3. Animal identification and registration.
4. Animal movement registration.
5. Synchronization.

The workflow should use the hereinafter software (see diagram):
1. A mobile application to be used by the herders or the field technicians. This application may be a specific AIRS application or another application with the same functionalities and able to exchange data with the information system. Its main functionalities would be:
   - Data request to the information system.
   - Data integration to merge AIRS data with other data of the mobile application.
   - Localization registration.
   - Animal registration.
   - Arrival registration.
   - Departure registration.
   - Sending events to the information system.
2. Information system components connected to the AIRS data base:
   - Retrieving herd data.
   - Retrieving animal register.
   - Localization registration.
   - Animal registration.
   - Arrival registration.
   - Departure registration.

Only Data retrieving and Synchronization should be achieved online and require an internet connection. 'Animal identification and registration' and 'Movement registration' should be achieved offline without any internet connection.

Data retrieving.

The lessons drawn from other countries indicating that an efficient and a reliable data collection should be based on an updated animal register, to start an animal review, the herders or the field technicians, through their application, should send a request to the information system (see **Data request** on the diagram) to retrieve the herd data (see **Retrieving herd data** on the diagram) and the animal register (see **Retrieving animal register** on the diagram) to integrate them in their application (see **Data integration** on the diagram).

Localization registration

As the majority of herders being nomadic, the second step should consist in the registration of the localization where the review takes place. (See **Localization registration** on the diagram) with two level of precision, the bagh and if possible, the geographic coordinates.

Animal identification and registration.

Three types of tagging should be achieved:

1. **Identification code affixation** (see on diagram) through a small plastic tag for small ruminants, through a large plastic tag for camels and bovines.
2. **RFID insert affixation** (see on diagram) tag for horses.
3. **Marking code affixation** (see on diagram) through a plastic tag for small ruminants.

These tasks should be achieved in accordance with the **Manual of standard operating procedures for animal identification and registration.**

The lessons drawn from the pilot in Mongolia showing that using a software is almost impossible because of working conditions. After each animal, the herder or the field technician should fill a blank paper form so called 'Tagging report' as recommended below.

Tagging report

Specie	Breed	Tag	Sex		Age		
			M	F	1 30 d	1 24 m	2 15 y
			☐	☐	☐	☐	☐
			☐	☐	☐	☐	☐
			☐	☐	☐	☐	☐
			☐	☐	☐	☐	☐

For each animal, the herder or the field officer reports:

- The specie only if it is different from the one of the previous animals.
- The breed only if it is different from the one of the previous animals.
- The last four digits of the animal number which should be retrieve, for RFID inserts, on the bag containing the insert.
- The sex by ticking the appropriate box.
- The age using the appropriate box depending on the age precision at tagging, from 1 to 30 days, 1 to 24 months, and 2 to 15 years,

Once tagging is completed, the tagging report is entered through the functionality **Animal entry** (see on diagram). For each animal, the herder or the field technician should:

- Enter the specie only if it is different from the one of the previous animals.
- Enter the breed only if it is different from the one of the previous animals.
- Enter the last four digits of the animal number which allow the application to retrieve the full number from the allocated tags downloaded by the application before starting the animal review.
- Tick the appropriate box for the sex.

- Enter the age in order to allow the application to calculate a birth date.

Movement registration.

The lessons drawn from the pilot in Mongolia show that the movement registration should be achieved directly through the application, without a paper form.

Lessons drawn from other countries show that ensuring the precision and the coherence of the dates of birth with the dates of movements and of the dates of animal movement among them is a cumbersome and time-consuming task which may have a negative impact on the involvement of the operators.

Considering there is no clear need to ensure a full traceability which requires that all the dates should be coherent and that there is no period where the animal is not assigned to a herd the only rules should be:
1. Arrival dates and departure dates should be the registration dates unless the precise dates may be got easily.
2. Arrival and departure dates should take place after the birth date.
3. Between herds no coherence is required for the dates of animal movement.

