RWANDA POLYTECHNIC

TVET LEVEL II

AGRICULTURE

Animal Shelter Constuction

TRAINEE MANUAL

RWANDA POLYTECHNIC

Approved by: Workforce Development Authority

USAID FROM THE AMERICAN PEOPLE

EDC Education Development Center

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ANIMAL SHELTER CONSTRUCTION

Unit 1: Ruminant shelter building

Unit 2: Piggery construction

Unit 3: Rabbit hutch construction

Unit 4: Poultry house construction

Unit 1: Ruminant shelter building

Topics

1.1 Selection of site

1.2 Organization of construction

1.3 Equipping cattle, goat and sheep shelters

1.4 Maintenance of shelters

Unit Summary:

In this unit, you will gain the knowledge, skills, and attitudes related to ruminant shelter construction, which includes shelters for cattle, sheep, and goats. At the end of this unit, you will be able to select sites for ruminant shelter construction, organize construction activities, and equip and carry out necessary maintenance of a ruminant shelter.

Self-Assessment: Unit 1

1. Look at the unit illustration above. What do you observe? What do you think this unit will be about? What topics might be covered?

2. Fill in the self-assessment below.

There are no right or wrong ways to answer this assessment. It is for your own use during this unit. Think about yourself: Do you think you can do this? How well? Read the statements across the top. Put a check in column that best represents your situation. At the end of this unit, we'll take this survey again.

My experience **Knowledge, skills, and attitudes**	**I don't have any experience doing this.**	**I know a little about this.**	**I have some experience doing this.**	**I have a lot of experience with this.**	**I am confident in my ability to do this.**
Describe the factors considered in selecting a site for ruminant shelter construction.					
Assess soil and weather factors for ruminant shelter construction.					
Identify the parts/blocks and facilities needed for ruminant shelters.					
Identify construction materials for ruminant shelters.					
Identify and determine the uses of equipment in ruminant shelters.					
Install and use common equipment in ruminant shelters.					
Identify the components to evaluate during					

My experience Knowledge, skills, and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
maintenance of ruminant shelters.					
Establish and implement a maintenance plan of ruminant shelters and equipment.					

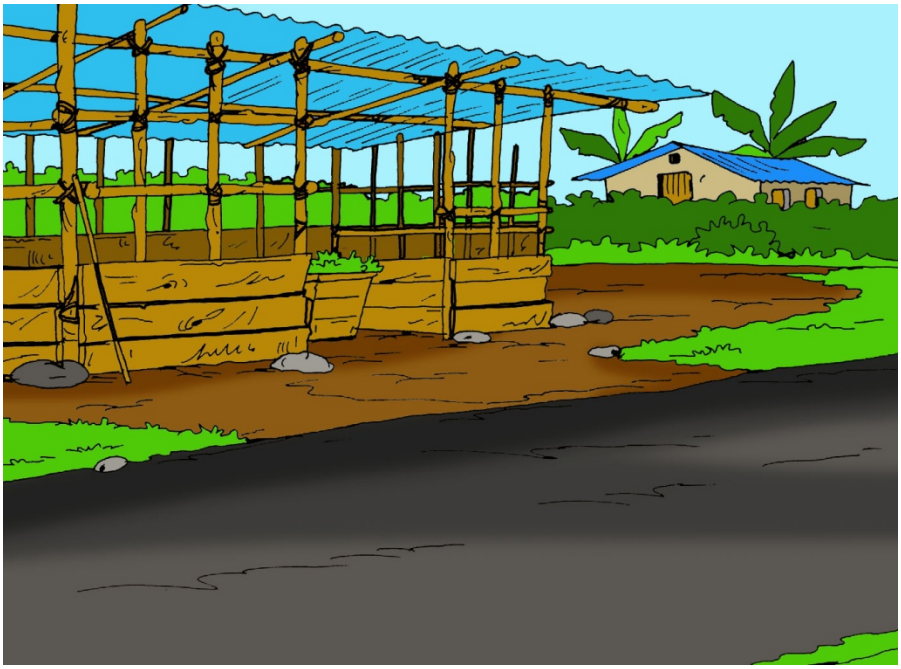
Topic 1.1: Selection of Site

Key Competencies:

Knowledge	Skills	Attitudes
1. Describe the factors considered in the selection of a site for a ruminant shelter.	**1.** Select a good place for ruminant shelter construction.	**1.** Careful
2. Describe the soil factors considered while selecting a site for a ruminant shelter.	**2.** Assess the land and soil for ruminant shelter construction.	**2.** Collaborative
3. Identify weather conditions to consider in selection of a site for a ruminant shelter.	**3.** Assess the weather factors for ruminant shelter construction.	**3.** Aware

Getting Started: What do we know and where are we going?

Topic 1.1 Task 1:



1. Observe the picture above and brainstorm the answers to the following questions:
   a. What is the common name of the structure?

   b. Why do you give it that name?

   c. What purpose can it serve?

   d. What do you think of when selecting a place to build this structure?

2. Discuss the topic you think this activity relates to.

Problem Solving Activity

Topic 1.1 Task 2:

1. Separate into three groups.

2. Read the scenario below and answer the related questions based on your group:

Kagabo is a farmer of small ruminants in Gicumbi district, he is planning to buy a new plot of land to construct a shelter for 60 goats. He requests that you help him in site selection by explaining all the factors to consider before making a decision.

3. Work with your group to answer the assigned questions:

- **Group 1:** Factor for Location of Site
  - **a.** What do you think are some important regulations and laws to respect in the selection of a site for a ruminant shelter?

  - **b.** How could laws and regulations impact the decisions Kagabo makes?

  - **c.** List what other factors you think Kagabo should consider while selecting the location for ruminants' shelter location.

- **Group 2:** Identification of Soil
  - **a.** Identify the types of topography and what their impact on construction activities could be.

  - **b.** Identify the soil structures you see and what their impact on construction activities could be.

  - **c.** Help Kagabo understand why animal waste (faeces and urine) is harmful to the groundwater.

- **Group 3:** Weather Factor Consideration
  Provide the group with measuring instruments: Thermometer, hygrometer, anemometer, and compass.
  - **a.** Using the tools you have, explain the weather factors Kagabo should measure when selecting a site for a ruminant shelter.

  - **b.** Why do you think checking the weather parameters is important before deciding where to build a shelter?

4. With your group, present your responses to the questions. Answer any questions from the rest of the class.

5. Listen to the other groups' presentations and write down their ideas. You will refer back to all of the responses after discussing **1.1 Key Facts.**

1.1 Key Facts

- **Land management regulations and laws in Rwanda:**
  - Official Gazette n° Special of 16/06/2013 determines the use and management of land in Rwanda[1]
  - Includes ministerial orders related to master plans and land use

- **Impact of land management regulations on animal shelter installation:**
  - Construct animal shelter on a farmer's own land or officially rented land.
  - Respect the land use master plan
  - Construct ruminant shelters in a zone reserved for livestock when you are in urban land
  - In urban land, permission from legal authorities is required before construction of animal shelter
  - Respect legal distance from swamps, marshland, river, and lakes

- **Impact of the different types of topography on ruminant shelter construction:**
  - **Mountains and Hills:**
    - Mountains: height of more than 300 metres
    - Hills: height of about 150-300 metres
    - Animal shelter construction needs more land preparation as the slope increases.
  - **Plains and Plateaus:**
    - Plains: flat or gently rolling lands
    - Plateau: an elevated land (less than 150 metres)
    - Animal shelters are easily constructed on this topography.
  - **Valleys:**
    - A low area of land between hills or mountains, typically with a river or stream flowing through it.
    - Rwandan regulations do not allow the construction of animal shelters on this land.[2]

- **Impact of the different soil structures on ruminant shelter construction:**
  - Soil structure is the arrangement of particles that vary in size and shape.
  - The more difficult the soil is to compact, the more it needs a strong foundation and wall.
  - From the smallest, the soil particles are clay, silt, sand, and gravel.

[1] International Labour Organization. (2013, June 16). *Official gazette no special of 16/06/2013*. https://ilo.org/dyn/natlex/docs/SERIAL/94019/110205/F-1367378394/RWA-94019.pdf

[2] James, R. (2017, April 24). *Kinds of land topography*. Sciencing. https://sciencing.com/kinds-land-topography-8158591.html

1. **Single-fraction soils** (soils with particles of the same size, like fine sand) is difficult to compact.
2. **Uniformly graded granular** (a mixture of sand and gravel) soils cannot be compacted.
3. **Mixed-fraction soils** (soil particles of different sizes like clay and sand) are easy to compact. Clay has smaller particles that move into the space between the larger particles and its' high-water content facilitates the work. This structure is also favourable as it absorbs water to avoid flooding around the construction.[3]

- **Impact of farm wastes on ground water quality**
  - Farm wastes cause pollution.
  - Ruminant farm waste, including manure and urine cause air pollution (by emission of methane gas) and water pollution (by ammonia).
  - Low altitude topography and soil structures that favour water infiltration are in danger of ground water pollution from these farm wastes.

- **Weather factors considered when selecting site for ruminant shelter construction:**
  - Wind direction and speed: Optimum 0.2-1 m/s
  - Natural light
  - Temperature: Optimum 10-20 ^{o}C
  - Precipitation (rain)

- **Role of checking climatic parameters in the selection of a ruminant shelter site:**
  - Consider the speed and direction of prevailing winds, precipitation, and temperature
  - Helps determine the construction materials to use and the size of walls and openings

- **Other factors to consider in the selection of a location for a ruminant shelter:**
  - Friendly neighbourhood
  - Security
  - Available facilities

[3] Lescohier, J. (2006, August 14). *The science of soil compaction*. For Construction Pros. https://www.forconstructionpros.com/equipment/compaction/article/10303359/the-science-of-soil-compaction

Guided Practice Activity

Topic 1.1 Task 3:

1. Read **1.1 Key Facts** out with your class. Pause after each fact to ask questions and return to the questions in the **Problem Solving Activity**. Revise your answers and share what you changed.

2. Carefully read the situation and perform the associated tasks in groups:

   A farmer named Beatrice has a swamp-land around Nyabarongo river. She is planning to construct a cow shelter on that land because it is near water and the rest of land will serve as a pasture which will be productive even in dry seasons. You are called to analyse her project by answering the following questions:

   a. Do you think Beatrice's site selection is a good choice? Give reasons to support your response.

   b. Do you think her reasons are sufficient to go ahead and construct the animal shelter? Give reasons to support your response.

   c. Do you think the authorities will allow her to continue with the construction? Give reasons to support your response.

   d. Advise her on the possible impact her choice may have on the environment.

   e. In your own view, advise her on what factors to consider while selecting a good site for ruminant shelter construction.

   f. Using the appropriate instruments (thermometer, hygrometer, anemometer, and compass), take turns demonstrating to your groupmates how to check the parameters in selecting a site for ruminant shelter construction and then explain what the ideal measurements would be for selecting a site.

3. After your discussion, share your group's ideas with the rest of the class.

Application Activity

Topic 1.1 Task 4:

1. Visit a plot of land/field and imagine that the site is where a farmer wants to build a ruminant shelter for five cows. You must help the farmer make the right choice by responding to the following tasks with your group.

Using a notepad/paper, record your findings for the following tasks:

a. Observe the land and explain if it meets legal requirements.

b. Assess the topography and explain its' impact on shelter construction.

c. Assess the soil structure and explain its' impact construction activities.

d. Using your instruments (thermometer, anemometer, hygrometer…) assess the weather parameters and give your observations.

e. What could be the impact of this farm (farm sewage) on the groundwater and what is your recommendation (if any)?

f. What do you think of the facilities, security, and neighbourhood in relation to this site?

2. When your group is finished, visit the other groups and discuss their findings.

Points to Remember

- Ruminant shelters must be constructed in a place that is easy for personal access, easy to get water, and easy to bring food to.
- Security and safety should be considered before choosing a site for a ruminant shelter.
- Consider the government regulations and laws before selecting a site.

Formative Assessment

After carefully reading the following items, answer the following questions individually:

1. List the criteria to consider in selection of site for a ruminant shelter.

2. Explain three types of topography and their impact on construction of ruminant shelter construction.

1.

2.

3.

3. What weather conditions should be considered when selecting a site for ruminant shelter construction?

4. What is the impact of farm waste on ground water quality?

5. Choose the correct answer below and give the reason.

6.

When constructing a ruminant shelter, farmers prefer:

- **a.** Single-fraction soils
- **b.** Uniformly graded granular soils
- **c.** Mixed - fraction soils

Topic 1.2: Organise construction

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify the parts (blocks) of a ruminant shelter.	**1.** Interpret the sketch of a ruminant shelter.	**1.** Attentive
2. Identify other facilities (infrastructures) for production and management.	**2.** Select construction materials for a ruminant shelter.	**2.** Willingness
3. Identify the construction materials for a ruminant shelter.	**3.** Assist in the construction of a ruminant shelter.	**3.** Collaborative

Getting Started: What do we know and where are we going?

Topic 1.2 Task 1:

1. Observe the photo above and brainstorm answers to the questions below:

a. Which activity do you see in picture?

b. What are the materials used?

c. What are other possible materials that can be used in this activity?

2. Predict the topic you are going to learn today.

Problem Solving Activity

Topic 1.2 Task 2:

1. Read the following scenario. Respond to the first two questions as a class:

A medium scale farmer is planning to start a dairy farm of 8 cows with a bull for mating. The farmer estimates to get 6 calves per year and will start selling them after one year to maintain the same number in the farm. Before construction of the shelter and the related facilities, the farmer wants a sketch from a more experience farmer. You are called to help him in this planning. You must do the following:

a. List all the parts (blocks) needed for the shelter.

b. Specify how many square meters needed for each category of animal (m^2/animal).

c. List other necessary infrastructures (facilities) needed in/around the shelter.

1.2 Key Facts

- **Different parts of a cow shed:**
  - Lactation block/pen
  - Dry cows block/pen
  - Maternity block/pen
  - Calf rearing block/pen
  - Young cattle block/pen
  - Breeding bull pen

- **Other facilities**:
  - Storage room/block
  - Office and sanitation room/block
  - Feeding alley
  - Waste management facilities (Drainage, manure alley, etc.)

- **Space for each category of animal:**
  - Calves: 1-1.8 m^2
  - Young cattle: 1.5-3 m^2
  - Mature cows: 3.5-5 m^2
  - Bull pen: 12-15 m^2

- Cattle in free stalls: 1.2-2.3 m length; 0.6-1.2 m width; 1.5-5 m^2 bedded shed area
- Cattle in tie stall: 1.6-1.8 length and 1.1-13 width[4]
- Doe/Ewe: 1.4 m^2
- Kids/Lamb: 0.5 m^2
- Ram/Buck: 3 m^2

- **Space for each small ruminant:[5]**
  - Doe/Ewe: 1.4 m^2
  - Kids/Lamb: 0.5 m^2
  - Ram/Buck: 3 m^2

- **Criteria to select construction materials:**
  - Availability
  - Cost
  - Technology
  - Durability
  - Strength

- **Some of construction materials:**
  - Wood
  - Timber
  - Metal sheets
  - Nails
  - Ropes
  - Bricks
  - Concrete blocks
  - Cement
  - Sand
  - Stones
  - Metallic tubes

- **Other notes**:
  - An East-West orientation is preferable to minimize exposure to the sun.

[4] Food and Agriculture Organization of the United Nations (FAO), & Informartion Network on Post-Harvest Operations (INPhO). (1998). *Farm structures in tropical climates: Cattle housing*. https://www.fao.org/3/s1250e/S1250E11.htm#Cattle%20housing

[5] Food and Agriculture Organization of the United Nations (FAO), & Informartion Network on Post-Harvest Operations (INPhO). (1998). *Farm structures in tropical climates: Sheep and goat housing*. https://www.fao.org/3/s1250e/s1250e17.htm

Guided Practice Activity

Topic 1.2 Task 3:

1. Read the following scenario and respond to the associated questions in groups:

A family wants to keep a few goats at home to sell milk and meat from them. They call you to design and assist in the construction of a shelter for 3 does. They want to use minimum resources and they have enough trees in their forest to supply their own wood.

a. Calculate the square meters (m^2) needed for 3 does in a pen.

b. Calculate the square meters needed for 3 kids in a pen.

c. Propose how many square meters are needed for storage.

d. Explain the criteria to select construction materials.

e. Select the construction materials which can be used.

f. Make a simple design (drawing) showing how the blocks can be arranged.

2. Participate in a large group discussion by sharing your group's responses to each point.

3. After all the groups have shared, walk around the room and observe the other groups' drawings. Select one member of your group to present the drawing and explain its components.

Application Activity

Topic 1.2 Task 4:

Part 1:

1. Visit a nearby plot of land/field outside of the school that is being considered as a possible site for small ruminant shelter construction. Volunteers to demonstrate organizing and measuring the shelter.

2. Volunteers should take the materials/equipment provided and fix the sticks, linking them using the rope in order to show where every part/pen will be constructed (doe

block, kid block, and store). Respect the designs/sketches from the previous activity in **Topic 1.2 Task 3.**

3. While the volunteers are working, assist and participate in order to have a common understanding.

Part 2:

1. Visit a ruminant farm to observe:

a. The parts/blocks of the ruminant shelter and their sizes.

b. Other facilities present on the ruminant farm.

c. The construction materials used in a ruminant shelter.

2. Listen to the explanations and comments from the farmer and the trainer.

3. At the end, share what you learned on the farm.

Points to Remember

- Each category of animal should have a separate pen/block with adequate space.
- Stocking density (the space for each animal) must be respected.
- Selection of construction materials is based on their availability, their cost, durability, and technology.

Formative Assessment

After carefully reading the following items, answer the following questions individually:

1. List the criteria for construction material selection for a ruminant shelter.

2. Circle the correct answers:

1. Stocking density in ruminant shelters are based on:

A. Species B. Size C. Age

D. Physiology E. Colour

2. Stocking density in a ruminant shelter is the same for:

A. Does and Ewes B. Lambs and Bulls C. Bucks and Rams

3. Which of the following are blocks that are necessary in a cattle shelter?

A. Lactation block B. Dry cows block C. Maternity block

D. Calf rearing block E. Breeding bull block F. Car parking block

3. Select five materials to use in the construction of a ruminant shelter and explain each one's purpose.

Topic 1.3: Equipping cattle, goat, and sheep shelters

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify equipment for a ruminant shelter.	**1.** Select the equipment used a in ruminant shelter.	**1.** Attentive
2. Determine the uses of each piece of equipment used in a ruminant shelter.	**2.** Install the equipment used in a ruminant shelter.	**2.** Methodical
3. Match the equipment used in a ruminant shelter to their appropriate places.	**3.** Test the equipment used in a ruminant shelter.	**3.** Decisive

Getting Started: What do we know and where are we going?

Topic 1.3 Task 1:

1. Turn to the person sitting next to you. Based on your own experience and knowledge, discuss and create a list of equipment you have seen in a ruminant (cow, sheet, goat) shelter before**.**

2. After discussing with your partner, participate in a group brainstorm by sharing the equipment you thought of.

3. Observe the answers that you brainstormed and consider the topic you are going to learn: Equipping cattle, goat, and sheep shelters.

