GEAVET TRAINING PROGRAMME FOR CSA

CLIMATE-SMART AND SUSTAINABLE AGRICULTURE, POST-HARVEST MANAGEMENT AND RENEWABLE ENERGY:

MOZAMBIQUE

UNIT 3.2 PROBLEM-SOLVING

ENGLISH VERSION

GEAVET Project n° 101129027

3.2.A. ANALYTICAL AND CRITICAL THINKING

PART I – LEARNING MATERIAL

1. Introduction

Agricultural work today takes place in environments that are constantly changing. Climate variability, market pressures, new technologies, and evolving production practices all shape how farmers, agricultural workers, and learners plan and act. In these conditions, success depends not only on technical knowledge, but also on the ability to understand situations, make informed decisions, and adjust actions when circumstances change. Developing these capacities supports more resilient agricultural practices and more effective learning within TVET systems. Two of the most useful soft skills in these problem solving processes are **analytical and critical thinking.**

Analytical thinking is the ability to break a problem into smaller parts, examine facts one by one, and understand how elements are connected before making a decision. For example, checking rainfall data, soil type, and crop needs separately before choosing what to plant. These skills help farmers and VET learners avoid poorly informed decisions that can waste time, labour, and resources.

Critical thinking refers to the ability to question information instead of accepting it immediately, and to assess whether it is reliable, relevant, and supported by evidence. For example, questioning a weather rumour, a new input, or a suggested practice before applying it. Critical thinking helps learners judge information more effectively in contexts where advice, markets, and climate conditions are often uncertain or contradictory.

2. Adaptation to Local Context (Kenya, Nigeria, Uganda, Mozambique)

Although this sub-unit is transversal, analytical and critical thinking must be applied to real agricultural conditions. The same core competences (distinguishing evidence from assumptions, using analytical tools, interpreting data, and justifying decisions) are hence applied to different focus areas in Nigeria, Kenya, Uganda, and Mozambique.

The goal is not not to provide country-specific agriculture, but to show how context shapes what learners analyse, which data matter, and how trade-offs differ.

2.1. Kenya

Kenya's emphasis on feed and water management, drip irrigation reasoning, soil and climate data use, and early warning information for postharvest decisions provides a strong basis for analytical and critical thinking.

- **Analytical thinking** supports the interpretation of feed availability indicators, water-quality observations, soil readings, and digital climate or forecast outputs, helping learners understand how these elements affect production decisions.
- **Critical thinking** enables learners to challenge assumptions about feeding routines, recognise misinterpretation of climate information, question irrigation decisions driven by local norms rather than data, and evaluate the soundness of postharvest strategies proposed by external actors.

2.2. Nigeria

Nigeria's focus areas include soil testing interpretation, drip irrigation decision-making, the use of climate data, and feed/water management in livestock systems. These themes allow learners to apply analytical and critical thinking in complementary ways.

- **Analytical thinking** is used to interpret soil test results, read basic climate information, break down irrigation or feeding challenges into components, and assess how different choices affect soil health or livestock performance.
- **Critical thinking** is used to question common fertiliser myths, scrutinise claims about feed quality or water suitability, identify when irrigation choices are based on habit rather than evidence, and evaluate the reliability of recommendations circulated among farmers.

2.3. Uganda

Uganda's thematic focus includes methane-reducing feed approaches, hydroponic fodder considerations, feed management, climate/seasonal information, and low-emission processing options.

- **Analytical thinking** is applied to examine performance data for feed options, identify resource constraints affecting hydroponic fodder feasibility, interpret rainfall and forecast information, and break down processing options into cost, labour, and environmental components.
- **Critical thinking** helps learners question unverified sustainability claims around innovative feed solutions, identify unfounded assumptions in decision-making, evaluate whether climate information is credible and

relevant, and scrutinise proposed low-GHG technologies for overstated benefits.

2.4. Mozambique

Mozambique's priorities include intercropping, planting pits, silage/hay decisions, climate and seasonal forecasts, and renewable-energy/solar dryers.