The animal departure should be entered by selecting the animal from the animal register which has been displayed by the application from downloaded data. Once selected, it should be possible to mention if the death is the reason of the departure, the departure date being the date of the review.

In case of animal arrival, the lessons drawn from other countries show with a check sum digit ensuring the accuracy of the animal identification only this data should be provided.

These tasks should be achieved in accordance with the working instructions of the manual of **Standard operating procedures for movement registration**.

Slaughter registration.

This workflow should involve the slaughterhouse information system and the AIRS one. Periodically slaughters with an animal identifier, a slaughter date and a slaughterhouse identification should be sent through internet to the corresponding AIRS API.
The output is the registration of a slaughter and of death date for the corresponding animal.

Support

The outputs of the support should consist in:
1. Software tested and ready to be used including:
   - Application to be used by the herder for herd monitoring.
   - Applications to be used by the AIRS actors.
   - Software components.
2. Standard operating procedures for AIRS actors
3. Material for training sessions
4. AIRS monitoring.
5. Support to the AIRS officers.

2.6   On field data collection.

2.6.1   General

For the purpose of the pilot implementation, data collection was based on the use of both smartphones and bar codes. The lessons learnt from the pilot implementation have suggested that using bar codes and smartphones is difficult for animal tagging because of working conditions and climatic issues (dust, light…).

Most data were collected through paper documents. Then, they have been manually captured. However, the use of smartphones remains relevant for data collection for tasks which do not require animals to be caught.
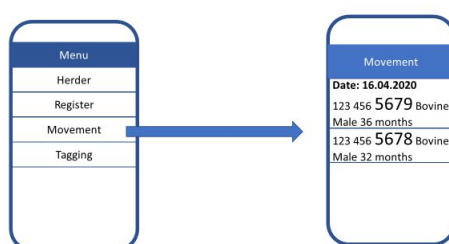
On field data collection should be carried out in a flexible way either through smartphones or through appropriate paper form to be entered after through a PC.
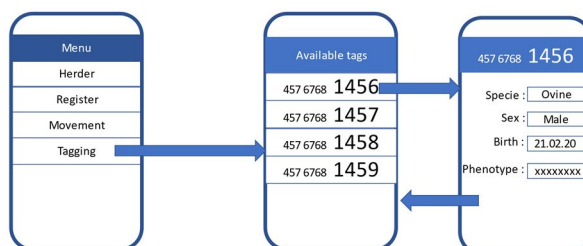
2.6.2   Mobile application

A new version of the android application should be developed to be used by the field technicians or by the herder with three levels of utilization:

- For any herder: download and access in his animal register.
- For the field technicians in charge of the animal: download and access in the animal register as well as in movement registration.
- For the herders or for the field technicians in charge of animal identification and movement registration: download and access in the animal register as well as the registration of the animals and of their movements.
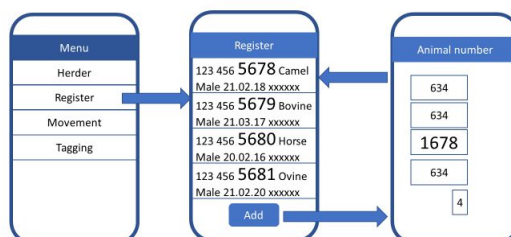
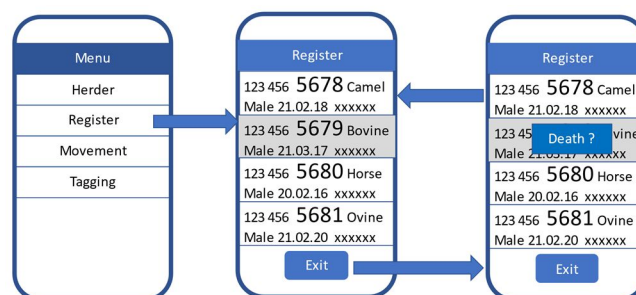The diagrams hereinafter provides some examples for this application.