4. Turn to the Key Competencies table to see what you will gain from the topic.

Problem Solving Activity

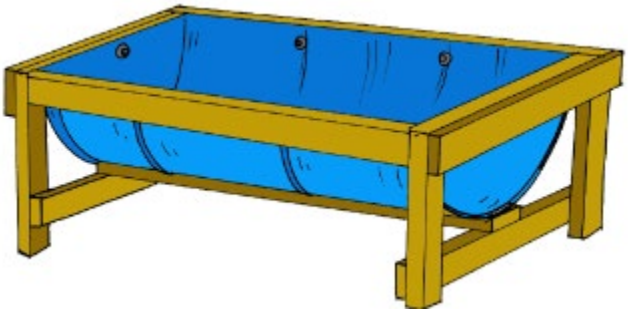
Topic 1.3 Task 2:

Part 1:

1. Observe each of the pictures below:

A1

A2



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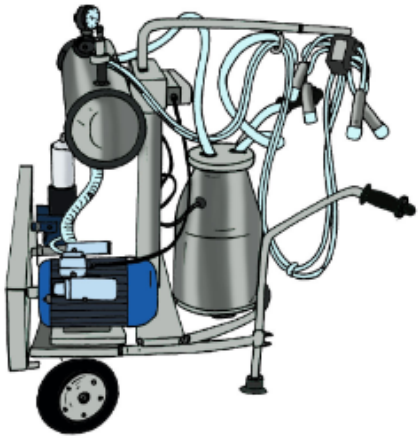

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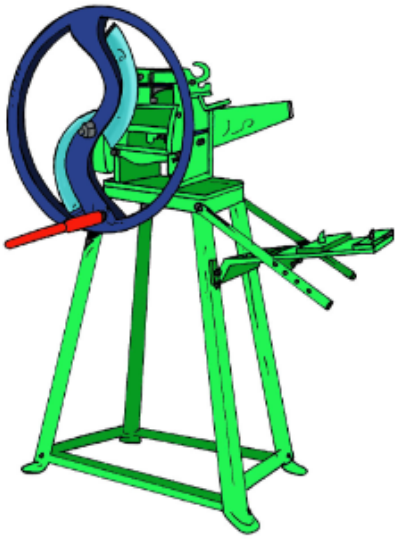

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2. Brainstorm answers to the following questions:

a. What do you think each piece of equipment is called?

b. What do you think each piece of equipment does? Discuss this with one of your colleagues.

c. Where do you think these pieces of equipment should go on a ruminant farm?

3. Give comments and ask any questions before moving on.

Part 2:

1. Observe a piece of equipment brought in by your trainer and guess the name of the equipment.

2. Volunteers to come in front of the class and help the trainer show the rest of class how to disassemble and reassemble the equipment.

3. Share the skills you learned from this practice. Ask questions and give comments. Tell the trainer if you need another demonstration for disassembly or reassembly of the sprayer in order to fully understand the content.

1.3 Key Facts

- **Equipment used in a cattle shelter:**
  - **Feeders**: Feeding material made from metal, plastic, timber, or construction using cement, bricks (or stones), and sand.
  - **Drinkers**: Water troughs, usually made of galvanized steel, plastic, or construction using cement, bricks (or stones), and sand.
  - **Milking equipment**: Made from stainless steel in order to preserve quality and safety.
  - **Sprayers**: Used to apply acaricides that control/kill the spread of mites and lice that live on animals.
  - **Choppers**: Used to cut straw, hay, or oats into small pieces for mixing with other feed to feed ruminants. This helps the animals digest their food.

- **Milking equipment**
  - **Milking machine**: Used to facilitate the flow of milk from the cow into a container.
  - **Cans**: Used to store and transport milk.

- **Role of equipment:**
  - **Feeders**: Used to distribute small pieces of grass and concentrates.
  - **Drinkers**: Used to distribute drinking water.
  - **Milking equipment**: Used for milking and milk collection.

- **Sprayers**: Used in the application of acaricides on animals (acaricides are substances that are poisonous to mites and ticks).
  - Each type of acaricide has its own dilution ratio. Always use diluted acaricide to avoid contamination of the environment. The safe use of acaricides is essential to an efficient, well-run program for the control of ticks.
- **Chopper**: Used to cut food into small pieces.

- **Location of equipment in a cattle shelter:**
  - **Feeders**: In all blocks (shelter parts) that keep animals.
  - **Drinkers**: In all blocks (shelter parts) that keep animals.
  - **Milking equipment**: In the milking block and/or store.
  - **Sprayers**: Mobile or fixed on an appropriate space outside of the shelter.
  - **Chopper**: Mobile or fixed on an appropriate space inside or outside of the shelter.

Guided Practice Activity

Topic 1.3 Task 3:

1. Read through **1.3 Key Facts** and look back at the pictures from the **Problem Solving Activity (Topic 1.3 Task 2)** for reference.

2. Form small groups. Choose a group secretary to write the answers and a group architect to draw the model.

3. Read the following scenario and questions together as a class:

A farmer in Kigali City has 20 cows with some calves, all in a zero-grazing system where they are kept within housing structures and food is brought to them. The farmer is planning to equip the shelter with the most important equipment that will help him make the most money and take good care of his animals.

The farmer knows that you have some knowledge and skills regarding how to equip ruminant shelters. You are requested to:

a. Identify the equipment needed in the cow shelter.

b. Explain the role of each piece of equipment.

c. Allocate the equipment in the shelter.

d. Draw and label the shelter with all the necessary equipment.

4. Read through **1.3 Key Facts** again out loud.

5. With your group, answer all the questions while the group secretaries write the answers. Discuss each answer before it is written in order to get the best answers.

6. After your discussion, share your ideas in a large group discussion. Write your group's answers on the board/flipchart. Direct the other groups to comment on the first group's answers. Refer to **1.3 Key Facts** for guidance.

7. Then, participate in a gallery walk—walk around the room to observe the others' drawings and give feedback.

Application Activity

Topic 1.3 Task 4:

Part 1:

1. Visit a farm/livestock input shop and greet the employees.

2. Observe and name different pieces of equipment in the shop.

3. Form small groups. If possible, disassemble and reassemble at least two pieces of equipment. Ask for support as needed.

4. After reassembling the equipment, demonstrate that the reassembled equipment is working properly.

5. At the end, thank the farmer/livestock input seller for helping you. Ask any questions or give comments to the farmer/livestock input seller before leaving.

Part 2:

1. Visit a cattle shelter.

2. Observe different pieces of equipment in the shelter.

3. Form small groups. Each group will receive a card with a piece of equipment written on it. Find that piece of equipment in the shelter. After your group has identified each piece of equipment, discuss how that equipment functions in the shelter.

4. Select one person from your group to act as a speaker. Have the speaker the rest of the trainees about your assigned piece of equipment and its purpose/function in the animal shelter.

Points to Remember

- The equipment commonly used in ruminant shelters are feeders, drinkers, milking equipment (milking machine and cans), sprayers, and choppers.

Formative Assessment

After carefully reading the following items, answer the following questions individually:

1. List the five most important pieces of equipment in a dairy ruminant shelter.
   1.
   2.
   3.
   4.
   5.

2. Why do you think it is necessary to have a chopper for ruminants?

3. Do you need to dilute acaricides before spraying? Support your answer by giving reason(s).

4. Answer: True or False
   a. The role of the feeder is to clean the shelter.
   b. Sprayers can be used in the application of acaricides on animals.
   c. Choppers must always be mobile in a ruminant shelter.

5. Choose the correct answer:
   The best equipment to collect milk is made from:
   a. Wood
   b. Plastic
   c. Metal
   d. Stainless steel

Topic 1.4: Maintain shelter

Key Competencies:

Knowledge	Skills	Attitudes
1. Explain the role of maintenance in ruminant farming.	**1.** Evaluate a shelter and the status of its' equipment.	**1.** Observant
2. Identify the components to evaluate in a ruminant shelter.	**2.** Establish a maintenance plan for a ruminant shelter and accompanying.	**2.** Realistic
3. Identify maintenance activities in ruminant farming.	**3.** Implement a shelter and an equipment maintenance plan.	**3.** Proactive

Getting Started: What do we know and where are we going?

Topic 1.4 Task 1:

1. Discuss how we maintain equipment and machines in our daily lives. Give examples.

2. Brainstorm common maintenance activities as a class.

3. Observe the brainstormed answers and discover the topic you are going to learn.

4. Turn to the Key Competencies table in their trainee manuals to see what you will gain from the topic and review it together.

Problem Solving Activity

Topic 1.4 Task 2:

1. Read the following scenario:

A dairy farm in Kicukiro has various equipment, including a fodder chopper and milking machines. The owner is planning to hire personnel to oversee maintenance for the shelter and its equipment.

Imagine that you are interested in applying for that job. In the interview with the farmer, you are asked to do the following:

a. List the types of maintenance applicable in farms.

b. Provide an example maintenance plan.

c. List the components of the shelter that you must inspect.

d. List activities that are part of an elaborated maintenance plan.

2. Form small groups of four trainees (one question per trainee) and discuss the answers using the knowledge gained from the previous learning outcomes.

a. Select one person in each group to write the answers on the board/flipchart.

b. Provide comments on the answers of each group.

3. You will have an opportunity to revise your answers after discussing **1.4 Key Facts** as a class.

1.4 Key Facts

- **Types of maintenance:**
  - **Day to day repair**: daily tasks
  - **Annual repair**: once a year tasks
  - **Special repair**: tasks performed as challenges arise (broken machinery, etc.)
  - **Additions and alterations**: tasks that meet the special requirements for functional efficiency
  - **Preventive maintenance**: tasks to keep your farm as efficient as possible[6]

- **Evaluation and maintenance are applied to:**
  - Roofs
  - Walls
  - Floors
  - Annexes
  - Equipment & Machinery

- **Maintenance plans include:**

[6] The Constructor. (n.d.). *Types of building repair and maintenance services*. https://theconstructor.org/building/building-repair-maintenance-service-types/6903/

- **Daily activities**: cleaning, inspection of the shelter and equipment, and simple or urgent repairs
- **Weekly activities**: oiling machines*, and repairs or replacements to the shelter and any equipment)
- **Monthly activities**: repairs and replacements, oiling machines*, liming, and painting on the shelter and any equipment
- **Annual activities**: repairs and replacements, liming, painting
- **Note**: Maintenance plans and activities change as new challenges arise. It is essential for a farmer to be flexible and resourceful when maintaining and finding solutions to problems that arise on his/her farm.

  *Machines with gears and moving parts should be oiled according to the manufacturer's recommended frequency.

- **Maintenance activities:**
  - **Routine maintenance**: regular inspection and repair of all shelters
    - Keeps your farm running efficiently and is essential in avoiding expensive and complicated machinery and equipment failure.
  - **Regular hygiene**: cleaning, liming, painting, disinfecting, spraying
    - Helps keep your animals healthy and helps the materials on your farm last longer and look better.
    - Lime is crushed up limestone – also known as Calcium Carbonate. It's used to prevent the smell of ammonia build-up and odours in barns and stalls. Ammonia comes from the urea in livestock waste when it's left sitting and not cleaned up. Ammonia can cause a variety of problems for your livestock, such as, respiratory issues and immune system issues. Barn lime can help keep animal pens, barn floors and gutters all clean, dry and sweet.[7]
  - **Repairing fixtures and equipment**: Immediately repair when something breaks
    - Avoid a loss in productivity or other machines/equipment also failing as a result.

- **Role of maintenance:**
  - To keep the construction strong, such as the roof, walls, floor, and annexes.
  - To keep a good image of the farm to the employees, customers and the community.
  - To better conserve and increase the life expectancy of equipment.
  - To improve safety and quality conditions for all activities.[8]

[7] Piek, L. (n.d.). *What is barn lime & why do I need it?* Blain's Farm & Fleet Blog. https://www.farmandfleet.com/blog/what-is-barn-lime-why-do-i-need-it/

[8] Joyner, J. (2018, June 29). *The duties of a building maintenance worker*. Chron. https://work.chron.com/duties-building-maintenance-worker-14163.html

- **Role of hygiene**:
  - **Cleaning**: To prevent diseases (for animals and human), control outbreaks, and keep a good image of the farm.
  - **Liming**: To kill pathogens for diseases prevention.
  - **Painting**: To increase the life expectancy (for construction and equipment) and to keep a good image.

Guided Practice Activity

Topic 1.4 Task 3:

1. Read through the **1.4 Key Facts**. Volunteer to read different **1.4 Key Facts.** As you read, give examples of other types of maintenance you are already familiar with.

2. Identify if the following tasks are done daily, weekly, or monthly.
   a. I cut (maintain) my hair every week. What type of maintenance is this?

   b. I wash my body every morning. What type of maintenance is this?

   c. I clean my car and change my oil every month. What type of maintenance is this?

3. Read the following situation individually:

   Mugisha is a businessman and wants to run a farm of Merino sheep in Musanze. Since he is a beginner, you are going to give him more information regarding shelter and equipment maintenance.

4. Return to your group from the previous activity and answer the following questions:
   a. Explain the role of hygiene: cleaning, liming and painting.

   b. Explain why regular maintenance of shelter and equipment is necessary.

   c. Establish a maintenance plan for his farm that he can follow. Your plan must include activities that Mugisha should perform daily, weekly, monthly and annually.

5. Share your answers with the class while the trainer writes the answers.

6. Provide any comments you have.

Application Activity

Topic 1.4 Task 4:

1. Visit a farm and greet the farmer.

2. Explain the role of maintenance to the farmer.

3. Separate into small groups and select a leader in your group.

4. Do the following tasks with your group:

a. Inspect the shelter (roof, wall, floor, facilities) and equipment and evaluate their status.

b. Explain what maintenance activities are needed for the shelter and equipment.

c. With the farm workers, participate in a maintenance activity: cleaning, liming (if possible), or repairing (if possible).

d. Propose a maintenance plan for this farm.

5. At the end, present your group's results and reflections from the tasks.

6. Finally, make general comments as a class and listen to the trainer's feedback based on the status of the shelter and the equipment.

Points to Remember

- Routine maintenance helps to extend the life of construction and equipment.
- It is important to have a detailed and specific maintenance plan because it keeps the farm up to date and running effectively.
- You must clean off the equipment before performing maintenance.
- Any malfunction or damage should be repaired as soon as possible.

Formative Assessment

After carefully reading the following items, answer the following questions individually:

1. State the role of shelter and equipment maintenance.

2. Answer with **True** or **False**:
   a. All maintenance of a shelter and equipment is done only once a month.
   b. A farm should normally have a written maintenance plan.
   c. Oiling machines is done as often as indicated by manufacturer.

3. Name 3 activities you can include in a farm maintenance plan.
   1.
   2.
   3.

4. Circle the wrong answer.
   The types of maintenance are:
   a. Day to day repair
   b. Annual repair
   c. Special repair
   d. Record keeping
   e. Addition and alteration repair
   f. Preventive maintenance

5. What are the parts (components) of a farm that are inspected during the development of a maintenance plan?

6. Complete the following sentences:
   1. Farmers should be _____ and _____ when maintaining and finding solutions to problems on their farms.

   2. Applying lime helps to _____in barns and stalls.

Self-Reflection

1. You have come to the end of the unit. You are going to do the survey you did at the beginning of the unit again to help you do self-assessment of your knowledge, skills and attitudes.

Again, there are no right or wrong answers to this survey. It is for your own use to gauge your knowledge, skills and attitudes after the unit. Read the Knowledge, Skill or Attitude in the left column. Think about yourself: do you think you can do this? How well? Read the statements across the top. Put a check in column that best represents your situation.

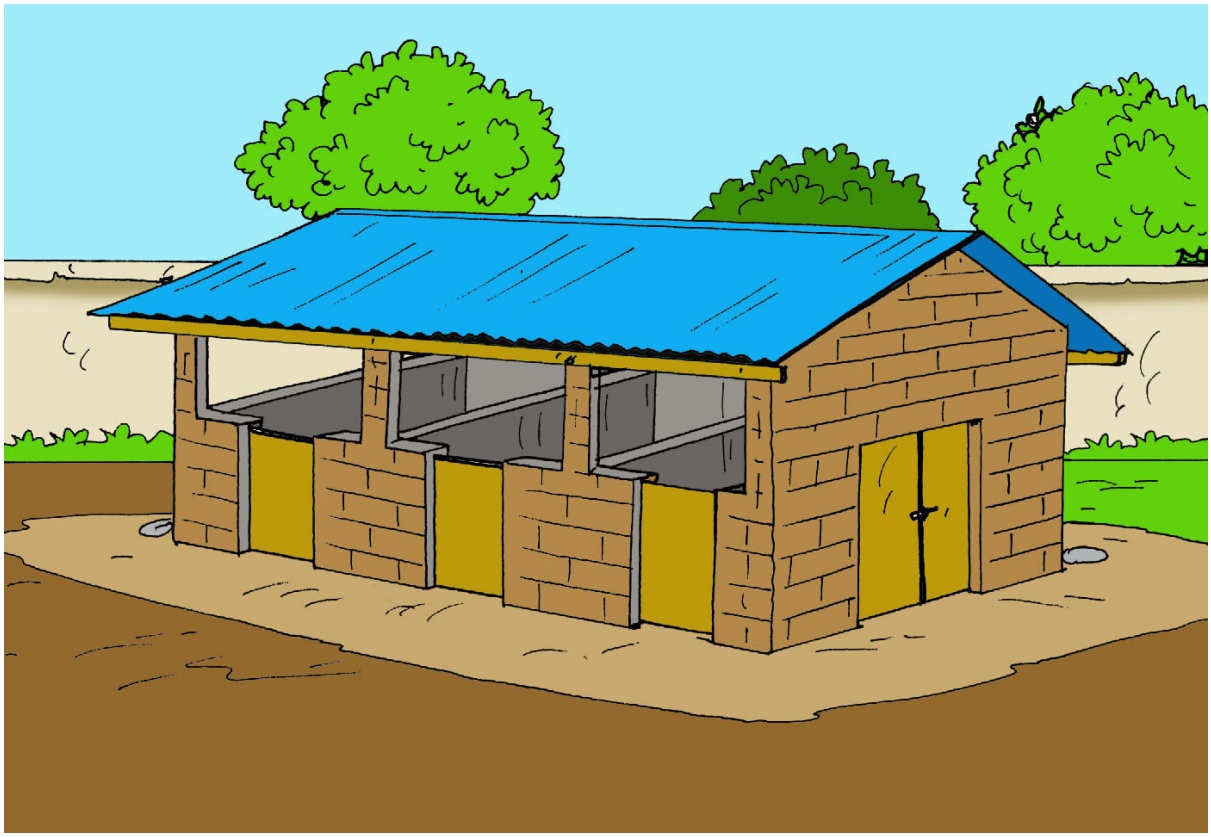
My experience **Knowledge, skills, and attitudes**	**I don't have any experience doing this.**	**I know a little about this.**	**I have some experience doing this.**	**I have a lot of experience with this.**	**I am confident in my ability to do this.**
Describe the factors considered in selecting a site for ruminant shelter construction.					
Assess soil and weather factors for ruminant shelter construction.					
Identify the parts/blocks and facilities needed for ruminant shelters.					
Identify construction materials for ruminant shelters.					
Identify and determine the uses of equipment in ruminant shelters.					
Install and use common equipment in ruminant shelters.					
Identify the components to evaluate during					

My experience Knowledge, skills, and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
maintenance of ruminant shelters.					
Establish and implement a maintenance plan of ruminant shelters and equipment.					

2. Complete the table below by identifying areas from the unit where you have improved and where you need improvement with the actions/strategies you will use to help you improve when receiving and interpreting information at the workplace.

Areas of strength	Areas for improvement	Actions to take to improve
1. **2.**	**1.** **2.**	**1.** **2.**

Unit 2: Assist in piggery construction



Topics

2.1 Select a site

2.2 Organize construction

2.3 Equip a piggery

2.4 Maintain a piggery

Unit Summary:

In this unit, you will gain knowledge, skills, and attitudes related to pig shelter, also known as piggery, construction. At the end of this unit, you will be able to select a site for piggery construction and organize construction activities. You will also learn how to equip a piggery and carry out the necessary maintenance.