- **Analytical thinking** helps learners examine how intercropping or planting pits affect soil moisture and erosion, assess feed conservation strategies based on simple quality indicators, interpret climate/seasonal forecasts for farm or processing decisions, and evaluate renewable technologies through basic cost–efficiency reasoning.
- **Critical thinking** allows learners to question traditional soil and cropping practices when evidence contradicts expectations, identify flawed assumptions in silage/hay decisions, challenge misuse of seasonal forecasts, and assess the credibility of sustainability claims around solar drying technologies.

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PART 2 – CURRICULUM

Learning Objectives

<table>
<tr><th>KNOWLEDGE</th><th>SKILLS</th><th>ATTITUDES</th></tr>
<tr>
<td>Students will know:
● How to distinguish facts, evidence, assumptions, and opinions.
● Basic analytical tools for diagnosing problems (root-cause logic, simple risk assessment).
● How to judge the reliability of information sources.</td>
<td>Student will be able to:
● Analyse an agricultural problem using a structured tool (e.g., 5 Whys or problem-tree).
● Interpret simple agronomic/climate data to extract implications for farm decisions.
● Compare two practical options and justify a choice with evidence.
● Identify weak arguments or unsupported claims during discussions.</td>
<td>Student will develop the following mindset:
● An evidence-first approach to decision-making.
● Openness to revising ideas based on better data.
● A constructive, questioning mindset during teamwork.</td>
</tr>
<tr><td colspan="3">TRANSVERSAL SKILLS INTEGRATED:
● Communication of reasoning clearly and concisely
● Collaboration during group-based problem analysis
● Basic self-reflection on decisions and mistakes</td></tr>
<tr><td colspan="3">DIGITAL SKILLS INTEGRATED:
● Interpreting basic digital data outputs: Soil test readings, rainfall charts, simple GIS visuals
● Using digital tools for information checking: Trusted databases, extension apps</td></tr>
<tr><td colspan="3">GREEN SKILLS INTEGRATED:
● Understanding environmental impact of decisions
● Applying evidence-based reasoning to choose sustainable practices
● Evaluating trade-offs affecting soil, water, biodiversity</td></tr>
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Implementation plan of pedagogical activities - Scheme of work

Duration: 2 hours				
Target: TVET learners				
No. of Activity	**Duration**	**Training Methods / Activity**	**What the trainers do**	**What the participants do**
1.	30 min	Root-Cause Investigation Lab	● Introduce the activity and explain the analytical tools (5 Whys, problem tree). ● Provide the scenario sheets and guide group work without giving answers. ● Facilitate presentations and lead a short debrief on evidence vs assumptions	● Analyse the scenario in groups, identifying facts, assumptions, and weak claims. ● Apply the 5 Whys and build a simple problem tree. ● Present their reasoning and reflect on how the process applies to decision-making.
2.	30 min	Information Credibility Challenge	● Introduce the task and explain the four classification categories. ● Distribute mixed information-card sets and	● Sort the cards into evidence, assumptions, opinions, and unreliable inputs. ● Use only evidence cards to make a decision and justify it.

			the decision scenario. ● Facilitate group presentations and debrief on information credibility.	● Present their reasoning and reflect on information filtering in real contexts.
3.	30 min	Trade-Off & Risk Assessment Exercise	● Introduce the constrained-budget scenario and explain the decision matrix. ● Provide scenario sheets, templates, and clarify criteria formation. ● Facilitate presentations and debrief on trade-offs and evidence-based reasoning.	● Analyse the scenario, define comparison criteria, and score options using the 1–5 scale. ● Calculate totals, identify trade-offs, and detect assumptions. ● Present and justify their final choice using the matrix.
4.	30 min	Assumption-Busting & Bias Awareness Workshop	● Introduce the constrained-budget scenario and explain the decision matrix. ● Provide scenario sheets,	● Analyse the scenario, define comparison criteria, and score options using the 1–5 scale. ● Calculate totals, identify trade-offs, and detect assumptions.

			templates, and clarify criteria formation. ● Facilitate presentation s and debrief on trade-offs and evidence-based reasoning.	● Present and justify their final choice using the matrix.