Example of movement monitoring

Example of animal identification and registration

Example of the entry of the arrival of a new animal.

Example of the entry of a departure

2.7 IT issues

2.7.1 Interoperability with other information systems

According to its general objectives, through the livestock information system, the AIRS information system should be interoperable with two MOFALI major information systems:
1. Animal breeding information system.
2. Animal health information system.

The AIRS interoperability should not be limited to these systems, it should include other information systems and mainly with trade partner information systems.

This interoperability should be achieved either by data exchange at the level of the databases, and/or through applications able to client of the API of the different information systems.

2.7.2 AIRS functional architecture

The AIRS information system should be implemented through a website whose the content is provided by the diagram below.
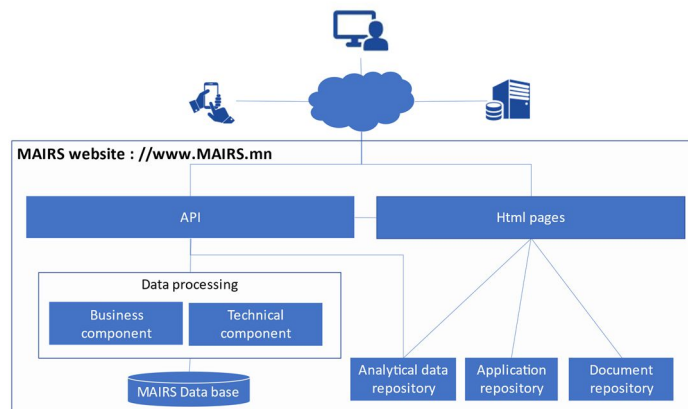

Resources are distributed in several parts:
1. **Home page** with a general information about the AIRS: legislation, organization, achievements, applied standards…
2. **API**
3. **Applications**, to be downloaded:
   - Herd monitoring.

- AIRS field operations.
- …

4. **HTML pages** to achieve:
   - Tag management.
   - Herd register management.
   - Team management.
   - AIRS monitoring.
   - …

5. **Analytical data**, at least:
   - Herd summary per campaign
   - Animal summary
   - …

6. **Documents** which include:
   - The manuals of standard operating procedures, with their working instruction.
   - Standards to be applied for tags, numbering system...
   - Training material including video.
   - …

The diagram hereinafter provides an overview of what may be the functional architecture of the AIRS website independently of the IT technologies to implement it.

The web site may be used by:
1. People with a mobile device such as a smartphone or a tablet
2. People with a PC
3. Servers of the beneficiary activities.

All users access in API or in the html pages through internet.

The API access either in the analytical data repository or in software components which may be either business components if they achieve an output delivering value to the user, for instance an animal register, or technical components.

The software components access in the AIRS database to update or to retrieve data.

The html pages are used to:
- Operate web applications through software components.

- Download analytical data.
- Download applications for mobile devices.
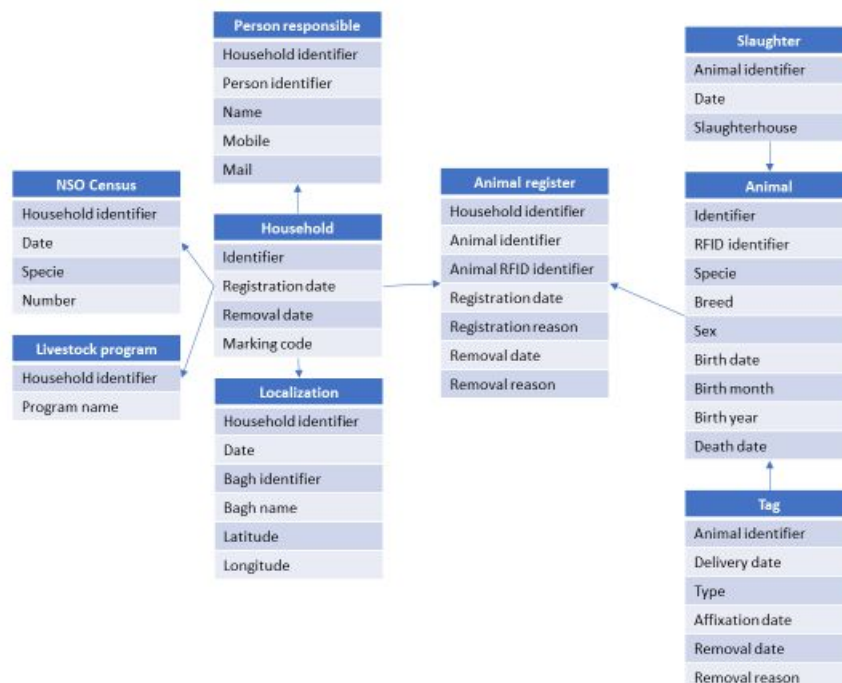- Download miscellaneous documents.