Self-Assessment: Unit 2

1. Look at the unit illustration. What do you see? What do you think this unit will be about? What topics might be covered?

2. Fill in the self-assessment below.

There are no right or wrong ways to answer this survey. It is for your own use during this course. The trainer will read a skill that is listed in the left column. Think about yourself: do you think you can do this? How well? Read the statements across the top. Put a check in column that best represents your situation. At the end of this unit, we'll take this survey again.

My experience **Knowledge, skills, and attitudes**	**I don't have any experience doing this.**	**I know a little about this.**	**I have some experience doing this.**	**I have a lot of experience with this.**	**I am confident in my ability to do this.**
Describe the factors considered in selecting a site for piggery construction.					
Identify soil and weather factors while selecting a site piggery construction.					
Be aware of the risks during site selection for a piggery.					
Identify the parts (pens) and other facilities needed in a piggery.					
Interpret a sketch/diagram and select materials for piggery construction.					
Develop a team working spirit and be a willing participant in construction activities.					

My experience Knowledge, skills, and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Identify different equipment and their uses in a piggery.					
Install and test common equipment used in a piggery.					
Be methodical and creative while installing equipment in a piggery.					
Identify the components of a piggery to evaluate for maintenance.					
Establish and implement a piggery maintenance plan.					
Be attentive and observant during the maintenance of a piggery and accompanying equipment.					

Topic 2.1: Selecting a site for piggery construction

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify the criteria to select a site for piggery construction.	**1.** Select a good site for piggery construction.	**1.** Risk awareness
2. Describe the soil conditions for piggery construction.	**2.** Assess the soil for piggery construction.	**2.** Proactive
3. Identify weather factors to consider in the selection of the piggery site.	**3.** Assess weather factors for piggery construction.	**3.** Teamwork spirit

Getting Started: What do we know and where are we going?

Topic 2.1 Task 1:

1. Brainstorm what factors you should think about when selecting a site for pig shelter construction.

2. Look at the Key Competencies table above to see what you will gain from the topic.

Problem Solving Activity

Topic 2.1 Task 2:

1. First, review Unit 1 by discussing the following questions:
   a. What kind of effect does farm waste have on water and air pollution?

   b. What weather factors should a farmer consider when building a shelter?

   c. What is one regulation you remember from Unit 1?

   d. Animal shelters are most easily constructed on which type of topography/land?

2. Now, read the following scenario:

   A small farmer named Mugenzi in Nyamagabe is planning to become a professional and wants to expand his pig farm. He asks for help with installing a piggery. He is going to buy new land and you are asked to help him find some information.

3. In your assigned group, discuss the following questions according to your group. Have the group leader write the answers.

   Group A:
   a. Based on your knowledge from Unit 1, what laws and regulations may Mugenzi need to consider before beginning his construction on the piggery?

   b. What type of criteria do you think is necessary for selecting a good location for a piggery?

Group B:

Provide this group with photos of topography and samples of soil structures.

a. Based on what you learned from Unit 1, describe different types of topography and their impact on construction.

b. Describe different soil structures and their impact on construction.

Group C:

a. Explain the impact of farm waste on the groundwater to Mugenzi.

b. Are there any weather factors that Mugenzi should consider? What are they?

4. Have your group leader share your ideas. While other groups are presenting, ask questions and give comments.

5. After all groups have presented, add any other ideas that are missing.

2.1 Key Facts

- **Land management regulations and laws in Rwanda:**
  - Official Gazette nº Special of 16/06/2013 determines the use and management of land in Rwanda[9]
  - Includes ministerial orders related to master plans and land use

- **Impact of land management regulations on animal shelter installation:**
  - Construct animal shelter on a farmer's own land or officially rented land.
  - Respect the land use master plan.
  - Construct piggeries in a zone reserved for livestock when you are in urban land.
  - In urban land, permission from legal authorities is required before construction of piggery.
  - Respect legal distance from swamps, marshland, river, and lakes.

- **Types of topography and their impacts on piggery construction:**
  - **Mountains and Hills**: Piggery construction needs more land preparation as the slope increases.
  - **Plains and Plateaus**: A piggery is easily constructed on this topography.
  - **Valleys:** Rwanda regulations do not allow the construction of animal shelters on this type of land.

[9] International Labour Organization. (2013, June 16). *Official gazette no special of 16/06/2013*. https://ilo.org/dyn/natlex/docs/SERIAL/94019/110205/F-1367378394/RWA-94019.pdf

- **Impact of the different soil structures on ruminant shelter construction:**
  - Soil structure is the arrangement of particles that vary in size and shape.
  - The more difficult the soil is to compact, the more it needs a strong foundation and wall.
  - From the smallest, the soil particles are: clay, silt, sand, and gravel.
    1. **Single-fraction soils** (soils with particles of the same size, like fine sand) is difficult to compact.
    2. **Uniformly graded granular soils** (a mixture of sand and gravel) cannot be compacted.
    3. **Mixed-fraction soils** (soil particles of different sizes like clay and sand) are easy to compact. Clay has smaller particles that move into the space between the larger particles and its' high-water content facilitates the work. This structure is also favourable as it absorbs water to avoid flooding around the construction.[10]

- **Impact of farm waste on ground water quality:**
  - Do not install a piggery near water.
  - Urine and water infiltration cause ground water pollution.
  - May negatively affect the health of ecosystems and nearby communities.

- **Weather factors to consider when selecting a site for a piggery:**
  - Wind direction and speed: Optimum 0.2-1 m/s
  - Natural Light
  - Temperature: Optimum 10-20 ^{o}C
  - Precipitation (rain)

- **Role of checking climatic parameters in selection of piggery site:**
  - Weather parameters include air temperature, atmospheric (barometric) pressure, humidity, precipitation, solar radiation and wind.
  - The environmental conditions produced by different weather parameters have an impact on the quality of the surrounding ecosystem.
  - Climatic parameters help determine the construction materials to use considering the speed and direction prevailing winds, the amount of precipitation (rain), and the average temperature of a specific location

- **A good site for piggery construction:**

[10] Lescohier, J. (2006, August 14). *The science of soil compaction*. For Construction Pros. https://www.forconstructionpros.com/equipment/compaction/article/10303359/the-science-of-soil-compaction

- Easy to access a good, all-weather road.
- Easy to access clean water.
- Sufficient distance from residential areas.
- Safe location (security).
- Location allowed by government regulations.
- Adequate topography.
- Soil which is easy to compact.
- Favourable (good) weather parameters for construction.[11]

- **Weather factors considered when selecting site for ruminant shelter construction:**
  - Wind direction and speed: Optimum 0.2-1 m/s
  - Natural light
  - Temperature: Optimum 10-20 ^{o}C
  - Precipitation (rain)

Guided Practice Activity

Topic 2.1 Task 3:

1. First, read through the **2.1 Key Facts** with your class.
   a. Take turns reading sections from **2.1 Key Facts**.
   b. Note the similarities between site selection for ruminant and pig shelters.

2. Return to **Topic 2.1 Task 2** and revise your answers based on the information provided in **2.1 Key Facts.**
   a. Share any changes you made.

3. Now, return to your group formed in the previous activity.

4. Receive and read a picture of a location along with several bullet points that provide details on the picture's surroundings and topography.

5. Read the following scenario and answer the following questions with your group:

[11] Food and Agriculture Organization of the United Nations (FAO), & Informartion Network on Post-Harvest Operations (INPhO). (1988). *Farm structures in tropical climates: Pig housing*. https://www.fao.org/3/s1250e/S1250E13.htm

Your friend wants to construct a piggery in the location of the picture your trainer has provided. Your help is requested to determine if the location will be suitable or not. You are requested to do the following with your group:

a. Examine the picture and read the details that come with it. Could there be a piggery here? Why or Why not?

b. Assume that the weather in the location is the same as where you are now. Using a thermometer, hygrometer, anemometer, and compass, show how to assess weather parameters to make sure that they meet pig farming criteria. Is this a good location?

c. Based on the information, are there any unfavourable characteristics for piggery construction? Explain your reasons.

6. Discuss your responses while a volunteer writes the responses. Refer to **2.1 Key Facts** and ask for support as needed.

7. After your discussion, participate in a large group discussion. Have a volunteer you're your group to share the answers. Listen and comment/provide feedback to other groups.

Application Activity

Topic 2.1 Task 4:

1. Visit a site in the community with your class.

2. Form small groups and equip yourselves with measuring instruments (thermometer, anemometer, hygrometer and compass).

3. The site is where the school wants to construct a piggery. With your group, perform the following tasks:

a. Observe the land and explain if it meets legal requirements.

b. Assess the topography and explain its impact on piggery construction.

c. Assess the soil structure and explain its impact on construction activities.

d. Using your instruments, assess the weather parameters and give your observations.

e. What do you think the impact of this farm will be on the groundwater at this site? What is your recommendation?

f. What do you think of the facilities, security, and neighbourhood relations at this site (including distance from residential houses)?

4. When all the groups have finished, share your findings and decisions.

5. Listen to observations and feedback from the trainer.

Points to Remember

- A good site for piggery construction has access to a good, all-weather road and clean water.
- Piggeries should be located a sufficient distance from residential areas and in a safe/secure area.
- Remember to check if the location is allowed by government regulations.
- Determine if the piggery location has adequate topography, easily compacted soil, and favourable weather conditions for construction.

Formative Assessment

After carefully reading the following items, answer the following questions individually:

1. Describe the qualities of a good site for piggery installation.

2. Read the following scenario and offer your advice to Jean Claude.

Jean Claude lives in a crowded community with a reliable source of clean water near his house. He thinks this will be perfect for the construction of a piggery.

Explain why it may **not** be a good idea for him to construct a piggery in his community:

3. Answer with **True** or **False**:

a. A mixed fraction soil is a best soil structure for piggery construction.

b. Among the types of topography, valleys are suitable for piggery construction.

c. Checking weather parameters helps to determine the construction materials for a piggery.

4. Using the appropriate instruments, demonstrate how to assess the weather parameters before beginning construction of a piggery.

Topic 2.2 Organise construction

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify the parts in a piggery.	**1.** Interpret the sketch of a piggery.	**1.** Proactive
2. Identify other facilities for pig production and management.	**2.** Select construction materials for a piggery.	**2.** Willingness
3. Identify construction materials for a piggery.	**3.** Assist in piggery construction.	**3.** Teamwork spirit

Getting Started: What do we know and where are we going?

Topic 2.2 Task 1:

1. Think about the learning outcomes from building and organizing ruminant shelters. As a class, brainstorm and review some of the information from **1.2 Key Facts**.

2. Consider the following guiding questions about **Topic 1.2**. Discuss and review your answers with your peers.

a. Do you remember the different parts of a cow shed? What are they? Do you think they will be similar or different for a piggery? Why?

b. What facilities are in ruminant shelters? Do you think they will be similar or different for pigs? Why?

c. What are some of the common materials used to build a ruminant shelter? Do you think those will be similar for pigs?

3. Brainstorm answers and write your ideas on the board/flipchart. Remember that because this is a brainstorm, there are no wrong answers. All of the correct information will be provided and discussed within this learning outcome.

4. After all the questions are answered, look at the Key Competencies table above to see what you will gain from the learning outcome.

Problem Solving Activity

Topic 2.2 Task 2:

1. Form small groups.

2. Receive 10 to 15 index cards with materials and/or components of a shelter written on them.

3. Your task is to determine which materials and components you think you need for a piggery and which do not belong. Sort the cards into "Need" and "Do Not Need" piles and list them below. Everyone in your group must come to a consensus (everyone agrees).

Need for Piggery Construction	Do Not Need for Piggery Construction

2.2 Key Facts

- **Different parts of a piggery:**
  - Pregnant sow pens/block
  - Lactating sow pens/block
  - Weaner pens/block
  - Growing pens
  - Fattening pens/block
  - Breeding boar pen
  - **Note:** An east-west orientation of a piggery is preferable to minimize exposure to the sun.

- **Space for each category of animal: ***
  - Farrowing /Suckling pen: 6-10 m^2

- Boar: 6-10 m^2
- Breeding sow: 1.64-2.25 m^2/sow
- Weaner pen: 0.25-0.35 m^2/piglet
- Growing pens: 0.4-0.5 m^2/pig
- Fattening /Finishing pens: 0.5-0.9 m^2/pig

***Note:** The space varies with the size and density of the pigs (low density, medium density or high density).

- **Other facilities**:
  - Storage rooms/block
  - Office and sanitation rooms/block
  - Feeding alley
  - Waste management facilities (i.e. manure alley, drainage)

- **Factors to consider in selection of piggery construction materials:**
  - Availability
  - Cost
  - Technology
  - Durability
  - Strength

- **Some of construction materials for piggery:**
  - Wood
  - Timber
  - Metal sheet
  - Nails
  - Bricks
  - Concrete blocks
  - Cement
  - Sand
  - Stones
  - Metallic tubes[12]

[12] Food and Agriculture Organization of the United Nations (FAO), & Informartion Network on Post-Harvest Operations (INPhO). (1988). *Farm structures in tropical climates: Pig housing*. https://www.fao.org/3/s1250e/S1250E13.htm

Guided Practice Activity

Topic 2.2 Task 3:

1. Separate into five groups.

2. Each group will be assigned one of the five sections of **2.2 Key Facts**. Discuss the section of **2.2 Key Facts** your group is assigned.

3. After five minutes, present your section to the rest of the class. While other groups are presenting, ask questions and make comments to help everyone understand.

4. Now, read the following scenario and tasks:

A farmer named Jean is starting a project of producing piglets which he will eventually sell after weaning. He will have five breeder sows and estimates that he will raise 75 piglets every six months. His architect is referring to you for the technical specifications. He asks you to:

a. Calculate the space needed for five sows that will stay permanently in the same pens.

b. Calculate the space needed for the weaner pens for 75 piglets.

c. Propose construction materials so that the farmer and architect can have what they need to begin building.

5. Discuss the tasks and refer to **2.2 Key Facts** as needed.

6. After all the groups have finished discussing, one group should write their answers on the board/flipchart. Then, others should make amendments (add answers and other comments).

7. Listen to observations and feedback from the trainer.

Application Activity

Topic 2.2 Task 4:

Part 1:

1. Visit a field around the school. The place is being considered as a site for piggery construction.

2. Form small groups and choose a group leader.

3. Look at the picture at the beginning above. Imagine you are on the field of a farmer who needs to construct a piggery like the one shown in the picture. The farmer has one boar, two sows, and 11 new piglets. The farmer needs your help. In your group, do the following tasks:

   a. Create a new sketch of the piggery with the correct dimensions needed for his pigs as well as the correct orientation of the shelter.

   b. List the construction materials that he will need.

   c. Check the availability of needed facilities or possibility to create them.

   d. Write a report for the farmer that will show him everything he needs to properly get started. The report should include the following information:
   - Space needed
   - Blocks/pens needed
   - Facilities needed

- Construction materials needed
- Factors to consider when buying materials

4. Refer to **2.2 Key Facts** and ask for support from the trainer as needed.

5. After group discussions, share your answers and receive comments from peers.

6. At the end, listen to general feedback from the trainer.

Part 2:

1. Visit a pig farm and greet the farmer and any workers who are present.

2. Observe the following at the farm:

a. The construction materials used in the piggery

b. The parts/pens in the piggery

c. Facilities that may be missing and are needed on the pig farm

3. Volunteer to share what you learned from this experience.

Points to Remember

- Each category of pig--except sow and piglets before weaning--should have separate pens/blocks.
- Pens for boars and suckling pigs should have 6-10 m^2 of space.
- An east-west orientation of a piggery is preferable to minimize exposure to the sun.
- Selection of construction materials is based on their availability, their cost, durability, and technology.

Formative Assessment

After carefully reading the following items, answer the following questions individually:

1. What are the materials used in the construction of a piggery?

2. What should you consider when selecting construction materials?

3. List the different pens you can find in a piggery.

4. Answer with **True** or **False**:
   a. During construction, a piggery is oriented in east-west direction.

   b. During construction, a piggery is oriented in north-south direction.

   c. During the construction of a piggery, space changes according to the size and density of the pigs.

5. Calculate the following:
   a. How much space is needed for 20 suckling piglets?

   b. How much space is needed for nine sows?

   c. What specific pens will be needed for 20 piglets and the nine sows?

Topic 2.3: Equip piggery

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify equipment to use in a piggery.	**1.** Select equipment to use in a piggery.	**1.** Resourceful
2. Determine the uses of equipment in a piggery.	**2.** Install equipment in a piggery.	**2.** Attentive
3. Match the equipment used in a piggery with their place.	**3.** Test the equipment used in a piggery.	**3.** Methodical

Getting Started: What do we know and where are we going?

Topic 2.3 Task 1:

1. Read the following scenario and question:

A farmer knows that you can properly equip a ruminant shelter and as a result, she asks for your advice on equipping a piggery. Based on what you know about ruminant shelters, what equipment do you think the farmer needs to properly manage her piggery?

2. Brainstorm the equipment that is needed in a piggery while the trainer writes your answers on the board/flipchart.

3. Observe the answers you have brainstormed and discover the topic you are going to learn.

4. Look at the Key Competencies table above to see what you will gain from the topic.

Problem Solving Activity

Topic 2.3 Task 2:

1. Form small groups (four or five trainees per group) and choose a group leader.

2. Discuss the following scenario and answer the questions:

A farmer named Rita in Gicumbi bought five pregnant sows to start a modern pig farm. Before bringing the sows to the piggery, she is going to buy and install all the necessary equipment in piggery. As a beginner, she is looking for your advice. Help Rita with the following:

a. What are three pieces of equipment you think she may need in a piggery? Use your knowledge of equipment needed for ruminants.

b. What important could be filled by the equipment you thought of?

c. Based on what you know about the organization of piggeries, where should the equipment be allocated?

3. After discussing, have your group leader share your answers while the trainer writes them the board/flipchart.

4. Listen to the trainer's observations.

5. Note that you will have an opportunity to revise your knowledge and learn the correct answers while discussing **2.3 Key Facts** as a class.

2.3 Key Facts

- **Equipment used in a piggery:**
  - Feeders: Made from stainless metal, plastic, timber or constructed using cement, bricks (or stones), and sand
  - Drinkers
  - Heaters
  - Littering boxes
  - Drenching gun
  - Safety and handling equipment: pig board, hog snare
  - Weighing scale
  - Weighing cage
  - Sprayers
  - Cleaning materials: wheelbarrow, pail, broom, brush, floor squeegee

- **Role of equipment:**
  - **Feeders**: To put food in for feeding.
  - **Drinkers**: To put water in for drinking.

- **Heaters**: To increase microclimate temperature for piglets and during cold seasons; to keep the piglets warm and comfortable.
- **Littering boxes**: To serve as beds for smaller pigs.
- **Drenching gun**: To administer drugs/medicines to the pigs.
  - Should be inserted into the mouth either from the left or right side, rather than straight in front. It should then be placed over the back of the tongue and the medicine gradually administered. Ideally this should all occur while the animal's head is held up to avoid the fluid running out of the mouth.