Materials (What trainers need to have prepared):

- Printed scenario sheets with conflicting statements
- 5 Whys and Problem Tree templates
- Mixed information-card sets
- Simple decision scenarios for evidence-based choice
- Decision Matrix templates
- Printed Assumption/Misconception/Bias/Claim Cards
- Flipcharts
- Markers
- Sticky notes
- Pens
- Basic stationary for group work.

Other notes:

PART 3 – ACTIVITY GUIDE

DESCRIPTION OF THE ACTIVITIES

The following activities are designed to strengthen problem-solving skills through practical exercises. They focus on helping learners analyse situations, question information, compare options, and make justified decisions using available evidence. The activities do not teach technical agricultural practices; instead, they develop analytical thinking, critical thinking, and adaptive problem-solving skills that learners can later apply to different agricultural and vocational contexts.

1. Root-Cause Investigation Lab

This activity helps participants look deeper into a problem instead of accepting quick explanations. They work with short everyday scenarios that contain mixed and sometimes confusing information. Learners must use analytical and critical thinking to determine *what is evidence*, *what is assumption*, and *where biases or weak reasoning* *appear.* In groups, they break down each situation into smaller parts to identify what might really be causing the issue. They compare different explanations, discuss what makes sense, and check whether the information supports their conclusions. The activity trains participants to question first impressions and look for the real cause before deciding what to do.

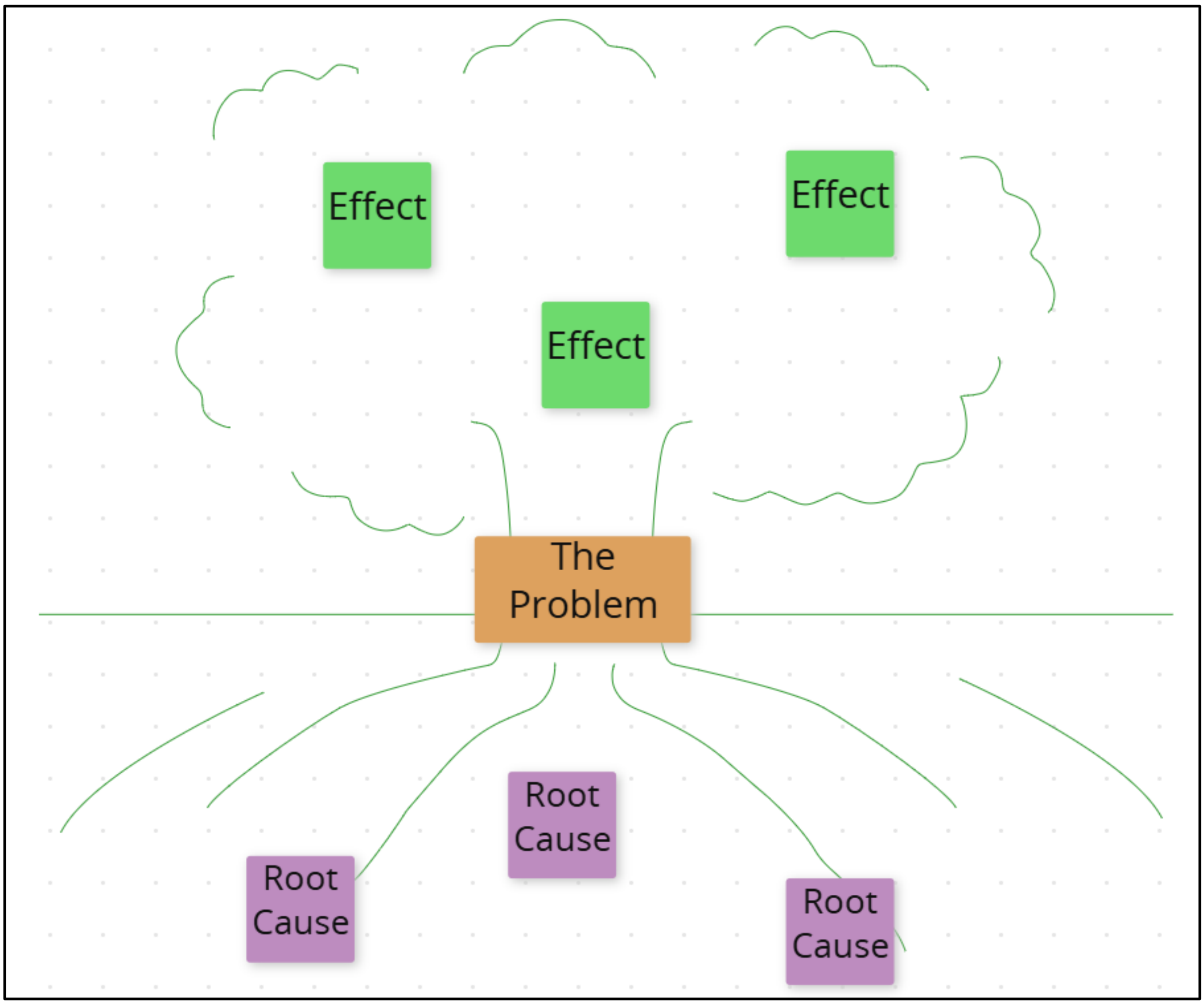
1. **Aim of the activity:** To develop the ability to decompose problems, test assumptions, and identify underlying causes using structured analytical methods.