2.7.3 AIRS database architecture

The lessons drawn from other countries indicate that:
- A relational database is the key tool for data sharing among many users ensuring data security.
- The value of a database depends widely on its data model which affects its ability to quickly bring a reliable reply to the basic requests addressed throughout the workflow.

The AIRS data base should be handled by a Relational DataBase Management System (RDMS) such as Postgree or Oracle.

The data model of the database should follow the hereinafter data model.

The key entities should be:
1. The household with:
   - A person responsible for the herd.
   - Several localizations.
   - Several annual animal censuses.
   - Several involvements in livestock programs: animal health, animal breeding…
2. The animal register of the household which contains several animals with for each animal belonging to the household its arrival and its departure date.
3. The animals which are tagged, and which may be slaughtered.

The key attributes of each entity are provided by the diagram.

3   Annual operational cost (2020 assessment)

3.1   Cost of the tags.

To assess the number of tags which is needed each year, we have to assess the number of newborn animals reaching an age of six months and over per year.

The line 1 of the table below provides the total number of animals in Mongolia from the 2020 census.

From the number of females and of the total number of animals in the Uvurkhangai aimag we can assess a proportion of reproductive female (line 2 of the table below). Assuming that this proportion is the same for Mongolia, we can assess the number of females (line 3 of the table below) in Mongolia.

From number of females and of newborn animals the Uvurkhangai aimag, we can assess a proportion of birth (line 4 of the table below). Assuming that this proportion is the same for Mongolia, we can assess the number of newborn animals (line 5 of the table below) in Mongolia.

Considering a mortality rate of 15 % before the age of six months, we cans calculate the number of newborn animals reaching an age over 6 months per year.

	Bovine	Camelid	Equine	Ovine	Caprine
Total number (2020 census)	4 700 000	472 900	4 100 000	30 000 000	27 000 000
Proportion of reproductive female	37%	34%	36%	45%	46%
Number of reproductive females	1 739 000	160 786	1 476 000	13 500 000	12 420 000
Birth rate	79%	52%	55%	76%	60%
Number of new born animals per year	1 373 810	83 609	811 800	10 260 000	7 452 000
Mortality before six months	15%	15%	15%	15%	15%
New born animals reaching an age over 6 months each year	1 167 739	71 067	690 030	8 721 000	6 334 200

Table 1 Number of newborn animals reaching an age over 6 months per year

The needs of the key direct beneficiaries would imply to affix at least one tag to:
- All the bovine and all the camels from an age of six months.
- Likely 50 % of the horses from an age of six months.
- 10 % of the small ruminants of the nucleus with an identification code.
- All the young ovine male with a marking code.

The table hereinafter provides the number of tags needed each year and the corresponding cost.