- **Safety and handling equipment:**
  - **Pig board**: Pig boards can be used to push pigs along and prevent them turning around. They are used to train pigs to be moved by the farmer. The handler should always keep the pig board between himself and the pig.[13]
  - **Hog snare**: A trapping device used to control hogs. This is essential because hogs can be dangerous and difficult to control without the proper equipment to hold them down.
  - **Weighing scale**: A scale used for recording the weight of pigs and feed.
  - **Weighing cage**: A cage that keeps the animal in place while it is weighed.
  - **Sprayers**: A device used to apply chemicals (like acaricides – pesticides that control/kill ticks and mites that can be harmful to the animal).
  - **Cleaning equipment**: Any device used to remove dirt and ensure good hygiene.

- **Location of equipment:**
  - Feeders: In all pens/blocks that keep pigs
  - Drinkers: In all pens/blocks
  - Sprayers: Mobile
  - Littering boxes: Kept with the piglets in the suckling pen
  - Drenching gun: Mobile
  - Weighing scale: Mobile
  - Weighing cage: Mobile
  - Safety and handling equipment: Mobile
  - Cleaning equipment: Mobile

[13] Food and Agriculture Organization of the United Nations. (1994). *A manual for the primary animal health care worker: Chapter 4: The pig*. https://www.fao.org/3/t0690e/t0690e06.htm

Guided Practice Activity

Topic 2.3 Task 3:

1. First, read through the information in **2.3 Key Facts** as a class and be sure that you understand the terminology. Volunteer to read **2.3 Key Facts** as the rest of the class listens carefully.

Part 1:

1. Receive a card with identifying information of equipment written on it (the name, the role, or the location).

2. Walk around the room with your card and match the card with the appropriate piece of equipment.
   a. When you match a piece of equipment with a card, stand next to that equipment.

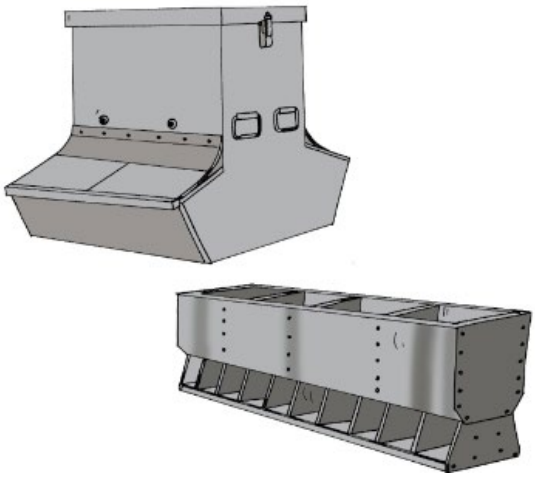
   b. Do this until all cards and equipment are in their correct space.

   c. Refer to **2.3 Key Facts** and discuss with one another before deciding where to stand.

3. After everyone is standing next to a piece of equipment, explain to the class why you matched your card with the equipment you are standing next to.
   a. Listen to each trainee's answer.

   b. Correct answers or add ideas.

4. Listen to the trainer's observations.



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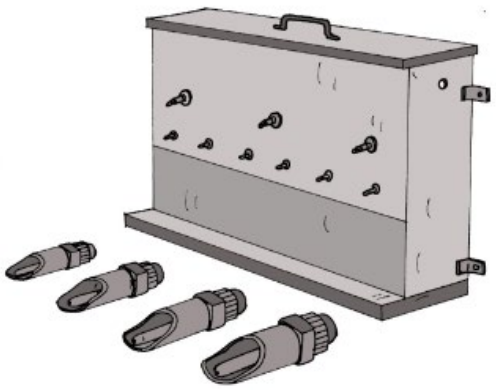

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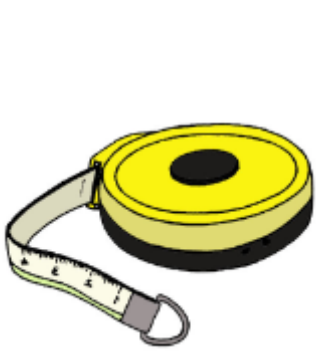

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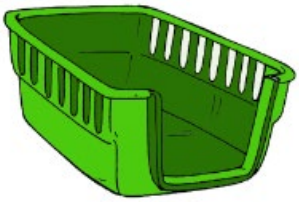

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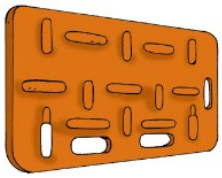

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Part 2:

1. Observe the trainer demonstrate how to assemble and use a piece of equipment.

2. Then, volunteer to help the trainer do the same with two other pieces of equipment. If you do not volunteer, pay attention because you will be doing this in a moment.

3. Form groups of four or five people and receive one piece of equipment per group.

4. With your group, do the following:
   a. Identify the piece of equipment.
   b. Explain the use of the equipment.
   c. Model assembling and using the equipment.

5. Refer to **2.3 Key Facts** and ask for support from the trainer as needed.

6. Share your answers and give comments to other groups.

7. Listen to observations and feedback from the trainer.

Application Activity

Topic 2.3 Task 4:

1. Visit a farm and greet the farmer and any other workers present.

2. Identify the names of the equipment present at the piggery.

3. The farmer will demonstrate several pieces of equipment. Pay attention and ask questions.

4. If possible and with supervision, disassemble and reassemble some of the equipment. Ask for support from the farmer and the trainer as needed.

5. At the end, listen to the trainer's observations and thank the farmer for his/her help.

Points to Remember

- Essential equipment in a piggery includes feeders, drinkers, heaters, littering boxes, drenching guns, a weighing scale, safety equipment, and cleaning equipment.

- Safety and handling equipment include pig boards and hog snares.

Formative Assessment

After carefully reading the following items, answer the following questions individually:

1. List five essential pieces of equipment used in a piggery.
   1.
   2.
   3.
   4.
   5.

2. Why is it important to clean and disinfect equipment after using it?

3. Explain the role of littering boxes in the suckling pen.

4. Answer with True or False:

a. A drenching gun is equipment used for administering drugs to animals.

b. Littering boxes serve as beds to protect the piglets from low temperature.

c. A weighing scale is used for feeding.

d. A pig board is used to carry pigs

5. Explain the purpose of the following pieces of equipment and why they are important to have in a piggery:

a. Pig board:

b. Sprayer:

Topic 2.4: Maintain piggery

Key Competencies:

Knowledge	Skills	Attitudes
1. Explain the role of maintenance of a piggery and equipment.	**1.** Evaluate a piggery and the status of its equipment.	**1.** Attentive
2. Identify which components of a piggery to evaluate.	**2.** Establish a maintenance plan for a piggery.	**2.** Observant
3. Identify necessary maintenance activities.	**3.** Implement a maintenance plan for piggery and its equipment.	**3.** Realistic

Getting Started: What do we know and where are we going?

Topic 2.4 Task 1:

1. Read the following quote and scenario and brainstorm responses to the question:

"Nothing lasts forever."
Imagine you are working on a pig farm. Just like a cattle farm, there are certain activities farmers must do to ensure a long life for the materials and equipment they need for the farm to be effective. What do you think some of these activities may be?

2. As you brainstorm, call out your ideas and answers so the trainer can write them on the board/flipchart.

3. Look at the Key Competencies table to see what you will gain from this topic.

Problem Solving Activity

Topic 2.4 Task 2:

1. Form small groups (about four trainees per group).

2. Read and discuss the following scenario and questions with your group:

A pig farmer in Rwamagana managed to equip his piggery as advised by a livestock professional. However, to meet the maintenance requirements, the farmer has chosen to work closely with your school and your class has been requested to assist him.

a. Brainstorm the role of maintenance in pig farming.

b. Discuss what types of maintenance might take place at a piggery.

c. List the most important maintenance activities at a piggery.

d. Discuss the locations and types of equipment in a piggery you think the farmer should inspect on a regular basis.

3. Discuss each item and nominate a group leader to write your responses.

4. Tell the group leader to write your answers for each question on the board/flipchart. Comment and ask questions to other groups.

5. Listen to the trainer's feedback and observations.

2.4 Key Facts

- **Role of Maintenance:**
  - To keep the construction strong, such as roof, wall, floor, and annexes.
  - To keep a good image of the farm to the employees, customers, and the community.
  - To improve the safety and the quality of the piggery.
  - To better conserve and increase the life expectancy of equipment.

- **Repairing (fixing) vs replacing (buying a new one) a broken piece of equipment:** Consider the following:
  - How long have you had the equipment?
  - Do you still have to make payments on it?
  - What is the estimated cost of a repair?
  - In what condition is the piece of equipment?
  - What is the estimated cost of replacing the equipment with a new one?

- **Types of maintenance:**
  - **Day to day repair**: daily tasks

- **Annual repair**: tasks done once a year
- **Special repair**: on an as needed basis
- **Additions and alterations**: to meet the special requirements for functional efficiency
- **Preventive maintenance**: regular tasks to make sure equipment is running properly[14]

- **Maintenance activities:**
  - **Routine maintenance**: regular inspection and repair of any equipment and annexes
  - **Regular hygiene**: cleaning, liming, and painting
    - Lime is crushed up limestone – also known as Calcium Carbonate. It's used to prevent the smell of ammonia build-up and odours in barns and stalls. Ammonia comes from the urine in livestock waste when it's left sitting and not cleaned up. Ammonia can cause a variety of problems for your livestock, such as, respiratory issues and immune system issues. Barn lime can help keep animal pens, barn floors and gutters all clean, dry and sweet.[15]
  - Repair fixtures and equipment

- **Role of frequently needed maintenance activities**:
  - **Inspection**: To evaluate the status of the piggery construction and equipment and decide what actions must be taken.
  - **Cleaning**: To prevent diseases (for pigs and humans), control disease outbreaks, and keep a good image of the piggery within the community.
  - **Liming**: To kill pathogens for diseases prevention.
  - **Painting**: To increase life expectancy (for construction and equipment), to protect against water damage, and to keep a good image of the piggery within the community.

- **Evaluation and maintenance should be applied to:**
  - Roof
  - Wall
  - Floor
  - Feeding alley
  - Manure alley
  - Annexes (storage room, sanitary room)
  - All equipment

[14] The Constructor. (n.d.). *Types of building repair and maintenance services*. https://theconstructor.org/building/building-repair-maintenance-service-types/6903/
[15] Piek, L. (n.d.). *What is barn lime & why do I need it?* Blain's Farm & Fleet Blog. https://www.farmandfleet.com/blog/what-is-barn-lime-why-do-i-need-it/

- **Maintenance plan includes:**
  - **Daily activities**: Cleaning, inspection of piggery and equipment, simple and urgent repairs
  - **Weekly activities**: Oiling equipment, repairs, and replacements
  - **Monthly activities**: Repairs and replacements, liming, painting, oiling equipment
  - **Annual activities**: Repairs and replacements, liming, painting, additional repairs that may be needed

Guided Practice Activity

Topic 2.4 Task 3:

1. Divide into six groups and read the section of the **2.4 Key Facts** that your group is assigned.

2. After five minutes, read out loud the section your group discussed. Ask questions about other groups' sections and make sure you understand the terminology used.

3. Now, return in your previous group of four from **Task 2**.

4. Read the following scenario and associated questions:

A farmer named Devota in Bugesera is operating an industrial pig farm. After realizing that some of the equipment needs to be repaired or replaced, she decided to include maintenance among her many priorities. Your class is going to advise Devota on piggery maintenance.

a. Write a proposal for a maintenance plan that Devota can follow.

b. List the frequently needed maintenance activities and explain to Devota why they are important.

c. What initial mistake did Devota make? How can she avoid this same mistake in the future?

5. Discuss and have your group leader write the answers on a piece of paper. Use **2.4 Key Facts** for guidance as needed.

6. After the discussion, have your group leader share your answers for each question.

7. Make the comments on the other groups' answers and listen to the trainer's observations and feedback.

Application Activity

Topic 2.4 Task 4:

1. Visit a farm and greet the farmer and any workers present.

2. Volunteer to explain the role of maintenance in pig farming to the farmer.

3. Form small groups (of about five trainees) and choose a group leader. Complete the following tasks with your group:
   a. Create an inspection checklist in the piggery, including roof, wall, floor, alleys, annexes, and equipment to evaluate their status.

   b. Identify the maintenance activities that may be needed for this piggery and its equipment.

   c. Propose a future maintenance plan for this piggery, including roof, wall, roof, alleys, annexes, and equipment.

   d. With the farm workers, participate in cleaning and repairing activities as needed to learn and/or show best practices.

4. At the end of the activity, each group leader gives a short presentation on what your group learned during the visit.

5. Share your group's proposed maintenance plan and needed maintenance from the inspection checklist. Comment (agree/disagree and why) on others' maintenance plans.

6. Listen to feedback from the trainer and thank the farmer for his/her help.

Points to Remember

- Maintenance helps to extend the life expectancy of a piggery and its equipment.
- Elaboration and respect of maintenance plan is a key. It must be detailed and completed as planned.
- It's important to switch off the equipment and/or electricity before performing maintenance. This is an essential safety measure.
- Any mechanical failure or break should be repaired as soon as possible.

Formative Assessment

After carefully reading the following items, answer the following questions individually:

1. Explain the role of maintenance in a piggery.

2. List the types of maintenance in pig farming.

3. List the parts of a piggery to inspect during the implementation of piggery maintenance.

4. Answer with **True** or **False**:
To the pig farmer, good hygiene is very important because it helps:
   a. Control and prevent diseases.

   b. Increase the number of employees and expenses.

   c. Increase life expectancy of the pigs.

   d. Keep a good image of the piggery.

5. How do you decide whether to replace or repair a piece of equipment during routine maintenance in a piggery?

Self-Reflection

1. You have come to the end of the unit. You are going to do the survey you did at the beginning of the unit again to help you do self-assessment of your knowledge, skills, and attitudes.

Again, there are no right or wrong answers to this survey. It is for your own use to gauge your knowledge, skills and attitudes after the unit. Read the Knowledge, Skill or Attitude in the left column. Think about yourself: do you think you can do this? How well? Read the statements across the top. Put a check in column that best represents your situation.

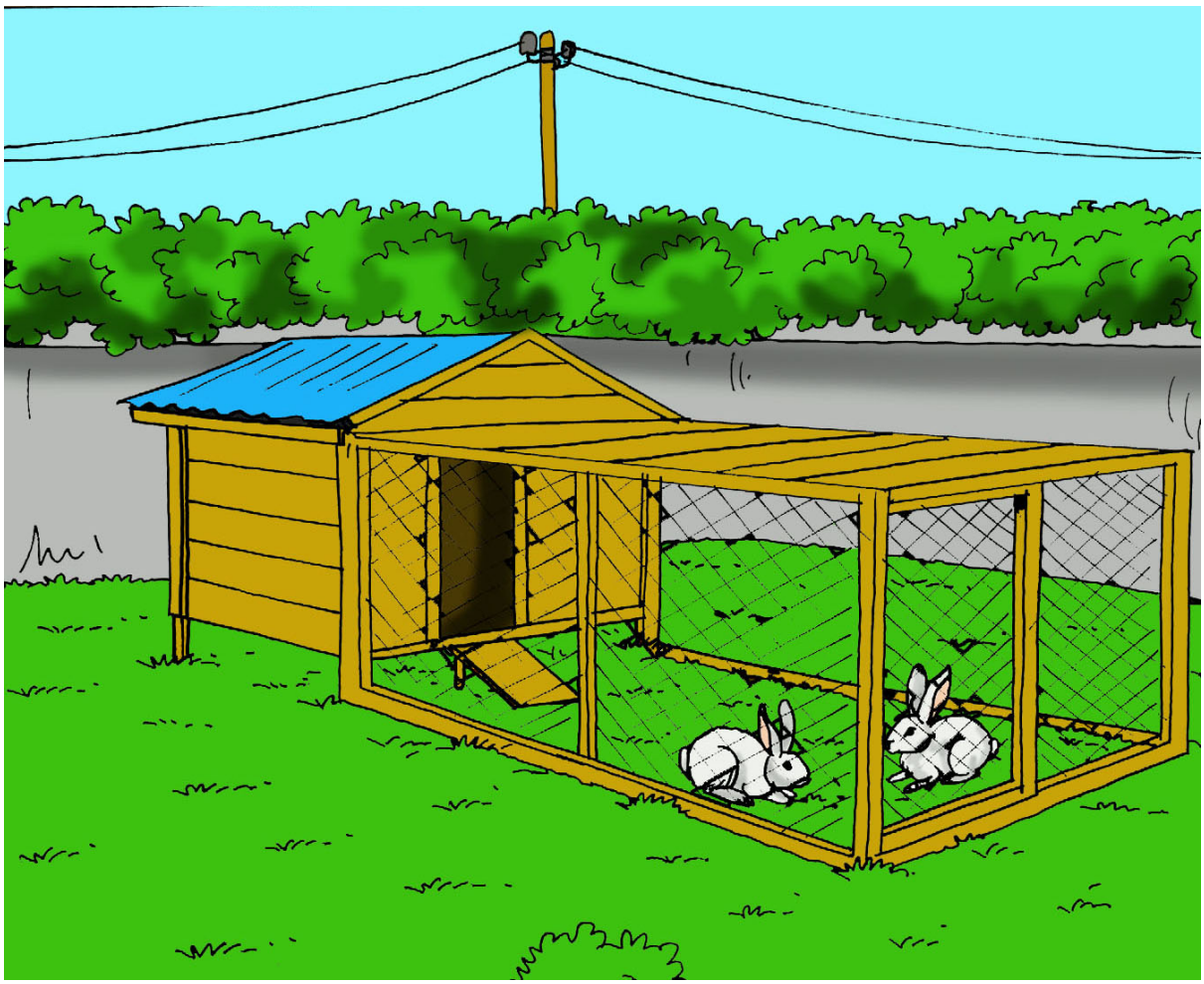
My experience **Knowledge, skills, and attitudes**	**I don't have any experience doing this.**	**I know a little about this.**	**I have some experience doing this.**	**I have a lot of experience with this.**	**I am confident in my ability to do this.**
Describe the factors considered in selecting a site for piggery construction.					
Identify soil and weather factors while selecting a site piggery construction.					
Identify the parts (pens) and other facilities needed in a piggery.					
Interpret a sketch/diagram and select materials for piggery construction.					
Develop a team working spirit and be a willing participant in construction activities.					
Identify different equipment and their uses in a piggery.					

My experience Knowledge, skills, and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Install and test common equipment used in a piggery.					
Identify the components of a piggery to evaluate for maintenance.					
Establish and implement a piggery maintenance plan.					

2. Complete the table below by identifying areas from the unit where you have improved and where you need improvement with the actions/strategies you will use to help you improve when receiving and interpreting information at the workplace.

Areas of strength	Areas for improvement	Actions to take to improve
1. **2.**	**1.** **2.**	**1.** **2.**

Unit 3: Assist in rabbit hutches construction



Topics

3.1 Select site

3.2 Organize construction

3.3 Equip hutches

3.4 Maintain hutches

Unit Summary:

This unit describes the essential knowledge, skills, and attitudes require to construct rabbit hutches, including how to select a good site, organize construction, install the necessary equipment, and maintain that equipment and hutch.

Self-Assessment: Unit 3

1. Look at the unit illustration. What do you see? What do you think this unit will be about? What topics might be covered?

2. Fill in the self-assessment below.

There are no right or wrong ways to answer this survey. It is for your own use during this unit. Read a skill that is listed in the left column. Think to yourself: do you think you can do this? How well? Read the statements across the top. Put a check in column that best represents your situation. At the end of this unit, we'll take this survey again.