2. **Duration:** 30 minutes

3. **Material required:**

- Flipcharts
- Problem-tree templates
- 5 Whys worksheets.

4. **Step-by-step instruction of the practical exercise:**
    - ➢ Divide participants into small groups.
    - ➢ Give each group one scenario + conflicting statements.
    - ➢ Groups highlight: facts / assumptions / unclear claims.
    - ➢ Apply 5 Whys to identify deeper causes.
    - ➢ Create a problem tree (root causes → effects).
    - ➢ Groups present findings and justify reasoning.
    - ➢ The facilitator leads a debrief focusing on evidence vs assumptions.



Source: Problem Tree template (Catlett (2024), PBLWorks)

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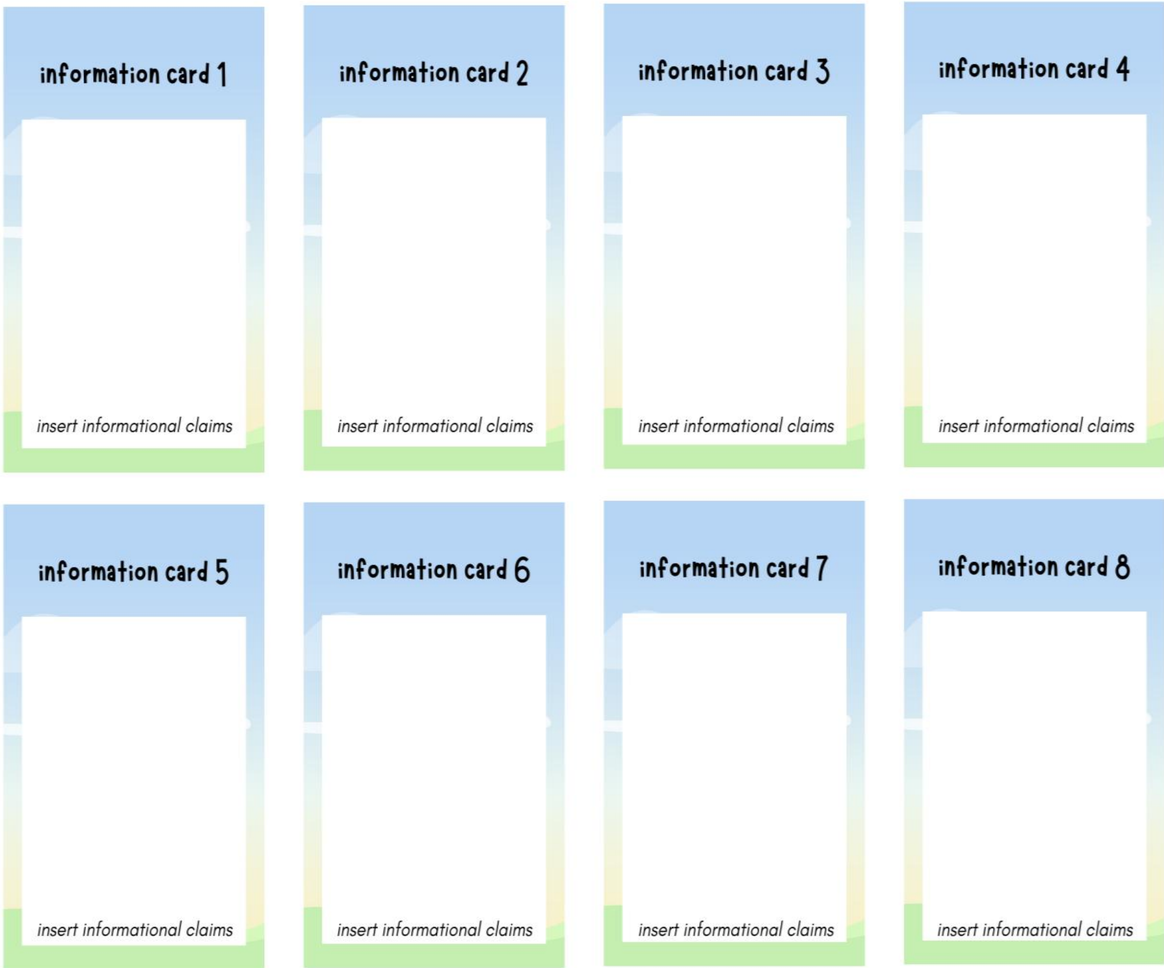
2. Information Credibility Challenge

This activity develops the ability to differentiate evidence from assumptions, opinions, or misinformation. Learners work in groups with a mixed set of information cards containing: factual data, manipulated statistics, anecdotal statements, emotional opinions, traditional beliefs, partial data, and expert advice. Cards deliberately contradict each other and vary in reliability. Participants must classify each card into categories: evidence, assumption, opinion, unreliable or unclear. They discover how difficult it is to distinguish high-quality information when confronted with noise, bias, and incomplete facts—mirroring real-life decision-making environments. Each group is then given a simple non-agricultural decision scenario (choosing a training venue, scheduling an event, selecting a partner organisation). They must choose the best option using only the cards classified as evidence and justify their reasoning publicly. The activity strengthens critical thinking by forcing learners to justify why certain information counts as evidence and why other inputs must be discarded.

1. **Aim of the activity:** To improve the ability to evaluate information sources, detect unreliable inputs, and justify decisions using credible evidence.
2. **Duration:** 30 minutes
3. **Material required:**

- Information-card sets
- Decision-scenario cards



4. **Step-by-step instruction of the task/practical exercise/case study:**
    - ➢ Distribute mixed information-card sets (template available).
    - ➢ Groups categorise each card (evidence/assumption/opinion/unreliable).
    - ➢ Give each group a simple decision scenario.
    - ➢ They select an option using evidence cards only.
    - ➢ Groups justify their decision publicly.
    - ➢ The facilitator highlights misclassified cards and reasoning gaps.