	Amount of tags		Unit cost	Total cost
Plastic tag for large animals		1 238 806	₮1 800	₮2 229 850 642
Bovine	1 167 739			
Camelid	71 067			
Insert for horses		345 015	₮3 500	₮1 207 552 500
Plastic tags for small ruminants		5 866 020	₮1 000	₮5 866 020 000
With an animal identification code	1 505 520			
With a marking code	4 360 500			
				₮9 303 423 142

Table 2 Cost and number of tags needed per year.

3.2 Cost of the field operations.

The field operations should be mostly performed during field technician visits arranged in conjunction with animal health and breeding programs. Under these conditions, the AIRS cost is the additional cost to affix tag and to register data.

From the lessons drawn from the pilot in Mongolia this cost might be:

- ₮ 500 per small ruminant.
- ₮ 1 000 per bovine, camelid and equine.

The table hereinafter provides an assessment of the cost of the field operations.

		Animals to be tagged	Unit cost	Total cost
Large animals		1 583 821	₮1 000	₮1 583 820 912
	Bovine	1 167 739		
	Camelids	71 067		
	Horses	345 015		
Small ruminants		5 866 020	₮500	₮2 933 010 000
	With an identification code	1 505 520		
	With a marking code	4 360 500		
				₮4 516 830 912

Table 3 Cost of the field operations.

3.3 Other costs.

The lessons learnt from other countries indicate that the AIRS would need a support team which would consists of in with five persons at the national level and one person per aimag, the indirect charges (office, computer…) being assumed to be 20 % of the raw cost.

	Person	Unit cost	Raw cost	Charges	Total cost
National level	5	₮12 000 000	₮60 000 000	₮12 000 000	₮72 000 000
Regional level	19	₮12 000 000	₮228 000 000	₮45 600 000	₮273 600 000
					₮345 600 000

Table 4 Cost of the support

The lessons drawn from other countries indicate that the development cost of the software would be around ₮1 750 000 000. The current practices indicate that it would result in an annual maintenance cost of 20 % of the initial investment, for a total of ₮350 000 000 per year.

The cost to host the information system would be around ₮350 000 000 per year.

The cost of the stakeholder management as long as it is based on the NSO data would be negligible.

Annual operational cost

The annual operational cost is provided by the table hereinafter.

Tag	₮9 303 423 142	63%
Field operations	₮4 516 830 912	30%
Support	₮345 600 000	2%
Software maintenance	₮350 000 000	2%
Hosting	₮350 000 000	2%
Total	₮14 865 854 054	
Number of herder	241 000	
Total per herder	₮61 684	

Table 5 Annual operational cost

This cost does not include the cost of the civil servant, the herder time to gather and handle the animals and the depreciation cost of the initial investment for the equipment and for the software.

Though, the software and the hosting of the information system represent only 7 % of the overall cost, it does not mean that they are secondary because they deliver the major part of the AIRS value. **If the information system is not efficient, the MAIRS value might decrease dramatically, jeopardizing its relevancy**.

Tags represent 61 % of the cost, the use of RFID tags for small ruminants would have increased the total cost by about 40 %.

Though the cost of the support team is only 2 %, the lessons learnt from other countries show that it plays a critical role in the efficiency of the AIRS.

4   Method of funding

Experiences and lessons from other countries indicate that it is good practice to require herders to make at least a relatively small financial contribution towards the operation of the AIRS from the outset. The contribution made by herders can be increased gradually year after year linked to growing understand among herders about the direct benefits of the AIRS for them, as well as the importance of penalties for non-compliance with the AIRS.

The lessons drawn from other countries show that is more difficult to move from a situation where the AIRS is free of charge for herders to a situation where herders are expected to contribute to finance the AIRS than from a situation where there is a contribution of the herders from the beginning (even if it is very limited).

The lessons drawn from the pilot show that the current herder interest for the AIRS is rather low. Their interest in AIRS appears mainly related to the fight against animal theft and secondarily for monitoring animal movements.