My experience **Knowledge, skills and attitudes**	**I don't have any experience doing this.**	**I know a little about this.**	**I have some experience doing this.**	**I have a lot of experience with this.**	**I am confident in my ability to do this.**
Identify the criteria for selecting a site for rabbit hutch construction.					
Assess weather factors for rabbit farming.					
Identify different types of rabbit hutches.					
Identify facilities needed for rabbit farming.					
Identify materials for rabbit hutches construction.					
Identify different equipment used in rabbit hutches.					
Install and test common equipment used in rabbit hutches.					
Identify the components of rabbit hutches to evaluate for maintenance.					

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Establish and implement maintenance plan for rabbit hutches.					

Topic 3.1: Select a site

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify the criteria for selecting a site for rabbit hutch construction.	**1.** Select a good place for rabbit hutch construction.	**1.** Risk awareness
2. Explain the impact of topography on the construction of rabbit hutches.	**2.** Select good topography for rabbit farming.	**2.** Observant
3. Identify weather factors to consider when selecting a site for rabbit hutches.	**3.** Assess weather factors for rabbit farming.	**3.** Resourceful

Getting Started: What do we know and where are we going?

Topic 3.1 Task 1:

1. Brainstorm and discuss everything you can remember about site selection for ruminant and pig shelters. Brainstorm answers to the following:

a. What should you look for?

b. What do you know about soil types and their impact on construction?

c. What types of topography are available in Rwanda for building animal shelters?

2. Observe the answers brainstormed on the flipchart/board and discover the topic you are going to learn.

3. Look at the Key Competencies table above to see what you will gain from the topic.

Problem Solving Activity

Topic 3.1 Task 2:

1. Form three groups (A, B, and C) and choose a group leader.

2. Read the following scenario:

Mugenzi is a young entrepreneur with big goals. After realizing that rabbits are profitable and easy to raise, he decided to start a rabbit farming business. He approaches you for advice on selecting a site for his business.

3. Discuss the questions according to your group (A, B, or C). Group leaders should write the answers down.

Group A:

a. What could be some of the criteria to select the location for rabbit hutch construction?

b. Do you think the same laws and regulations that apply for ruminants and pigs apply for rabbit hutch construction? Why or Why not?

Group B:

Give this group the photos of topography and samples of soil structures.

a. Describe the types of topography and their impact on building animal shelters.

b. Describe the soil structures and their impact on construction activities.

Group C:

a. Explain the impact of farm waste on the groundwater.

b. Ruminants, pigs, and rabbits are all very different animals. What does your group think will be different about building rabbit hutches?

4. Tell the group leader to share your answers. Ask questions and give comments to other groups.

5. After all groups have presented, add any other ideas that may be missing from the answers given.

3.1 Key Facts

- **Land management regulations and laws in Rwanda:**
  - Official Gazette n° Special of 16/06/2013 determines the use and management of land in Rwanda[16]
  - Includes ministerial orders related to master plans and land use

- **Criteria to select a good location**:
  - Location allowed by government regulations
  - Easy access for the farmer
  - Friendly neighbourhood
  - Enough security (protected from predators, noise, and dust)
  - Nearby to utility sources (running water and energy supply)
  - Near public facilities (roads, food stores, etc.)

- **Impact of land management regulations on animal shelter installation:**
  - Construct animal shelter on a farmer's own land or officially rented land.
  - Respect the land use master plan: Use the land for what farmer says it is for – rabbit hutches, piggery, ruminants, etc.
  - In urban land, permission from legal authorities is required before construction of rabbit hutches.
  - Respect legal distance from swamps, marshland, river, and lakes.

- **Types of topography and their impact on rabbit farming:**
  - **Mountains and Hills**: Due to high altitude, there may be strong wind, low temperature, and heavy rains. Construction should be strong enough and temporary shelters are needed to protect rabbits from strong winds, low temperatures, and rain.
  - **Plains and Plateaus:** Best sites due to adequate air circulation, temperature, and precipitation (rain).

[16] International Labour Organization. (2013, June 16). *Official gazette no special of 16/06/2013*. https://ilo.org/dyn/natlex/docs/SERIAL/94019/110205/F-1367378394/RWA-94019.pdf

- **Valleys:** Rwanda regulations do not allow the construction of animal shelters on this topography.

- **Soil structures and their impact on rabbit hutch construction:**
  - Soil structure is the arrangement of particles that vary in size and shape.
  - The more difficult the soil is to compact, the more it needs a strong foundation and wall.
  - From the smallest, the soil particles are: clay, silt, sand, and gravel.
    1. **Single-fraction soils** (soils with particles of the same size, like fine sand) is difficult to compact.
    2. **Uniformly graded granular soils** (a mixture of sand and gravel) cannot be compacted.
    3. **Mixed-fraction soils** (soil particles of different sizes like clay and sand) are easy to compact. Clay has smaller particles that move into the space between the larger particles and its' high-water content facilitates the work. This structure is also favourable as it absorbs water to avoid flooding around the construction.[17]

- **Impact of farm wastes on ground water quality:**
  - Do not install rabbit hutches near water sources (lakes, rivers, swamps) because waste from farming can cause pollution by infiltrating the ground water.

- **Weather factors considered when selecting site for rabbit hutches:**
  - Wind direction and speed
  - Natural Light
  - Temperature (15-20 degrees)
  - Precipitation/humidity

- **Role of checking climatic parameters in selection of a rabbit hutch site:**
  - Climatic parameters help determine which construction materials to use and the size and thickness of walls and openings
  - Consider the speed and direction prevailing winds, precipitation (rain), and temperature.

- **Weather conditions for rabbits:**
  - Adequate air circulation (wind)
  - Fairly natural light
  - Moderate temperature: 15-20 °C

[17] Lescohier, J. (2006, August 14). *The science of soil compaction*. For Construction Pros. https://www.forconstructionpros.com/equipment/compaction/article/10303359/the-science-of-soil-compaction

- Moderate precipitation/humidity

- **In case of unfavourable climate conditions:**
  - To avoid/address lower temperatures in a hutch:
    - Construct solid walls in the direction facing prevailing winds.
    - Provide plenty of hay/straw for the rabbits to sleep.
    - Establish temporary protection from strong winds, low temperatures, and rain using curtains of hessian (a strong, coarse fabric made from hemp or jute, used for sacks.), grass, plastic, etc.
  - In case of hot climate:
    - Increase the ventilation.

- **Notes about rabbits and heat:**
  - Rabbits tolerate heat less well than cold. They cannot sweat like humans do, and they cannot pant like a dog. They get rid of their body heat through their ears, but they will die if they get over-heated.
  - Any temperature above 20 degrees will begin to stress a rabbit. Getting too hot is dangerous for them. They can't pant or sweat to get rid of the heat. At 28 ° C, they get dangerously hot. Therefore, shade must be provided.
  - Hot hutches also make rabbits vulnerable to fly bites.[18]

Guided Practice Activity

Topic 3.1 Task 3:

1. Divide into groups and each group will be assigned a section from **3.1 Key Facts** to read and study for five minutes.

2. After five minutes, present and read your group's section from **3.1 Key Facts** to the rest of the class. Note the last two sections about unfavourable climate conditions and rabbit body temperature**.**

3. Now, stay in your groups and look at an image of a landscape with an accompanying index card/piece of paper detailing the site's topography, climate, proximity to facilities, etc.

[18] Harcourt-Brown, F. (2002). *Textbook of rabbit medicine*. Butterworth-Heinemann Medical; and Harcourt-Brown, F. (2009, May 15). *The rabbit consultation and clinical techniques*. US National Library of Medicine: National Institutes of Health. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7158343/

4. Read the following scenario and related questions:

   Suppose that your school wants to buy land in the country to construct and manage a rabbit farm. Your trainer hands you an image of a possible site along with details of that location and asks you to help the school decide if the location is appropriate for rabbit farming. With your group discuss the following:

   a. Explain and elaborate on each factor to consider when selecting a good place for rabbit hutch construction. Be specific to your location and details your trainer gave you.

   b. Are the climatic parameters suitable for rabbit farming? Demonstrate how you would measure the climatic parameters provided to you by your trainer (temperature, hygrometer, and wind).

   c. Give recommendations and feedback to your school about the location you've been presented with.

5. Use instruments to check the weather parameters (thermometer, hygrometer, anemometer and compass) for **part b.** Demonstrate how to use them to the trainer and your colleagues.

6. After all groups have finished their work, participation in a large group discussion as a class. Select a volunteer in your group to share your answers. Listen to the trainer's comments and observations as needed.

Application Activity

Topic 3.1 Task 4:

1. Visit a space outside of the classroom as instructed by the trainer.

2. Form small groups (of 5-6 trainees) and nominate a group leader.

3. Imagine that the site is where the school wants to construct rabbit hutches. Complete the following tasks with your group:
   a. Within the space provided, select a good place to begin constructing rabbit hutches. Explain the reason why you chose the specific location and orientation.

b. Match the present weather conditions with the preference of rabbit farming using the appropriate instruments.

c. Is the altitude and/or topography good enough for rabbit farming? What is your recommendation for the next step?

4. Use weather checking instruments to measure the wind (direction and speed), temperature, and precipitation for **part b**.

5. After everyone has finished, come together as a call. Tell your group leader to present your group's findings. Comment and ask questions to other groups.

6. Listen to the trainer's observations and feedback.

Points to Remember

- A good site for hutches construction is easy to access and has access to clean water.
- Hutches should be in a friendly neighbourhood where there is security and silence.
- Be sure that the site for construction is allowed by the land management master plan.

Formative Assessment

After carefully reading the following items, answer the following questions individually:

1. What are the characteristics of a good site for rabbit hutches constructions?

2. Answer with **True** or **False**.
Favourable weather conditions for rabbits are:

a. Adequate air circulation (wind)

b. Fairly natural light

c. Moderate temperature

d. Heavy rains

3. Choose the correct answer.
When the weather is either too cold or too windy, you should:

a. Cancel the rabbit farming project
b. Strengthen and increase the wall surface
c. Improve artificially indoor micro-climate
d. Both B and C
e. No correct answer is provided.

4. When your rabbits are too hot, what are two things can you do to help them be more comfortable?

1.

2.

5. When your rabbits are too cold, what are two things can you do to help them be more comfortable?

1.

2.

Topic 3.2 Organize construction

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify different types of rabbit hutches.	**1.** Select the appropriate type of rabbit hutch.	**1.** Risk aware
2. Identify facilities needed for rabbit farming.	**2.** Supervise construction of rabbit hutches.	**2.** Proactive
3. Identify materials for rabbit hutch construction.	**3.** Select construction materials for rabbit hutches.	**3.** Observant

Getting Started: What do we know and where are we going?

Topic 3.2 Task 1:

1. Read and discuss the following scenario and questions:

After being introduced to rabbit farming, you can choose to operate a rabbit farm as a business. Suppose that you have already chosen an appropriate and you are now going to organize the construction.

a. What are the materials you think you will need to construct rabbit hutches?

b. As a resourceful farmer, what should you consider before choosing materials?

c. Do you think you will need facilities in addition to hutches? If yes, list what you think those will be.

2. After all the questions are answered, discover topic you are going to learn.

3. Look at the Key Competencies table above to see what you will gain from the topic.

Problem Solving Activity

Topic 3.2 Task 2:

1. Separate into three groups.

2. Hand each group a poster/image with a type of hutch on it. On the back of the image there will be information about that type of hutch (definition and purpose).

3. Using the images and definitions, infer the following about the hutch that is on your card:

a. Types of materials for construction

b. Advantages of this material

c. Disadvantages of this material

4. Discuss your ideas and write your answers. Remember to carefully inspect the images, read the definitions and purposes, and use the knowledge you learned from past units to make good inferences.

5. After group discussions, the group leaders share the answers from their groups while the trainer writes those answers on the board/flipchart.

6. Add comments and ideas.

3.2 Key Facts

- **Different types of rabbit hutches/colonies**
  - A hutch is a type of cage/enclosure that houses rabbits or other small domestic animals

Types of Hutches/Colonies	Construction Materials	Advantages	Disadvantages
Ground hutches: Enclosure made on the ground; outdoor.	Wire mesh, cages, wood-frame, or bamboo hutch	• Least expensive • Easy to clean	• No provision of comfort and protection from bad weather or predators.

Battery hutches: Multiple elevated boxes organized together as a unit (battery) with closed bottom; outdoor.	Wire mesh, cages, wood-frame, or bamboo hutch	• Strong and stable • Efficient if you have a lot of rabbits.	• Expensive and can get hot if constructed in a wooden box. • Harder to clean than other types of hutches. Because the animals must be close all the time, disease can spread more easily.
Cage hutches: Elevated box with open bottom allows for the passage of droppings/waste; outdoor.	Wire mesh, cages, wood-frame, or bamboo hutch	• Comfortable • Safe • Easy to clean	• Expensive
Indoor Colonies: Use cages	Wire mesh, cages, wood-frame, or bamboo hutch	• Most comfortable • Offers the most protection	• One may not have indoor space for a hutch.

- **Other facilities**:
  - Storage rooms/block
  - Office and sanitation rooms/block
  - Feeding alley
  - Waste management facilities

- **Factors to select construction materials:**
  - Availability
  - Cost
  - Technology
  - Durability/strength
  - Facilitation of hygiene and farming activities

- **Types of cages*:**

- **Lactating doe (female rabbits) cage**: Enough space to allow nest box installation, at least 80 × 115 cm.
- **Young female rabbit cage**: 700-1800 cm^2/rabbit (or 100-1200 cm^2/kg of live weight)
- **Grower cage**: 450 to 600 cm^2/rabbit
- **Fattening cage:** 60 × 80× 50 cm or 70 × 100 × 60 cm
- **Adults**: 1200-1500 cm^2/kg of live weight
- **Bucks (male rabbits):** at least 80 × 80 cm or 1200-1500 cm^2/kg of live weight

*****Cages should be elevated 80-100 cm off the ground

- **Construction materials for rabbit hutches:**
  - Wire mesh
  - Wood
  - Timber
  - Bamboo
  - Metal
  - Galvanized sheet
  - Nail
  - Stones
  - Bricks
  - Cement

- **How to set up your rabbit hutch or cage:**
  - Clean, open environment; free from cold air; provides air circulation
  - Make sure rabbits have enough space: 4-5 times the body size of the rabbit should be the minimum.
  - Provide 1-3 inches of proper bedding to rest on (no pine or cedar shavings). –
    - Materials commonly used for bedding include straw, sawdust or hay.
    - Straw is best because it is springy and soft, plus in winter it holds heat. Straw is also safe if the rabbit chews it.
  - If you have a cage with a wire bottom, provide a resting board so your animal may move off from the wire if desired. This helps the animal be more comfortable and happier in its hutch.

Guided Practice Activity

Topic 3.2 Task 3:

1. Read **3.2 Key Facts** and identify the hutch from your card in the previous activity**.**

a. Confirm the type of hutch, advantages, disadvantages, and materials used for the image of the hutch you were given.

2. Next, read through the rest of **3.2 Key Facts** as a class. Pause after each section to make sure you understand the terminology used.

3. Now, form groups (about five people per group) and choose a group leader.

4. Read the following scenario:

Your school wants to begin rabbit farming. You already helped select a site. Now we are ready to begin organizing the construction of the hutches. Your school has 2 does, 2 bucks, and 12 kits (young rabbits) which will be fattened before being sold. You must participate in the construction and stocking of the hutches.

4. Do the following tasks with the trainer. Assist the trainer by giving comments and observations.

a. Indicate the categories of cages needed in this rabbit farm.

b. Calculate the minimum space needed for breeder rabbits.

5. Then, do the following in your group by applying what you have learned in **3.2 Key Facts:**

c. Calculate the minimum space needed for growing rabbits estimated. The school cannot have more than 70 rabbits at one time.

d. Calculate the minimum space needed for rabbits to be fattened. The school cannot exceed 70 rabbits at one time.

e. Select construction materials available in the region to be used for the construction of the rabbit hutches.

6. After working in groups, one group will write their answers on the board/flipchart while the rest of the class comments based on their answers and **3.2 Key Facts.**

7. Listen to the trainer's observations and feedback.

Application Activity

Topic 3.2 Task 4:

1. Visit a rabbit farm and greet the farmer and any workers present.

2. Remember that rabbits are sensitive to noise, so you must be quiet and gentle while working with them.

3. Form small groups (of about 5-6 trainees) and nominate a group leader.

4. Complete the following tasks with your group:
   a. Make a checklist and document different categories of rabbit cages present on this rabbit farm.

   b. Ask the farmer to show you the categories of cages he/she has, to confirm that your checklist is accurate.

   c. Using a tape measure to check the parameters of cages including the size, height, and elevation from the floor. Record your findings.

   d. Compare the size of rabbit cages with the standards from the **3.2 Key Facts** that you learned in class.

   e. Observe the construction materials used, explain their advantages and give any recommendations (if needed).

   f. Discuss the facilities that are present (feeding alley, waste management alley, store, etc.) and give your observations.

   g. Evaluate the orientation of the hutches as well as the weather conditions for rabbit farming in this location.

5. When you have finished, come together to present your findings.

6. Listen to the trainer's observations on the findings recorded.

7. Thank the farmer for his/her help.

Points to Remember

- Make sure rabbits have enough space: 4-5 times the body size of the rabbit should be the minimum amount of space given to each animal. There should be a cage for each adult rabbit.
- Provide rabbits with fresh air and light but keep them out of direct sunlight.
- Protection from wind and rain is key to rabbit hutch construction.
- Consider the sanitary conditions of the space, if it is easy to clean, and if it allows rabbits to be handled easily.
- Prioritise construction that is stable and affordable (not too expensive), but also free from conditions that could injure the animals.
- Ensure that wooden bars and wire mesh are close enough (not more than 2cm).

Formative Assessment

After carefully reading the following items, answer the following questions individually:

1. Explain the advantages and disadvantages of the different types rabbit hutches that are used.

Type	Advantages	Disadvantages
Ground		
Battery		
Cage		
Indoor		

2. What are two differences between battery hutches and ground hutches?

1.

2.

3. What are four characteristics of a good rabbit hutch?

1.

2.

3.

4.

4. Circle the **wrong** answer.

The following are the types of rabbit outdoor colonies:

a. Ground hutches

b. Battery hutches

c. Cage hutches

d. Underground hutches

5. Why is it important to provide a rabbit with a resting board in a cage with a wire mesh on the bottom?

Topic 3.3: Equip hutches

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify equipment to use in rabbit hutches.	**1.** Select equipment to use in rabbit hutches.	**1.** Resourceful
2. Explain the role of equipment used rabbit hutches.	**2.** Properly install equipment in rabbit hutches.	**2.** Methodical
3. State the proper location of equipment in hutches.	**3.** Test the equipment used in rabbit hutches.	**3.** Observant

Getting Started: What do we know and where are we going?

Topic 3.3 Task 1:

1. Read the following information:

In rural areas, rabbit farming is among the most profitable agri-businesses. However, a rabbit farmer, like any farmer, must be proficient in everything there is to know about operating a rabbit farm including the equipment used.

2. Discuss the statement above:

a. Do you agree or disagree?

b. What information do you think is important to know about operating a rabbit farm?

3. Then, observe the sample equipment in front of the room brainstorm what their purposes are.

4. Discuss the brainstormed answers. Remember that it is ok if they you incorrect because by the end of this learning outcome, you will have the correct information.

5. Observe the answers you have brainstormed and discover the topic you are going to learn.

6. Look at the Key Competencies table above to see what you will gain from the topic.

Problem Solving Activity

Topic 3.3 Task 2:

1. Note the equipment at different locations around the room/space.

2. Take a card with identifying information about a piece of equipment written on it (the name, the role, or the location).