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3. Trade-Off & Risk Assessment Exercise

This activity teaches participants to analyse options under resource constraints, compare alternatives systematically, and make transparent decisions. Participants are given a fictional community scenario with a limited budget and limited time. They must choose between three possible investments (training hut, communal storage shed, youth equipment). None is perfect: each has strengths, weaknesses, and risks. Participants build a *simple decision matrix* with pre-defined criteria: cost, time, feasibility, benefits, risks. They assign scores based on short descriptions in the scenario and debate their choices. The exercise trains analytical thinking through structured comparison, option scoring, and scenario reasoning. It trains critical thinking through identifying hidden assumptions, recognising overconfidence, and challenging group biases ("we like this option more" vs "this option performs better on criteria"). The activity emphasises that good decisions require clarity, structure, and fairness—not intuition alone.

1. **Aim of the activity:** To build capacity to compare options, analyse trade-offs, and justify decisions using a structured, transparent method.
2. **Duration:** 30 minutes
3. **Material required:** Decision matrix templates; scenario sheets; calculators.
4. **Step-by-step instruction of the task/practical exercise/case study:**

    - ➢ Present the fictional constrained-budget scenario.
    - ➢ Groups create a decision matrix with 4–5 criteria.
    - ➢ Assign scores to each option 1-5:
        1 = Very Poor / Very Low / Strongly Negative
        2 = Poor / Low / Negative
        3 = Moderate / Acceptable / Neutral
        4 = Good / Above Average / Positive
        5 = Very Good / Very High / Strongly Positive
    - ➢ Total scores and discuss inconsistencies.
    - ➢ Groups justify their final choice.
    - ➢ The facilitator leads reflection on biases and trade-offs.

References/Sources/Further materials:

Decision matrix templates: Available at *Smartsheet*. Retrieve the templates here: https://www.smartsheet.com/decision-matrix-templates?srsltid=AfmBOoqQMYopoSeKiL5kkGmudqXt9JHtNo-GOk3bfYbYwPgh911ScUu7

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4. Assumption-Busting & Bias Awareness Workshop

This activity helps participants detect hidden assumptions, break cognitive biases, and verify claims before accepting them. Groups receive a set of common misconceptions (e.g., "new technology is always better", "tradition is always right", "the majority cannot be wrong", "expensive means quality"). None relate to agriculture directly; the goal is to strengthen cognitive flexibility. Participants classify each statement into: *assumption*, *claim*, or *belief*. They must then discuss how the statement could lead to a wrong decision in real life and what evidence would be needed to verify or disprove it. Groups choose 2–3 statements and design a **simple test or observation** that would reveal whether the statement is correct. Finally, they rewrite each misconception as an **evidence-based statement**, demonstrating how reasoning changes once assumptions are examined critically. This activity builds critical thinking by pushing learners to examine thought patterns, detect bias, and recognise when "common sense" is misleading. It strengthens analytical thinking by requiring them to design verification strategies and identify what data would matter.

1. **Aim of the activity:** To strengthen capacity to identify assumptions, detect cognitive biases, and ground decisions in verifiable evidence.

2. **Duration:** 30 minutes

3. **Material required:**

- Assumption-card sets
- Flipcharts
- Sticky notes.

ASSUMPTION CARD “IF MANY PEOPLE BELIEVE IT, IT MUST BE TRUE.”	ASSUMPTION CARD “IF SOMETHING WORKED ONCE, IT WILL WORK AGAIN IN THE SAME WAY.”	ASSUMPTION CARD “NEW SOLUTIONS ARE AUTOMATICALLY BETTER THAN OLD ONES.”	ASSUMPTION CARD “IF A PERSON IS CONFIDENT, THEIR REASONING MUST BE CORRECT.”
MISCONCEPTION CARD “DATA ALWAYS SPEAKS FOR ITSELF; INTERPRETATION IS UNNECESSARY.”	MISCONCEPTION CARD “EXPERT ADVICE IS ALWAYS RELIABLE, REGARDLESS OF CONTEXT.”	MISCONCEPTION CARD “TWO EVENTS HAPPENING TOGETHER MEANS ONE CAUSED THE OTHER.”	MISCONCEPTION CARD “MORE INFORMATION ALWAYS LEADS TO BETTER DECISIONS.”
BIAS CARDS “I NOTICE INFORMATION THAT SUPPORTS MY BELIEFS.”	BIAS CARDS “IF AN AUTHORITY SAYS IT, IT MUST BE TRUE.”	BIAS CARDS “IF MOST PEOPLE CHOOSE IT, IT MUST BE THE BEST OPTION.”	BIAS CARDS “IF SOMETHING IS EASY TO REMEMBER, IT MUST BE IMPORTANT.”
CLAIM CARDS “THIS OPTION IS THE BEST CHOICE FOR OUR GROUP.”	CLAIM CARDS “THIS APPROACH WILL SAVE TIME AND EFFORT.”	CLAIM CARDS “EVERYONE WILL BENEFIT EQUALLY FROM THIS SOLUTION.”	CLAIM CARDS “THIS METHOD WORKS IN ALL SITUATIONS.”