In view of the relatively limited interest of herders in MAIRS and the mainly indirect benefits of MAIRS for herders, for at least the next 5 years, the financial contribution of herders towards the system should be limited and most financing should be allocated by the government. This is justified in view of:

- The low level of the direct benefits for the herders
- The time already spent by herders to gather the animals which would represent almost 20% of the total MAIRS cost
- The need to build trust with herders, and to pave the way towards an increased financial contribution from herders in the future.
- The herder involvement in the MAIRS should be increased by all possible means.

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5   Legislation

The implementation of AIRS requires major changes to the current legislation including to achieve the following:
- Review the responsibility between the government and the herders.
- Review the way of funding the AIRS.
- To set up a competent authority for the AIRS and the relevant organization.
- Review the role of the national, aimag and soum level and those of the AIRS officer.
- Define the terms of reference of the support body.
- Define the status of RFID tags and of tags with marking code.
- Set up the technical advisory committees.
- …

6   Road map

The AIRS implementation is not possible without a strong coordination between the different MoFALI departments, mainly but not only between the veterinary and the registration departments. Effective coordination should be based on the appointment by the Government of a high-level coordinator, reporting to the state secretary. His purpose will be to implement the AIRS, which, once implemented will not need a coordinator.

Considering its cost and the additional workload for the herders, the AIRS should be implemented as long as all the below conditions are met:
- The key direct beneficiaries and mainly the veterinary department use the AIRS and do not implement separately their own animal identification and registration.
- The AIRS implementation is closely coordinated with the development of the key direct beneficiaries and mainly with the MAHIS.
- RFID tags are limited to species where there is no other alternative.
- A Government commitment to support the major part of the cost during several years.

The AIRS implementation should be achieved in a flexible manner during at least three years according to a step-by-step implementation plan, each step corresponding to a specified subset of aimags, the first step dealing both the information system and the implementation for some aimags will be the more expansive and the more complex.

The deadline to start with a significant subset of aimags for 2022 / 2023 is to launch the operations by the end of spring 2022.

7 Recommendation summary

Objectives

N°	Scope	1	Recommendations
1	General objective	C	The AIRS should support: 1. In priority: animal health improvement and meat and skin certification. 2. In second place: animal breeding program, fight against the animal theft, product labelling, pastureland management, and herd management.
2	Specific objective	C	The AIRS should provide: 1. The herd of origin of any animal covered by a veterinary certificate. 2. The inventory of the identified animals of a herd.

Target population

N°	Scope	1	Recommendations
3	Herds	C	AIRS should not be mandatory for any herd but only focused on: 1. Herds of herders participating in a breeding program and / or concerned by the veterinary certificates. 2. Intensive farms for dairy and / or beef production from bovine.
4	Animals	C	All the animals should not be tagged, only animals of herds already considered by AIRS and for these herds only animals covered by a veterinary certificate or a breeding program.
5	Slaughterhouses	C	The slaughterhouses to be considered, should be limited to facilities where the animals are slaughtered, and which are receiving animals covered by a veterinary certificate.

Identifiers

N°	Scope	1	Recommendations
6	General	C	The AIRS should be based on four types of identifiers: 1. Animal visual identifiers allocated by the AIRS. 2. Animal RFID identifiers allocated by the AIRS 3. Herd marking codes allocated by the AIRS from herd identifiers. 4. Herd identifiers based on the NSO household identifiers.
7	Herd identifier	C	The herd identifier should the 13-digit household identifier allocated by the NSO.
8	Herd marking code	C	A 'marking code' composed of 6 digits as a short alias for the 13 digits herd identifier should be allocated by the AIRS to each herd to be printed on tags to be used for small ruminant covered by a veterinary certificate.
9	Visual animal identifier	C	The visual animal identifier should only include • 'MN', • two digits for the aimag. • ten digits for the animal.

N°	Scope	1	Recommendations
10	RFID animal identifier	C	The RFID identifier should include: • Three digits for the ISO country code for Mongolia: 496. • Two digits for the aimag • Ten digits for the animal.