3. Walk around the room with your card and match the cards with what you think is the appropriate equipment.

a. Do this until all cards and equipment are matched.

b. Do NOT look at **3.3 Key Facts** yet. Instead, discuss with their colleagues and use any information they have already learned.

c. After you have matched a piece of equipment with a card, stand by that equipment.

4. When all trainees are standing next to a piece of equipment, take turns explaining to the class why you matched their card with the equipment you are standing next to.

5. Leave your card with the information next to the equipment you selected. After the class reviews the **3.3 Key Facts**, you will go back and correct any mistakes made in the selection of equipment.

6. Listen to the trainer's observations.

3.3 Key Facts

- **Important equipment used in rabbit hutches:**
  1. **Types of feeders**:
     - **Crock**: A small container for food or water. Can be made from plastic, metal, ceramic, or glass.
     - **Bamboo trough**: A long, narrow open container for animals to eat or drink out of (made of bamboo wood).
     - **Grass mangers**: A long open box or trough for animals to eat from

- **Hoppers**: A container for a bulk material such as grain, rock, or trash, typically one that tapers downward and can discharge its contents at the bottom.[19]

2. **Types of drinkers**:
   - **Crock**: a small container for food or water. Can be made from plastic, metal, ceramic, or glass.
   - **Enamel cups**
   - **Bamboo trough**: a long, narrow open container for animals to eat or drink out of (made of bamboo wood).
   - **Cans**
   - **Automatic waterer:** a device that distributes water from one place to another.
     - Practical and sanitary.
     - Simple-to-install system for small stock operations of any size.
     - Allows you to spend more time raising healthy stock.
     - More expensive than manually installed and operated drinkers.

3. **Types of nest boxes**:
   - Wooded box: the best type has wire at the bottom and a resting board that is not wire.
   - Wire box: made from wire mesh/net.

4. **Cleaning materials:**
   - Wheelbarrow
   - Pail
   - Broom
   - Brush
   - Floor squeegee
   - Disinfectant spray
   - Gloves

- **Role of equipment in hutches:**
  - **Feeders**: To feed rabbits.
  - **Drinkers**: To provide water to rabbits.
  - **Nest boxes**: To accommodate rabbit kids (newborns).
    - Place the nest in the doe's cage 1 to 2 days before she is scheduled to kindle, usually at the 28th day of gestation.

[19] New Zealand Digital Library. (n.d.). *A complete handbook on backyard and commercial rabbit production: Feeding equipment*. http://www.nzdl.org/gsdlmod?e=d-00000-00---off-0hdl--00-0----0-10-0---0---0direct-10---4-------0-1l--11-en-50---20-about---00-0-1-00-0--4----0-0-11-10-0utfZz-8-00&a=d&c=hdl&cl=CL1.3&d=HASH8ef3addce883f5d4bcb708.7.3#HASH8ef3addce883f5d4bcb708.7.3

- Care should be taken to not place the nest box in too early because the doe will eat the hay from the nest box and use it as a bathroom.

  - **Cleaning equipment**: To disinfect equipment, to remove dirt, and to ensure good hygiene.
    - Disinfect the nest box with bleach and let it dry in the sun before preparing the nest for the doe.[20]

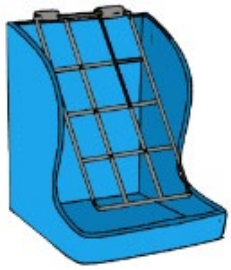
- **Location of equipment in hutches:**
  - **Feeders**: In all cages
  - **Drinkers**: In all cages
  - **Nest boxes**: In a doe's cage only
  - **Cleaning equipment**: Mobile

Guided Practice Activity

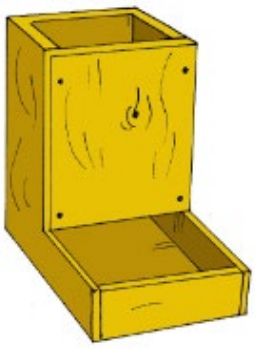
Topic 3.3 Task 3:

1. Read through all of **3.3 Key Facts** aloud as a class. Pause after each fact to ensure that you understand the terminology.

2. Then, move around the room and observe the cards next to the equipment from the last activity (images below). Make changes that may be necessary now that you have read and understood the correct information regarding the equipment from the **3.3 Key Facts.**

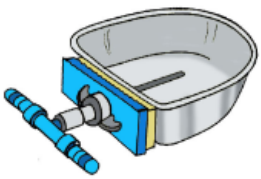


A1



A2

B



C

3. Separate into four groups. Choose a group leader.

[20] KageWerks. (n.d.). *Rabbit nest boxes 101*. KW Cages Advanced Design. https://www.kwcages.com/rabbit-nest-boxes-101

4. Note the four pieces of equipment in the corners of the room/space. Each group will be assigned to a piece of equipment. Answer the following questions with your group:
   a. What is the name of this equipment?

   b. What is the use of this equipment?

   c. Where is this equipment installed in a rabbit hutch?

   d. Demonstrate how to install and use this equipment in a rabbit hutch.

5. After you have discussed the questions, rotate to a different piece of equipment. Repeat the discussion from **Question 4.**

6. Repeat this process until you have discussed each piece of equipment in the room.

7. After you have discussed each piece of equipment in the room, group leaders present the findings. Give comments and observations to other groups.

Application Activity

Topic 3.3 Task 4:

1. Visit a rabbit farm and greet the farmer and any workers present.

2. Make small groups of four trainees and choose a group leader.

3. One at a time, carefully look into the cages and do the following with your group:
   a. Identify the equipment that is present.

   b. Identify the equipment that is missing.

4. With the help of the farmer and workers, observe how the equipment is installed in the hutches.

5. Using the equipment in unoccupied cages, practice reinstalling the equipment with the help of the farmer and the trainer.

6. Show the trainer that the equipment you reinstalled is functioning properly.

7. Then, come together and present the observations from your groups. Comment or ask questions to other groups.

8. At the end, listen to the trainer's observations/feedback and thank the farmer for his/her help.

Points to Remember

- The essential equipment in rabbit hutches includes feeders, drinkers, nest boxes, and cleaning and disinfectant equipment.
- Heaters are used in regions with very cold climates.

Formative Assessment

After carefully reading the following items, answer the following questions individually:

1. What are the most important pieces of equipment used in rabbit hutches?

2. Answer with True or False.
   The following are the types of feeders in rabbit hutches:
   a. Crocks
   b. Bamboo troughs
   c. Grass mangers
   d. Nest box
   e. Hoppers

3. Circle the **wrong** answer:
   The following are types of drinkers usable in rabbit hutches:
   a. Crocks
   b. Enamel cups
   c. Ceramic crocks
   d. Bamboo trough
   e. Thermometer
   f. Cans
   g. Automatic watering

4. Explain the location and role of nest box in hutches

5. Explain the advantages and disadvantages of installing an automatic watering system for rabbit hutches.
   Advantages:

   Disadvantages:

Topic 3.4: Maintain hutches

Key Competencies:

Knowledge	Skills	Attitudes
1. Explain the role of maintenance in rabbit farming.	**1.** Evaluate the status of rabbit hutches.	**1.** Observant
2. Identify the components of rabbit hutches to evaluate for maintenance.	**2.** Establish a maintenance plan for rabbit hutches.	**2.** Proactive
3. Identify maintenance activities for rabbit hutches.	**3.** Implement a maintenance plan for rabbit hutches.	**3.** Careful

Getting Started: What do we know and where are we going?

Topic 3.4 Task 1:

1. Read the following scenario and discuss the questions that follow:

We often ask for a guarantee when we purchase new equipment, meaning that we want to keep our assets for a long period of time. Suppose that you have rabbit farm with a lot of equipment, and you want to keep the equipment in good condition for as long as possible.

a. How do you keep equipment in good condition?

b. What activities can you do to ensure that it lasts a long time?

2. Share your ideas while the trainer writes them on the board/flipchart.

3. Observe the brainstormed answers and discover the topic you are going to learn.

4. Look at the Key Competencies table above to see what you will gain from the topic.

Problem Solving Activity

Topic 3.4 Task 2:

1. Form groups of five people and assign a group leader.

2. Read the following scenario and discuss the questions with your group:

Ange is new to rabbit farming. She has selected an excellent site for her rabbit farm and has new equipment that will ensure that her farm is productive and of the highest quality. However, all of the sudden her rabbits start getting sick, and her machines begin to break and stop working properly. She doesn't know what is going on. Ange's rabbit farm stops running and she begins to lose money.

a. Why do you think Ange's rabbits are getting sick?

b. Why do you think Ange's machines are breaking?

c. What can Ange do so avoid these problems in the future?

d. Explain the role of maintenance on a farm.

3. Group leaders write the responses on a piece of paper.

4. After discussing, your group leader writes your answers on the board/flipchart.

5. Comment on the answers provided by other groups. Listen to the trainer's observations.

6. You will return to this activity after you have read **3.4 Key Facts** to check your answers.

3.4 Key Facts

- **Role of maintenance**
  - To keep the construction strong, such as the roof, wall, floor, and annexes.
  - To keep a good image of the farm to the employees, customers, and the community.
  - To better conserve and increased life expectancy of equipment and animals.
  - To improve safety and quality of conditions for all activities.
  - To maintain good hygiene and avoid the spread of diseases and infections among humans and animals.

- **Repairing (fixing) vs. Replacing (buying a new one) a broken piece of equipment**
  Consider the following:
    - How long have you had the equipment?
    - Do you still have to make payments on it?
    - What is the estimated cost of a repair?
    - In what condition is the piece of equipment?
    - What is the estimated cost of replacing the equipment with a new one?

- **Types of maintenance:**
    - **Day to day repair**: daily tasks
    - **Annual repair**: tasks done once a year
    - **Special repair**: on an as needed basis
    - **Additions and alterations**: to meet the special requirements for functional efficiency
    - **Preventive maintenance**: regular tasks to make sure equipment is running properly[21]

- **Maintenance activities:**
    - **Perform routine maintenance**: regular inspection and repair of all hutches and facilities
    - **Regular hygiene**: cleaning, disinfecting, liming, painting
        - Lime is crushed up limestone – also known as Calcium Carbonate. It's used to prevent the smell of ammonia build-up and odours in barns and stalls. Ammonia comes from the urine in livestock waste when it's left sitting and not cleaned up. Ammonia can cause a variety of problems for your livestock, such as, respiratory issues and immune system issues. Barn lime can help keep animal pens, barn floors, and gutters all clean, dry and sweet.[22]
    - Repairing fixtures and equipment
    - Cleaning the nest box: Nest boxes collect a lot of moisture within the first few days after the kits are born and can become a breeding ground for bacteria.
        - Change out all the nesting material in the box with clean, dry material within the first 3-7 days. Larger breeds and older kits will require more

[21] The Constructor. (n.d.). *Types of building repair and maintenance services*. https://theconstructor.org/building/building-repair-maintenance-service-types/6903/
[22] Piek, L. (n.d.). *What is barn lime & why do I need it?* Blain's Farm & Fleet Blog. https://www.farmandfleet.com/blog/what-is-barn-lime-why-do-i-need-it/

frequent changes of bedding. The doe's pulled fur can be retained and used to line the newly changed nest.[23]

- **Maintenance plan:**
  - **Daily activities**: Cleaning, littering, inspection of equipment, simple and urgent repairs, etc.
  - **Weekly activities**: Oiling equipment, cleaning, repairs and replacements
    - Deep clean one day per week: remove, wash, and scrub cages; remove and replace bedding; wipe cage with hot water and vinegar; disinfect and rinse
  - **Monthly activities**: Repairs, replacements, painting
  - **Annual activities**: Repairs and replacements, liming, painting, additional repairs[24]

- **Evaluation and maintenance are applied to:**
  - Cages: Roof, walls, bottom
  - Floor
  - Feeders and drinkers
  - Drainage and manure alley
  - Annexes (storage room, sanitary room)
  - Equipment
  - Fences (enclosures)

Guided Practice Activity

Topic 3.4 Task 3:

Part 1:

1. Separate into five groups. Read and discussed your assigned section of **3.4 Key Facts**.

2. Stand up and read your section of **3.4 Key Facts** to the rest of the class. After each group has presented, confirm that you understand the terminology used.

Part 2:

1. Return to the previous scenario from **Topic 3.4 Task 2**:

[23] KageWerks. (n.d.). *Rabbit nest boxes 101*. KW Cages Advanced Design. https://www.kwcages.com/rabbit-nest-boxes-101

[24] McLeod, L. (n.d.). *How to clean a rabbit cage*. The Spruce Pets. https://www.thesprucepets.com/rabbit-cages-cleaning-tips-1239301

Ange is new to rabbit farming. She has selected an excellent site for her rabbit farm and has new equipment that will ensure that her farm is productive and of the highest quality. However, all of the sudden her rabbits start getting sick, and her machines begin to break and stop working properly. She doesn't know what is going on. Ange's rabbit farm stops running and she begins to lose money.

a. Why do you think Ange's rabbits are getting sick?

b. Why do you think Ange's machines are breaking?

c. What can Ange do so avoid these problems in the future?

d. Explain the role of maintenance on a farm.

2. Read this scenario again take a few minutes to revise your answers to be more specific now that you have read and discussed **3.4 Key Facts.**

3. After a few minutes, share what you added to make your answers more specific according to **3.4 Key Facts.**

Part 3:

1. Return to your group and read the following scenario. Discuss the questions in your group:

A fifteen-year-old boy named Kagabo has always been interested in rabbit farming. One year, his mother gives him a medium-sized rabbit farm as a gift. Kagabo wants to keep his farm for many years and in good working condition. He does not have any money, so he wants to take good care of equipment and rabbits. He approaches you for help and asks the following questions:

a. What are four important maintenance activities on a rabbit farm and their role?

b. How often is maintenance done?

c. Using examples (of equipment and hutches), demonstrate how to perform maintenance.

d. Based on your education in animal shelters, what do you think is the most important thing to know about farm maintenance?

2. Using a piece of equipment given by the trainer, discuss and brainstorm answers to Kagabo's questions. Your group leader must write the answers during the discussion.

3. After your discussion, your group leader shares the answers and demonstrates how to maintain the equipment you were given. Ask questions and give comments to other groups.

4. Finally, listen to the trainer's observations and feedback.

Application Activity

Topic 3.4 Task 4:

1. Visit a rabbit farm and greet the farmer and any workers present.

2. Volunteer to explain to the farmer the role of maintenance in rabbit farming. Ask the farmer to add or clarify any of the information given based on his/her experience.

3. Form small groups (of about four trainees) and choose a group leader.

4. Do the following tasks with your groups:
   a. Inspect the hutches and their equipment. Evaluate their status. Write your recommendations.

   b. Ask the farmer what his routine maintenance activities are and write your observations. Do not forget to talk about cleaning, liming, littering, and painting.

   c. Based on what you see on the farm, design a maintenance plan for this rabbit farm considering its status.

   d. Participate in hygienic and/or other maintenance activities (cleaning, liming, littering, and repairing if possible).

5. After everyone has completed the tasks, your group leader makes a short presentation on the tasks done.

6. Provide comments and give feedback on the answers from other groups.

Points to Remember

- Maintenance helps to extend the life expectancy of rabbit hutches and equipment.
- Elaboration and respect of maintenance plan is a must.
- Any malfunction should be repaired as soon as possible.
- Littering, especially in the nest box, helps provide adequate temperatures to the rabbits and should be thoroughly cleaned out once a week.

Formative Assessment

After carefully reading the following items, answer the following questions individually:

1. Explain the role of hutch maintenance on a rabbit farm.

2. What are the components of rabbit hutches to evaluate for maintenance?

3. Answer with **True** or **False**:

a. It is necessary to put litter in a nest box.

b. Lime helps protect your equipment from rain.

c. Most of the maintenance activities are done every day on a rabbit farm.

4. Explain how applying lime can be good for the health of your farm workers and animals.

Self-Reflection

1. You have come to the end of the unit. You are going to do the survey you did at the beginning of the unit again to help you do self-assessment of your knowledge, skills, and attitudes.

Again, there are no right or wrong answers to this survey. It is for your own use to gauge your knowledge, skills and attitudes after the unit. Read the Knowledge, Skill or Attitude in the left column. Think about yourself: do you think you can do this? How well? Read the statements across the top. Put a check in column that best represents your situation. Read the self-assessment you have done at the beginning of this unit, repeat the same assessment and fill the table below:

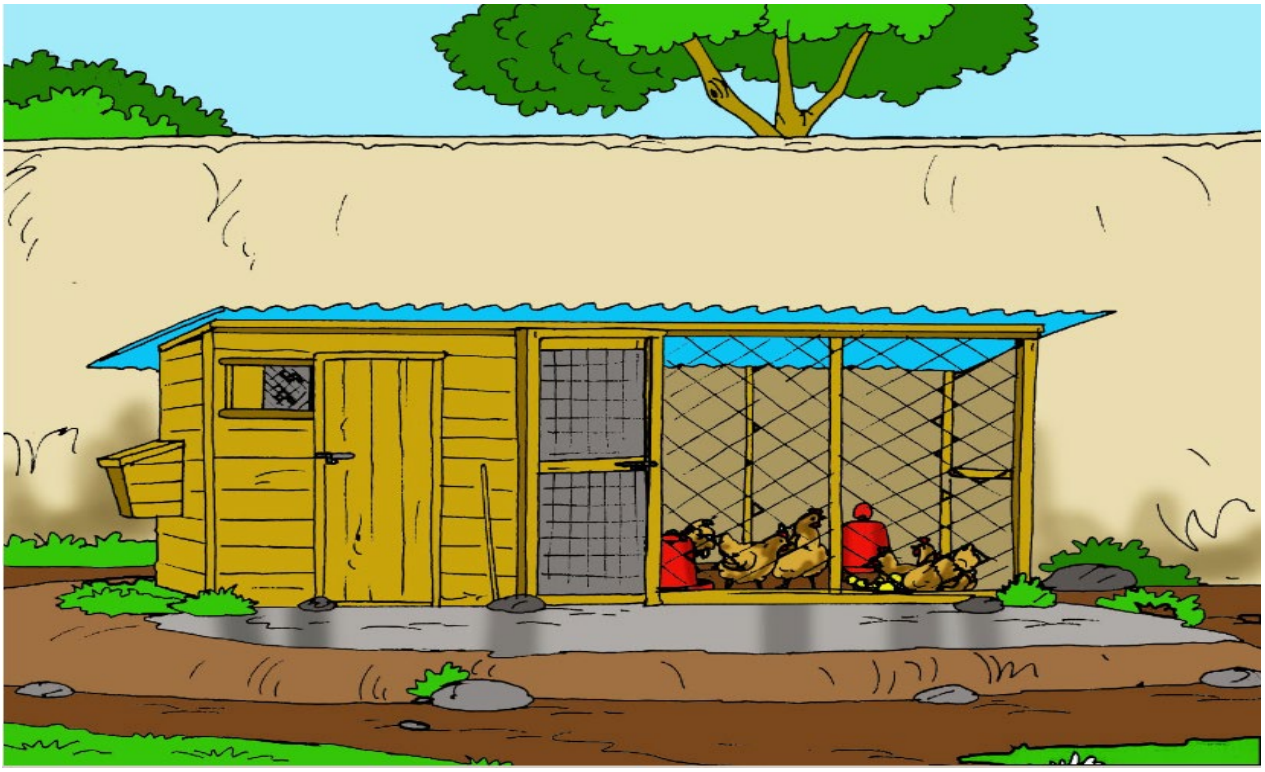
My experience **Knowledge, skills and attitudes**	**I don't have any experience doing this.**	**I know a little about this.**	**I have some experience doing this.**	**I have a lot of experience with this.**	**I am confident in my ability to do this.**
Identify the criteria for selecting a site for rabbit hutch construction.					
Assess weather factors for rabbit farming.					
Identify different types of rabbit hutches.					
Identify facilities needed for rabbit farming.					
Identify materials for rabbit hutches construction.					
Identify different equipment used in rabbit hutches.					
Install and test common equipment used in rabbit hutches.					