Identification devices

N°	Scope	1	Recommendations
11	General	C	The AIRS should be based on four types of identification devices: 1. Short life cycle tag for caprine and ovine to be printed with a marking code. 2. Large lifetime tag for bovine and camelids to be printed with a visual animal identifier. 3. Small lifetime tags for small ruminants to be printed with a visual animal identifier. 4. Lifetime RFIFD insert for horses with a RFID animal identifier
12	Short life cycle tag for small ruminants	C	Low-cost short life cycle tag should be used to tag small ruminants with a marking code.
13	Lifetime tag for bovine and camelids	C	To facilitate the on field, use the last four last digits should be separated from the rest of the animal identifier with a size of at least of 20 mmm with a check digit which can be calculated in accordance with the GS1 method.
14	Lifetime tag for small ruminants	C	The current plastic tags for small ruminants may be used, but only for animals belonging to a breeding program.
15	RFID insert for horses	C	The most common technology in the world for horse identification is based on RFID inserts. The use of tags is very limited for horses despite some trials, mainly because of: • The hear anatomy with a lot of blood vessels and nerve ending. • The sensibility of horses to infections.

Organization

N°	Scope	1	Recommendations
16	Output	C	The AIRS outputs should consist in: 1. A stakeholder register providing for each herd considered by the AIRS: • An identification code in the form of the NSO household identifier. • The number of animals per specie • The person responsible for the herd. • The localization, at the bagh level and if possible, by geographic coordinates. • Means to contact (mail, phone…) the person responsible for the herd. • The marking codes for small ruminants. 2. Tagging devices affixed to the animals providing: • Codes to retrieve the herd of origin.

			• Animal identifiers to register animal data and to retrieve or select animals. • For horses, a secure animal identification, through RFID inserts. 3. An animal register providing for each herd considered by the AIRS: • The list of the identified animals belonging to the herd. • For each animal its core data: specie, breed, sex, and birth date.
17	Organization principles.	C	The core principles to set up AIRS should be: • The reporting line of the MoFALl with three levels: national, aimag and soum. • Specific officers dedicated to the AIRS at national, aimag and soum levels without other assignment (animal breeding, animal health…) • National and aimag AIRS advisory committees including stakeholder's representatives. • A support body at the national and the aimag level.
18	Terms of reference for the national AIRS officer:	C	The national AIRS officer should achieve the hereinafter tasks: • Representation of the competent authority for animal identification and registration. • Responsible for the legislation implementation and for the analysis of any proposal of evolution of the regulation. • Responsible for the implementation and of the monitoring of the national contracts with private bodies for tag procurement and for support.
19	Terms of reference for the aimag AIRS officers	C	The aimag AIRS officers should achieve the hereinafter tasks: • Communication. • Field technician and herder training and approval. • Slaughterhouse registration and monitoring. • Soum AIRS officer monitoring. • Local service providers selection and contract. *For the justification and the detailed description see e § 3.5.3 'Position description' of the '2021 Recommendations to improve animal identification and registration in Mongolia'.*
20	Terms of reference for the soum AIRS officers	C	The soum AIRS officer should achieve the hereinafter tasks: • Populate the stakeholder register with herd contact person and herd localization. • Entrust the field operations to the herders and to the field technicians employed by the local service providers. • Monitor the herders and the field technicians. • Manage the right of access in the information system of the herders and of the field technicians. • Distribute the tags. • Provide the herders and the field technicians with support.
21	Terms of reference of the support body	C	In support to the AIRS officers, the support body should achieve the hereinafter tasks. • Communication and training material. • Manual of standard operating procedures.

| | | | | • Quality monitoring.
• Software maintenance monitoring.
• Information system hosting monitoring.
• National functional administration of the information system. |

Private public partnership

N°	Scope	1	2	Recommendations
21	Principle	U	C	Private public partnerships should be established: • At the national level for the support body and for the development and the operation of the information system. • At the soum level with private veterinary and breeding service units to carry out the field operations.