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Identify the components of rabbit hutches to evaluate for maintenance.					
Establish and implement maintenance plan for rabbit hutches.					

2. Complete the table below by identifying areas from the unit where you have improved and where you need improvement with the actions/strategies you will use to help you improve when receiving and interpreting information at the workplace.

Areas of strength	Areas for improvement	Actions to take to improve
1. **2.**	**1.** **2.**	**1.** **2.**

Unit 4: Assist in poultry house construction



Topics

4.1 Select site

4.2 Organize construction

4.3 Equip poultry house

4.4 Maintain poultry house

Unit Summary:
In this unit, you will gain the essential knowledge, skills, and attitudes needed to construct and maintain a poultry house. This includes learning how to select a good site, organize of construction activities, install the necessary equipment, and perform routine maintenance on poultry houses and their equipment.

Self-Assessment: Unit 4

1. Look at the unit illustration. What do you see? What do you think this unit will be about? What topics might be covered?

2. Fill in the self-assessment below.

There are no right or wrong ways to answer this assessment. It is for your own use during this unit. Read a skill that is listed in the left column. Think about yourself: do you think you can do this? How well? Read the statements across the top. Put a check in column that best represents your situation. At the end of this unit, we'll take this assessment again.

My experience **Knowledge, skills, and attitudes**	**I don't have any experience doing this.**	**I know a little about this.**	**I have some experience doing this.**	**I have a lot of experience with this.**	**I am confident in my ability to do this.**
Identify the criteria for selecting a site for a poultry house.					
Assess weather parameters for poultry farming.					
Identify the different types of poultry houses.					
Select construction materials for a poultry house.					
Identify different equipment to use in a poultry house.					
Install and test common equipment used in poultry houses.					
State the role of maintenance and which components to maintain in a poultry farm.					

My experience Knowledge, skills, and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Establish and implement a maintenance plan for a poultry house and its equipment.					

Topic 4.1: Select a site

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify the criteria to select a good location for poultry house construction.	**1.** Select a good place for poultry house construction.	**1.** Risk awareness
2. Identify the soil conditions for poultry house construction.	**2.** Select the soil structure for poultry house construction.	**2.** Observant
3. Explain the role of evaluating weather parameters for poultry houses.	**3.** Assess weather parameters for poultry house construction.	**3.** Attentive

Getting Started: What do we know and where are we going?

Topic 4.1 Task 1:

1. As a group, brainstorm responses to the following questions:

a. How many of you have eaten eggs before?

b. What do you think some of the steps are before the egg arrives on your plate for you to eat?

c. In what ways do you think chicken (poultry) farming is similar to the other animals we have discussed in class?

d. You have likely seen chicken/poultry houses before. What were the sites like where the poultry houses were location?

2. Share your ideas while the trainer writes the ideas on the board/flipchart. Observe the brainstormed ideas and discover what topic you are going to learn.

3. Look at the Key Competencies table above to see what you will gain from the topic.

Problem Solving Activity

Topic 4.1 Task 2:

1. Form groups (4-5 people in each group) and choose a group leader.

2. Be attentive while the trainer reads the scenario out loud to the class:

   Youth Cooperative in Kigali City is proud to be a role model in rural development. Youth Cooperative received grant money to start poultry farming. They do not know how to select a site for poultry houses.

   They make the following decisions:
   - **a.** Because they need water, they decide to locate the poultry houses beside a nearby lake.
   - **b.** Chickens are small, so they decide to build the houses on top of their building in Kigali.
   - **c.** They have seen chickens in their community before, so they don't check the weather parameters. The chickens have feathers, so they will be warm.

3. Think about what you know about laws, regulations, and best practices for selecting a site for animal shelters. Then, answer the following questions with your group while your group leader writes the responses:

   - **a.** What recommendations do you have for Youth Cooperative about their three decisions (**parts a, b, and c**)?

   - **b.** What could happen to the poultry house grant project if the group continues to make decisions without the proper education?

4. Group leaders take turns sharing the answers. While each group is presenting, a volunteer writes the answers on the board/flipchart and the rest of class can ask questions and give comments.

5. After all groups have presented, add other ideas that are missing and remember that you will return to this activity to revise your work after reading through **4.1 Key Facts.**

4.1 Key Facts

- **Land management regulations and laws in Rwanda:**
  - Official Gazette nº Special of 16/06/2013 determines the use and management of land in Rwanda.[25]
  - Includes ministerial orders related to master plans and land use.

- **Impact of land management regulations on poultry farm installation:**
  - Construct animal shelter on a farmer's own land or officially rented land.
  - Respect the land use master plan: Use the land for what farmer says it is for – rabbit hutches, piggery, ruminants, or poultry.
  - In urban land, obtain permission from legal authorities before construction of poultry farms.
  - Respect legal distance from swamps, marshland, river, and lakes.

- **Factors to select a site for a poultry farm:**
  - Government laws
  - Distance to water source, swamps, marshland, and human habitation.
  - Friendly and safe neighbourhood.
  - Security: Not a lot of noise and vibrations and not too far from communities to ensure security.
  - Available facilities: Accessible roads, running water supply, and reliable electricity.

- **Factors to select the soil for a poultry farm:**
  - Topography
  - Soil structure
  - Sewage disposal
  - Presence of groundwater

- **Soil structures and their impact on site selection for poultry houses:**
  - Soil structure is the arrangement of soil particles.
  - Particles include clay, silt, sand and gravel.
  - Soil structure determines the type of foundations and construction materials to use for walls.
  - A soil rich in sand and clay is favourable for construction because it is easy to compact and absorbs water to avoid flooding around construction.

[25] International Labour Organization. (2013, June 16). *Official gazette no special of 16/06/2013*. https://ilo.org/dyn/natlex/docs/SERIAL/94019/110205/F-1367378394/RWA-94019.pdf

- **Types of topography and poultry house construction:**
  - **Mountains and Hills:** Animal shelter construction needs more land preparation as the slope increases.
  - **Plains and Plateaus:** Animal shelter are easily constructed on this topography.
  - **Valleys:** Rwanda regulations do not allow the construction of animal shelters on this type of land.

- **Weather consideration in selection of site for poultry farm**:
  - Wind direction
  - Natural light
  - Temperature
  - Precipitation/humidity

- **Role of checking climatic parameters:**
  - To ensure good heat dissipation (spread) by minimal radiation, air temperature, humidity, and maximal air velocity.
  - To prevent diseases: natural air circulation brings in oxygen in order to evacuate bad air and moisture; high humidity favour microbes and diseases.
  - To determine the construction materials: choose size of wall and openings based on speed and direction prevailing wind, precipitation, and temperature.
  - Check climatic parameters using thermometer, hygrometer, compass, anemometer.

- **Role of checking weather parameters in the selection of a site for poultry houses: ***
  - Climatic parameters: temperature, wind (air flow), relative humidity, precipitation, and natural light.
  - Climatic parameters vary with topography and animal shelters are constructed accordingly.
    - High altitude + mountain ranges that prevent air movement = colder and more humid
    - Top of mountains and sea level = more wind
  - Optimal climatic parameters vary with types of poultry, types of production, and age.
    - For example, broiler chickens need the following: Temperature (22-30^{0}C), relative humidity (30-60 %), ammonia level (less than 25 ppm), litter moisture (15-25%), and air flow (10-30 meters/minute).[26]

[26] Tamil Nadu Agricultural University (TNAU). (n.d.). *Poultry house construction*. https://www.agritech.tnau.ac.in/expert_system/poultry/Poultry%20House%20Construction.html

- **Impact of animal wastes on environment:**
  - Disease transmission.
  - Water pollution due to ammonia (underground water, rivers, lakes).
  - Air pollution (bad odours and methane gas).

Guided Practice Activity

Topic 4.1 Task 3:

Part 1:

1. With your group, read through **4.1 Key Facts** and revise your answers from the **Problem Solving Activity**.

2. Share what revisions you made to your answers after reading through **4.1 Key Facts.**

3. Now, read through **4.1 Key Facts** one more time out loud to the class and be sure that you understand the terminology and content.

Part 2:

1. Read following scenario and related questions:
   After being convinced that poultry farming is a great way to generate income, many of the unemployed youth in one village have decided to start a community poultry farm. You and your colleagues have been asked to provide a training pamphlet (book, manual, brochure) to the youth of this village that shows the proper steps and helpful tips to select a good site for poultry farming.

   Help the youth of this village by making a pamphlet IN YOUR OWN WORDS with the following information:

   a. Directions on how to measure the climatic parameters using a thermometer, a hygrometer, and an anemometer.

   b. Three important laws and regulations to follow and what could happen if you don't follow them properly.

   c. Illustrations of the types of topography and information about which ones you could use for building animal shelters in Rwanda.

d. Explanation of why good air circulation in poultry houses is essential and why natural air flow should not be interrupted.

2. Discuss and make your pamphlets. Be sure to make a high quality pamphlet.
   a. Pamphlets should use detail, be original, be artistic, and accurately based on **4.1 Key Facts.**

3. After all groups have finished their discussions and prepared their pamphlets, give your pamphlet to another group.

4. Your group will present another group's pamphlet to the class. During this time, make comments and ask questions to the presenting group.

5. When the presentations are finished, listen to the trainer's feedback and observations.

Application Activity

Topic 4.1 Task 4:

1. Visit a field.

2. Form small groups and nominate a group leader.

3. Imagine that the site you are standing on is where a farmer wants to construct a poultry house. Complete the following tasks with your group:

   a. Look at your surrounding environment and select a good place for poultry house construction. Explain why you chose this specific location.

   b. Evaluate the soil structure and predict how it will have the impact on the poultry house construction activities. Record your findings.

   c. Observe the topography and explain how it could impact poultry house construction activities.

   d. Assess the current weather parameters (wind speed, wind direction, temperature and humidity). Are they suitable for poultry farming?

   e. Explain what other facilities the farmer may need at the selected site.

f. Explain how animal waste will impact the environment.

4. Use the given weather measurement tools to measure wind (direction and speed), temperature, precipitation, and humidity.

5. After all groups have finished, come together. Your group leader presents what your group discussed and recorded. Provide feedback and comment on the other groups' findings.

6. Listen to the trainer's observations and feedback.

Points to Remember

- Well-drained land is an important feature of a good poultry house, especially when litter systems will be used.
- Poultry house sites should be within sight of the owner/supervising personnel and away from other chicken houses to reduce the spread of diseases.
- In hot climates, you should cast shade on the roof, such as by located the house near tall trees.
- Poultry houses should not interrupt the natural air flow/wind and should not allow direct sunlight to enter the house. They should therefore be constructed in the east-west direction.
- Access to a good road for transportation and a clean running water supply are essential to successful poultry houses.

Formative Assessment

After carefully reading the following items, answer the following questions individually:

1. What are three characteristics of a good site for poultry house construction?

1.

2.

3.

2. Why is it important to check weather parameters for poultry farming?

3. Answer with True or False and explain.

a. Animal waste is harmful when they are not well managed.

4. Which facilities are needed at the site of poultry farming?

5. List the types of topography suitable for construction of poultry houses in Rwanda.

Topic 4.2 Organize construction

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify different types of poultry houses.	**1.** Select a good type of poultry house.	**1.** Willingness
2. Identify facilities needed for poultry farming.	**2.** Select construction materials for poultry houses.	**2.** Proactive
3. Identify materials for poultry house construction.	**3.** Supervise the construction of poultry houses.	**3.** Careful

Getting Started: What do we know and where are we going?

Topic 4.2 Task 1:

1. Poultry farming has many advantages, and that is why it is preferred by many farmers, especially in rural areas. Like other types of animal shelters, poultry houses must be carefully planned and organized before operating.

2. Brainstorm all the different types of materials you think are available and useful in Rwanda for poultry farming. Call out ideas and have a volunteer write them on the board/flipchart for the class to observe.

3. Look at the Key Competencies table above to see what you will gain from the topic.

Problem Solving Activity

Topic 4.2 Task 2:

1. Form small groups (of about five people) and choose someone to be the group leader.

2. Read the following scenario:

Your close friend, Claudine, recently found out how profitable poultry farming can be and decided to start chicken farming. She has managed to select a good site, but she needs help understanding the roles of some of the different components for poultry houses. Using the information you have learned for other types of animals, make an

educated guess about what the purposes are for the following types of house components:

a. Brooder House:

b. Grower House:

c. Broiler House:

d. Layer House:

e. Hatchery:

3. Discuss and write your predictions down. After group discussions, group leaders share the answers from their groups while the trainer writes the answers on the board/flipchart.

4. Add comments to the answers.

5. You will return to this activity to revise your predictions based on the information you read and discuss in **4.2 Key Facts**.

4.2 Key Facts

- **Poultry house terms:**
  - **Chicken run**: a fenced or enclosed outdoor space you provide for your chickens
  - **Slatted floor**: a space for waste to fall through
  - **Battery system**: a housing system used for various animal production methods, but primarily for egg-laying hens. The name arises from the arrangement of rows and columns of identical cages connected, in a unit, as in an artillery battery.

Types of poultry houses[27]	Advantages	Disadvantages
Housing with a run	• The chickens can move in the open air. • More control than free-range. • Some protection against predators.	• A limited run can get wet and increase the risk of infection and parasites. • It is still possible for predators to get at the poultry.

[27] Technical Centre for agricultural and rural cooperation (CTA). (2010). *Small scale chicken production*. Food and Agriculture Organization of the United Nations. https://www.fao.org/3/CA2806EN/ca2806en.pdf

	• Less risk of infection. • Stocking density can be increased.	
Housing with litter but without a run	• There is complete control over the chickens: the feed, the eggs, etc. • The birds are well protected against predators since they do not have space to go outside.	• More expensive. • Higher risk of infection. • Dependence the locally available litter. • Need dry place to store the litter.
Housing with a slatted floor	• Less contact between chicken and their feces to reduce risk of diseases. • Stocking density can be increased (more birds). • Low cost of litter.	• Can be expensive. • More cleaning. • Higher risk of injuring chickens' feet because of slatted floors.
Battery system	• Increased stocking density. • Optimum protection from predators. • Easy to perform farming activities. • Reduced risk of diseases. • Lower production costs.	• Expensive. • Less space to move around for the poultry. • Higher incidence of foot injuries.

- **Types of poultry birds**
  - **Brood**: a family of young animals, especially of a bird
  - **Broilers**: any chicken that is bred and raised specifically for meat production.
  - **Layers**: poultry birds that are used specifically for egg production.
  - **Breeders**: poultry birds that are raised to specifically breed other birds – broilers, layers, etc.
  - **Compost:** organic matter that has been decomposed in a process called composting. It is rich in nutrients and can be used in gardening, landscape, and farming. It can contain food scraps and other organic materials.

- **Poultry house components (facilities)**:
  - Houses
    - **Brooder house**: Used to rear egg-type chicks from 0 to 8 weeks of age.
    - **Grower house**: Used to grow egg-type birds from 9 to 18 weeks of age.

- **Brooder-grower house**: Used for entire brooding and growing period of egg-type chickens.
- **Broiler house**: Used to rear broilers up to 6 weeks of age.
- **Layers house**: Used to rear birds over 18 weeks of age, usually up to 72 weeks of age.
- **Breeder house*:*** Used to maintain both male and female breeders at appropriate sex ratio.

  - Other facilities
    - **Hatchery**: Where eggs are hatched, sometimes under artificial conditions.
    - **Footbath**: Simple way to help prevent the potential spread of disease. Placed at entrances of poultry/livestock areas.
    - **Run/grassy area**: Enclosed area that is outside for the chickens to move around freely.
    - **Baths**: Place for ducks and geese to swim.
    - **Feed store**: Clean, dry and secure place where food is stored for the poultry.
    - **Feed mill**: Facility where feed is prepared for the poultry.
    - **Compost pit**: Used for preparing compost.
    - **Drug store**: For vaccinations and medicines.
    - **Office**

- **Factors to select construction materials for poultry houses:**
  - Availability
  - Cost
  - Technology
  - Durability
  - Facilitation of hygiene and farming activities

- **Construction materials for poultry houses:**
  - Wood
  - Metal
  - Bricks
  - Stones
  - Gravel
  - Sand
  - Cement
  - Plastic materials
  - Iron sheets
  - Nails
  - Wire
  - Mesh

- **Stocking density in poultry houses**
  - **Turkey**: 1125 - 4500 cm^2 depending on age
  - **Duck and geese**: 289- 2809 cm^2 depending on age
  - **Guinea fowl**: 3/m^2 for adult layer and 4-5/m^2 for other adults
  - **Squabs**: 0.4 m^2/bird

Chickens[28] Number of animal/m^2			
	Chicken Category		
Floor type	**Broilers**	**Layer growers 0 – 18 weeks**	**Layers**
full slats	15	9	7
2/3 slats, 1/3 litter	-	8	6
1/3 slats, 1/2 litter	-	7	5
full litter	10	6	4

Guided Practice Activity

Topic 4.2 Task 3:

1. Read through **4.2 Key Facts** and revise your responses from the **Problem Solving Activity**. Share the revisions to your answers.

2. Read all of **4.2 Key Facts** again with the class. Pause after each fact and make sure you understand the terminology used.

3. Now, separate into groups of five and choose a group leader. Read the following scenario:

   Mr. Munyakazi is a poultry farmer in Kamonyi. He already has turkeys, guinea fowl, and squabs (pigeons). He wants to add geese, ducks, and chickens. The chickens will be reared only for egg production (after importation of 1200 one day old chicks), and the other birds will be reared for meat. He has selected land as a site for new poultry houses

[28] Sonaiya, E. B. (2004). *Small-scale poultry production: Chapter 4: General management*. Food and Agriculture Organization of the United Nations. https://www.fao.org/3/y5169e/y5169e05.htm

and each species will have separate houses. He approaches you to guide him in the construction of these houses.

4. Do the following tasks with your group, using **4.2 Key Facts** for guidance:
   a. Identify the poultry houses needed on his farm.

   b. List the construction materials used to construct poultry houses that are available in the region.

   c. Demonstrate the stocking density to respect in those poultry houses.

   d. Calculate the minimum space needed for chicken houses.

5. After group discussions, your group leader writes your answers (including formulas for calculations) on the board/flipchart. Comment and/or correct answers.

6. Listen to the trainer's observations and feedback.

Application Activity

Topic 4.2 Task 4:

1. Visit a poultry farm and greet the farmer and any workers present. Remember to avoid making loud noises and disinfect your shoes when needed.

2. Form small groups of five trainees and nominate group leaders for each group.

3. Complete the following tasks with your group:
   a. Observe the design and orientation of the poultry houses and provide your comments.

   b. Identify the types of poultry houses and construction materials used.

   c. Ask the farmer for the number of poultry in each house and calculate the surface area of the house (using a tape measure) to calculate the stocking density and give comments.

4. When all groups have finished their tasks, group leaders give presentations on their findings as the other trainees comment and provide feedback.