AIRS workflow

N°	Scope	1	Recommendations
22	Overall description	C	The AIRS outputs are delivered through the hereinafter workflows: 1. Stakeholder management. 2. Animal management. 3. Information system management. 4. Identification device management. 5. Slaughter registration. 6. IT infrastructure operation. 7. Support.
23	Stakeholder management	C	The main outputs should be: • Herd identification. • Herd localization. • Contact person registration.
24	Animal management	C	The main outputs should be: • Tagged animals. • Animal registration. • Movement and mortality registration.
25	Identification device management	C	The main outputs are available tags at the soum level.
26	Slaughter registration	I	The outputs are for the identified animals, the registrations of: • Slaughter. • Death.

Field operations

N°	Scope	1	Recommendations
27	General	C	The field operations should be carried out during at least one annual visit and should consist in: • Animal tagging • Animal registration • Animal movement registration

N°	Scope	1	Recommendations
28	Implementation	C	Field operations should be achieved by a maximum number of herders as long as they are interested and able to carry out the corresponding tasks otherwise by service providers as much as possible through field visits together with animal health or breeding visits.
29	Data collection	C	On field data collection should be carried out in a flexible way either through smartphones or through appropriate paper forms to be entered after through a PC.

Information system

N°	Scope	1	Recommendations
30	Outputs	C	The main outputs through paper or digital support should be: • Actors register (herder, intensive farms, slaughterhouse…) • Herd marking code • Herd localization. • Herd contact person. • Animal core data. • Herd inventory.
31	Architecture	C	The architecture of information system should not include business applications and should be based on a web platform consisting of: 1. API to be used by client applications to use business and technical components in connection with the AIRS data base. 2. Html pages to be used through the browser of a PC to access to: • A document repository. • An application repository. • Analytical data. • API.
32	Interoperability	C	The AIRS information system should be interoperable with other systems and in priority with the MAHIS.
33	Data base	C	The main objects of the data base should be: 1. Herd including: • Herd animal census • Herds localization • Herd responsible 2. Herd animal register including: • Animal core data • Animal herd register registration and removal • Animal slaughter 3. Tag

Mobile applications

N°	Scope	1	Recommendations
34	General	C	Several mobile applications should become client of the AIRS web platform, at least: • MAHIS mobile application.

			• NOMAD, an application developed by the MoFALI for the herders. • A specific AIRS application to be developed. • …

Legislation

N°	Scope	1	Recommendations
35	General	C	Implementing the AIRS would require huge changes in the current legislation at least: • Review the responsibility between the government and the herders. • Review the way of funding the AIRS. • To set up a competent authority for the AIRS. • Review the role of the national, aimag and soum level and those of the AIRS officer. • Define the terms of reference of the support body. • Define the status of RFID tags and of tags with marking code. • Set up the technical advisory committees. • …

Road map

N°	Scope	1	Recommendations
36	Prerequisites		Considering its cost and the additional workload for the herders, the AIRS should be implemented as long as all the below conditions are met: • The key direct beneficiaries use the AIRS and do not implement separately their own animal identification and registration. • The AIRS implementation is closely coordinated with the development of the key direct beneficiaries and mainly with the MAHIS. • RFID tags are limited to species where there is no other alternative. • A Government commitment to support the major part of cost during several years.
37	Coordination	C	The AIRS implementation is not possible without a strong coordination between the different MoFALI departments, mainly but not only between the veterinary and registration departments, through the appointment by the Government of high-level coordinator.
38	Implementation plan	C	The AIRS implementation should be achieved in a flexible manner during several years according to a step-by-step implementation plan, each step corresponding to a specified subset of aimags, the first step dealing both the information system and the implementation for some aimags will be the more expansive and the more complex.
39	Deadline	C	The deadline to start with a significant of subset of aimags for 2022 / 2023 is to launch the operations by the end of spring 2022.

1: C: critical, I: important, S: secondary

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