5. Provide any recommendations for ways to improve the farm.

6. Listen to the trainer's observations and feedback considering the situation of the farm.

7. Thank the farmer for his/her help.

Points to Remember

- Be sure to construct houses in a way that protect birds from adverse weather conditions and facilitates proper micro-weather conditions
- Prioritize an easy and economic (cost effective) operation whenever possible.
- Ensure scientific feeding in a controlled manner, effective disease control measures, and proper supervision.

Formative Assessment

After carefully reading the following items, answer the following questions individually:

1. What is an advantage of providing poultry with a run?

2. What are four poultry house components (facilities) needed in poultry farming? Explain their roles.
   1.
   2.
   3.
   4.

3. What are three general characteristics of a good poultry house?
   1.
   2.
   3.

4. Answer with **True** or **False**.
   The following are included in poultry:
   a. Chicken
   b. Turkeys

c. Pig
d. Pigeon (squab)
e. Geese

5. Circle the wrong answer(s).
Stocking density in poultry is based on:
a. Species
b. Age
c. Type of production
d. Type of floor
e. Type of poultry house

Topic 4.3: Equip poultry house

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify the equipment to use in poultry farming.	**1.** Select equipment to use on a poultry farm.	**1.** Careful
2. Explain the role of equipment used in poultry farming.	**2.** Install the equipment on a poultry farm.	**2.** Methodical
3. Allocate equipment on a poultry farm.	**3.** Test the equipment installed on a poultry farm.	**3.** Risk aware

Getting Started: What do we know and where are we going?

Topic 4.3 Task 1:

1. Brainstorm responses to the following with a partner:

- Similarities between ruminants, pigs, rabbits, and poultry
- Differences between ruminants, pigs, rabbits, and poultry
- Equipment ruminants and rabbits both need
- Types of equipment that poultry may need

2. Offer to write the ideas on the board/flipchart. Discover what topic you are going to learn.

3. Look at the Key Competencies table above to see what you will gain from the topic.

Problem Solving Activity

Topic 4.3 Task 2:

1. Separate into groups of three.

2. Observe the pieces of equipment around the room or images of equipment on the walls around the room.

3. You will have five minutes at each piece of equipment/image of equipment to discuss and come to a consensus (all agree) on the following:
   a. Equipment's name

   b. Equipment's role & importance

   c. Equipment's location on a poultry farm

4. After five minutes, move to another piece/image of equipment and repeat the process from **Question 3** until you have visited each piece of equipment.

5. After each group has discussed and recorded the information needed, come together and present your group's findings.

6. During presentations, comment and ask questions.

7. Remember that after **4.3 Key Facts** are discussed as a class, you will go back and revise your responses.

4.3 Key Facts

- **Equipment used on a poultry farm**:
  - Feeders
  - Drinkers
  - Laying nests
  - Perch
  - Cages
  - Heaters
  - Thermometer
  - Hygrometer
  - Cleaning and disinfection equipment: wheelbarrow, pail, broom, floor squeegee, sprayer, personal protective equipment (PPE)
  - Footbath

- **Role of equipment on a poultry farm:**
  - **Feeders**: For eating.
  - **Drinkers**: For drinking water.
  - **Laying nests**: Littered boxes where eggs are laid (when the hens are not in cages).

- **Perch**: Horizontal fixed stick which serves as a resting place for nervous birds or during night.
- **Cages**: A box or enclosure with an opening.
- **Heaters**: A device that warms the air/space around the poultry.
- **Cleaning and disinfection equipment**: To remove dirt and kill pathogens.
- **Thermometer**: To measure the temperature of a given space.
- **Hygrometer**: For measuring the humidity (moisture/water in the air).
- **Footbath**: Placed at the entrances of the poultry houses for the farmers/workers to disinfect their shoes/boots/feet after walking around on the poultry farm. Easy and effective way to stop the spread of bacteria and diseases.

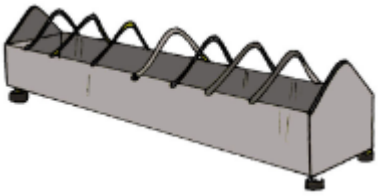
- **Location of equipment in poultry farm:**
  - **Feeders**: In all poultry houses.
  - **Drinkers**: In all poultry houses.
  - **Laying nest**: In layer poultry houses.
  - **Perches**: In grower and adult poultry houses.
  - **Cleaning equipment**: Mobile.
  - **Heaters**: In brooder (newborn/starter) houses and all houses in temperate (colder) climate.
  - **Weighing scale**: Mobile.
  - **Sprayers**: Mobile.
  - **Cleaning and disinfection equipment**: Mobile.
  - **Footbath**: At the entries of poultry houses.
  - **Thermometer**: Inside all poultry houses (on inner wall). A farmer should always know the temperature inside of his/her poultry houses/farms.
  - **Hygrometer**: Inside all poultry houses. A farmer must always know the humidity (moisture/water in the air) inside of his/her poultry houses.
    - Too little moisture can result in dehydration and respiratory illness.
    - Too much moisture leads to litter clumping and ammonia, which causes problems ranging from blindness to poor flock uniformity.

- **The use of cages is preferable because it results in:**
  - **Fewer parasitic diseases**: Good for animal and farm welfare.
  - **Higher egg weight**: Good for egg production.
  - **Higher body weight gain**: Good for meat production.
  - Easier selection during culling (culling is the process of removing inferior, sick, or injured chickens from the flock whenever you spot them).
  - Less noise for poultry

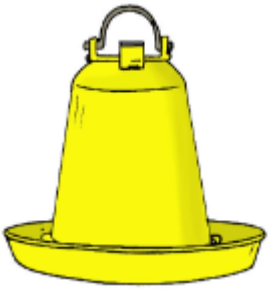
Guided Practice Activity

Topic 4.3 Task 3:

A_1



A_2



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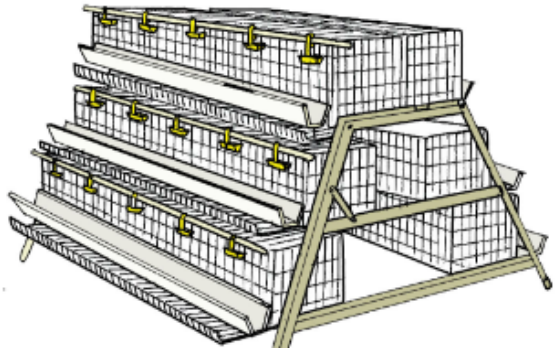
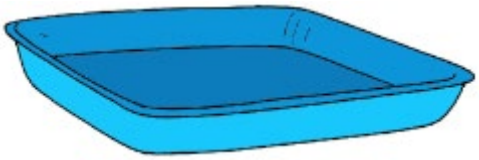


D



E

F

1. Read through **4.3 Key Facts**. Pause after each fact so you can understand the terminology used.

2. Return to the **Problem Solving Activity** and change any answers that were incorrect or missing information.

3. Share your revisions and share them with the class.

4. Using the photos at the beginning of the task and a given piece of equipment, do the following tasks:
   a. Observe the pictures A (A_1 and A_2), B, C, D, E, F and give the common names of each piece of equipment.

   b. Explain the use of each equipment (A, B, C, D, E, F).

   c. Determine the location of each piece of equipment on a poultry farm.

   d. Discuss and practice with your group how to install and use the equipment you have been given.

5. Group leaders present their group's answers. Pay attention because each group will demonstrate how to install and explain how to use a piece of equipment.

6. At the end, listen to the trainer's observations and feedback to each group.

Application Activity

Topic 4.3 Task 4:

1. Visit a poultry farm and greet the farmer and any other workers present.

2. With a partner, do the following tasks:
   a. Look around the poultry farm and identify the equipment you see.

   b. Explain and confirm the importance of each piece of equipment to the farmer.

   c. Mention the equipment that is missing and ask the farmer if he/she has it somewhere else.

d. After getting the permission from the farmer, remove some equipment and explain to your partner how to install it, use it, and where to place it on the farm.

e. Demonstrate to your partner how to use the equipment you have chosen to make sure that it functions properly.

3. At the end, demonstrate their answers from **Question 2** to the rest of the trainees. Encourage others to ask questions and provide feedback.

4. At the end, you give your observations and thank the farmer for his/her help.

Points to Remember

- The most essential pieces of equipment in poultry farms are feeders, drinkers, laying nests, perches, heaters, thermometers, hygrometers, cleaning and disinfection materials (wheelbarrow, pail, broom, floor squeegee, sprayer, PPE), and footbaths.

- Cages are preferable because they result in fewer parasitic diseases, higher egg weights, higher body weight gain, easier selection during culling (process of removing inferior, sick, or injured chickens from the flock whenever you spot them), and less noise for poultry.

Formative Assessment

After carefully reading the following items, answer the following questions individually:

1. What are three of the most important pieces of equipment used on a poultry farm?
1.
2.
3.

2. Explain the location and role of:
a. Laying nests:

b. Perches:

c. Foot baths:

3. Choose the correct answer.
A hygrometer is used to measure:
a. Ammonia

b. Temperature
c. Humidity
d. Ventilation

4. Explain why it is important to always know the temperature and humidity in a poultry house.

5. Complete the following sentence:
a. Using cages on a poultry farm is preferable because _____.

Topic 4.4: Maintain poultry house

Key Competencies:

Knowledge	Skills	Attitudes
1. Explain the role of maintenance in poultry farming.	**1.** Evaluate the status of poultry houses and equipment.	**1.** Attentive
2. Identify the components of poultry houses to evaluate for maintenance.	**2.** Establish a maintenance plan for a poultry farm.	**2.** Observant
3. Identify maintenance activities on a poultry farm.	**3.** Implement a maintenance plan on a poultry farm.	**3.** Resourceful

Getting Started: What do we know and where are we going?

Topic 4.4 Task 1:

1. Read the scenario and associated questions below:

Businesses are more profitable when they last for a long time. The same is true for poultry farming. It is important to perform routine maintenance so that the farmer can earn back the money that he/she invested into his/her farm.

2. Imagine that you are a farmer and brainstorm three important activities that should go into a maintenance plan and explain why.

3. Observe the brainstormed answers on the flipchart/board and discover the topic you are going to learn.

4. Look at the Key Competencies table above to see what you will gain from the learning outcome.

Problem Solving Activity

Topic 4.4 Task 2:

1. Form groups of about five people and choose a group leader.

2. Read the scenario along with the following questions:

A group of youth volunteers is committed to speeding up rural development through agribusiness. They decide to apply for grant money to organize and operate a poultry farm. They organize the training of the beneficiaries on poultry farming but they realize that they lack some knowledge on poultry maintenance. Their application for the grant money needs a detailed plan of how they will maintain their farm and equipment. The youth know that you are studying livestock production and they request your support. They want you to write a draft of a maintenance plan that includes the following:

a. Daily maintenance tasks

b. Weekly maintenance tasks with examples

c. Monthly maintenance tasks

d. Annual maintenance tasks

e. A brief explanation of the role that routine maintenance will have on this poultry farm (2-3 sentences)

3. Group leaders write the answers for each question on the board/flipchart while other groups add their comments and feedback.

4. After you read and discuss **4.4 Key Facts,** you will go back and revise your responses for this activity.

4.4 Key Facts

- **Evaluation and maintenance are applied to:**
  - Poultry house: Roof, wall, floor
  - Drainage and compost

- Compost is a natural process that happens when organic material breaks down into a soil-like product. It can then be used for many purposes such as fertilizing soils and crops. Poultry litter can be recycled and composted.
  - Annexes: storage room and sanitary room
  - Equipment: drinkers & feeders
  - Cages and litter
  - Fences and enclosures[29]

- **Role of Maintenance**
  - To keep all construction strong: roof, wall, floor, annexes.
  - To keep the good image of the farm to the employees, customers and community.
  - To better conserve and increase the shelf life of equipment.
  - To improve the safety of the farm.
  - To prevent the spread of diseases and improve the health of the poultry.

- **Types of maintenance**
  - **Day to day repair**: daily tasks
  - **Annual repair**: done once a year
  - **Special repair**: on an as needed basis
  - **Additions and alterations**: to meet the special requirements for functional efficiency
  - **Preventive maintenance**: regular tasks to make sure equipment is running properly[30]

- **Maintenance activities**
  - **Routine maintenance activities**: regular inspection and repair of poultry houses and annexes
  - **Regular hygiene**: littering, cleaning, liming, painting
  - Repair fixtures and equipment

- **Frequency of maintenance activities (maintenance plan)**
  - **Daily activities**: cleaning, inspection of poultry houses and equipment, simple and urgent repairs
  - **Weekly activities**: clean and disinfect, repairs and replacements
  - **Monthly activities**: clean out and replace littering, repairs and replacements, liming, painting

[29] Walker, F. (n.d.). *On-farm composting of poultry litter*. University of Tennessee: Agricultural Extension Service. https://extension.tennessee.edu/publications/Documents/Info%20319.pdf

[30] The Constructor. (n.d.). *Types of building repair and maintenance services*. https://theconstructor.org/building/building-repair-maintenance-service-types/6903/

- **Annual activities**: repairs and replacements, liming, painting, additional repairs

- **Role of hygienic activities**
  - **Cleaning**: To prevent diseases, control outbreaks, and keep a good image of the farm.
  - **Littering**: To use as bedding for poultry; to absorb the moisture of the chickens' faeces to prevent ammonia and multiplication of pathogens; to keep the litter dry, which is important for the health of the poultry as well as the humans caring for them.
  - **Liming**: To reduce harmful odours, kill pathogens for diseases, and reduce fly problems. Specifically, Avian influenza (bird flu), Newcastle disease, and Ornithosis
  - **Painting**: To increase the life of your farm's equipment and shelter, and to keep a good image.

- **Reading Comprehension:**
  Consider the following information from Cornell College of Agriculture and Life Sciences' Small Farms Program:

  "Dry Cleaning:
  Sweep loose dirt off ceilings, light fixtures, walls, cages or nest boxes, fans, air inlets etc. onto the floor. Remove all feed from feeders. Scrape manure and accumulated dust and dirt from perches and roosts. Remove all litter from the floor. Litter can be added to a compost pile. Sweep the floor to remove as much dry material as possible**.**
  Wet Cleaning:
  Turn the power off to the building prior to using any water for cleaning. Wet cleaning is done in three steps: soaking, washing and rinsing. Warm or hot water will do a better job getting through organic matter than cold water. You can use a cheap neutral detergent, like dish soap.
  Soaking:
  Soak the heavily soiled areas (perches and roosting areas, floors, etc.) thoroughly. Use a low-pressure sprayer to totally soak all surfaces. Soak until the accumulated dirt and manure has softened to the point it is easily removed.
  Washing:
  Wash every surface in the building, especially windowsills, ceiling trusses, wall and any surface where dirt and dust may accumulate.
  Rinsing:
  A final rinse after washing is recommended to remove any harmful residues and to obtain a spotless building. Mop/squeegee up puddles as they can rapidly become breeding grounds for harmful bacteria.

Drying:
Thoroughly air-dry the building after rinsing. Open all windows and ventilation. openings. Use a blower or fan if available. Cleaning on a dry, sunny day helps in the drying process."[31]

Guided Practice Activity

Topic 4.4 Task 3:

Part 1:

1. Read through **4.4 Key Facts** with a partner and revise your answers to the **Problem Solving Activity** from **Topic 4.4 Task 2**.

2. Share your revisions with the class.

3. Next, read through **4.4 Key Facts** (not the **Reading Comprehension** section) with the class. Make sure you understand the terminology.

Part 2:

1. With a partner, take turns reading the **Reading Comprehension** section in **4.4 Key Facts**. Then, answer the following questions using the information given:
   a. After you completely clean out a poultry house, what should you do with the old litter?

   b. Why is it important to mop/squeegee puddles immediately after washing?

   c. What are the three steps of wet cleaning and why are they important?

   d. Why do you think it is important to turn off the power before wet cleaning?

2. Share your answers while the other trainees provide comments and feedback.

Part 3:

1. Volunteer to stand up and demonstrate how to inspect and evaluate a feeder and drinker for maintenance.
   a. Consider: Is it clean? Is it damaged? Is it functioning properly?

[31] Darre, M. (2014, April 7). *Cleaning and disinfecting your poultry house*. Cornell College of Agriculture and Life Sciences: Small Farms Program. https://smallfarms.cornell.edu/2014/04/cleaning-and-disinfecting-your-poultry-house/

b. Inspect every side of it. Look for dents, scrapes, and broken pieces. Is there clogged food or built up residue from old food or water?

2. Form four groups and each group will be given one piece of equipment to maintain.

3. Suppose that you are preparing to do field work to train farm workers on the best practices for maintenance. Discuss and perform the following with your group:

a. Explain why the farmer should apply lime to the litter of a poultry farm.

b. Explain how to inspect litter and decide when it is time for it to be changed.

c. Using the equipment in your classroom, practice and demonstrate to your colleagues how to inspect and evaluate a feeder and drinker for maintenance.

4. Present your group's answers.

5. Comment on other groups' presentations and then listen to the trainer's observations and feedback.

Application Activity

Topic 4.4 Task 4:

1. Visit a poultry farm and greet the farmer and any workers present.

2. Form small groups (of about five people) and choose a group leader.

3. Complete the following tasks with your group:

a. Inspect the poultry house and equipment, evaluate their status and explain your observations.

b. Ask to the farmer to give you the opportunity to participate in:

- Cleaning
- Littering
- Liming
- Painting
- Repairing

4. After all groups have finished, come together and group leader shares the findings and what their group has done. Make general comments and listen to the trainer's observations and feedback.

5. Thank the farmer for his/her help.

Points to Remember

- Maintenance helps extend the shelf life of construction materials and equipment.
- Elaboration and respect of maintenance plan is key.
- Any damages should be repaired as soon as possible.
- Hygiene is very important to prevent diseases and succeed in poultry farming.

Formative Assessment

After carefully reading the following items, answer the following questions individually:

1. Explain the role of maintenance in poultry farming.

2. What are the components of a poultry farm to evaluate during maintenance?

3. List two of the most important hygienic activities and explain their roles.
   1.

   2.

4. Answer with **True** or **False**.
   The types of maintenance in poultry house are:
   a. Day to day repair
   b. Treatment of sick poultry
   c. Annual repair
   d. Special repair
   e. Additions and alterations
   f. Preventive maintenance
   g. Disinfection

5. Explain why you think it is important to recycle and compost old litter.

Self-Reflection

1. You have come to the end of the unit. You are going to do the survey you did at the beginning of the unit again to help you do self-assessment of your knowledge, skills, and attitudes.

Again, there are no right or wrong answers to this survey. It is for your own use to gauge your knowledge, skills and attitudes after the unit. Think about yourself: Do you think you can do this? How well? Read the statements across the top. Put a check in column that best represents your situation. Read the self-assessment you have done at the beginning of this unit, repeat the same assessment and fill the table below:

My experience **Knowledge, skills, and attitudes**	**I don't have any experience doing this.**	**I know a little about this.**	**I have some experience doing this.**	**I have a lot of experience with this.**	**I am confident in my ability to do this.**
Identify the criteria for selecting a site for a poultry house.					
Assess weather parameters for poultry farming.					
Identify the different types of poultry houses.					
Select construction materials for a poultry house.					
Identify different equipment to use in a poultry house.					
Install and test common equipment used in poultry houses.					

My experience Knowledge, skills, and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
State the role of maintenance and which components to maintain in a poultry farm.					
Establish and implement a maintenance plan for a poultry house and its equipment.					

2. Complete the table below by identifying areas from the unit where you have improved and where you need improvement with the actions/strategies you will use to help you improve when receiving and interpreting information at the workplace.

Areas of strength	Areas for improvement	Actions to take to improve
1. **2.**	**1.** **2.**	**1.** **2.**

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