4. Step-by-step instruction of the practical exercise:

- ➢ Distribute misconception/assumption cards.
- ➢ Groups classify each (assumption/claim/belief).
- ➢ Discuss risks of acting on each assumption.
- ➢ Design simple ways to test or verify them.
- ➢ Rewrite statements into evidence-based versions.
- ➢ Present findings and reflect on bias.

Resources/Further Materials:

A template containing 4 example cards for each of the 4 types (Assumptions, Misconceptions, Biases, and Claims) to guide the activity.

3.2.B. INNOVATIVE AND ADAPTIVE PROBLEM SOLVING

PART I – LEARNING MATERIAL

1. Introduction

Innovative and adaptive problem solving is a core competence for farmers and (T)VET learners working in increasingly unpredictable climate-affected agricultural environments. Climate-Smart Agriculture (CSA) requires frequent decision-making under uncertainty: rainfall patterns shift unexpectedly; pests emerge earlier; soils behave differently across seasons; markets fluctuate; and resources such as labour, water, and inputs are often limited (IPCC, 2022). Across Nigeria, Kenya, Uganda, and Mozambique, erratic rainfall, delayed onset of rains, rapid soil-moisture loss, and changing climatic patterns represent shared and persistent challenges (FAO, 2013). In these situations, effective problem solving is not linear.

These conditions force farmers to make and adjust decisions dynamically, with incomplete, conflicting, or fast-changing information: when to plant, how to conserve soil moisture, which low-cost practices can reduce risk, and how to react when conditions suddenly shift (Asfaw & Lipper, 2016). Traditional problem-solving models assume stable conditions and complete information. By contrast, CSA contexts involve ambiguity, evolving constraints, and the need to act before certainty is available.

This unit introduces learners to an **Integrated Problem-Solving Framework** that brings together linear logic, critical thinking, and adaptive reasoning. Learners first explore a clear, structured problem-solving sequence (linear), and then see how it evolves into more flexible, iterative approaches suitable for uncertainty. This prepares them for Activity 1 (Adaptive Scenario Lab) and Activity 2 (Solution Prototyping & Rapid Testing).

Learners will then work through a realistic cross-country CSA scenario involving unpredictable rainfall and moisture stress, classify credible vs. uncertain information, take decisions, revise them when new variables appear, and ultimately develop and test low-cost prototypes (e.g., moisture-retaining pits, simple water-harvesting structures, low-cost drip emitters, mulching approaches, seedling shelters).

The unit supports learners in developing a mindset that embraces experimentation, evidence-based reasoning, and adaptation — essential capacities for smallholders and trainers across Sub-Saharan Africa (CGIAR-CCAFS, 2019; Rockström et al., 2010).

2. Foundations: Linear and Adaptive Problem-Solving

Problem solving traditionally follows a linear, sequential structure similar to the scientific method: observing a phenomenon, generating hypotheses, testing them, and analysing results (Popper, 1959; Platt, 1964). In practical contexts, this includes observing the situation, defining the problem, collecting relevant information, analysing causes, generating and evaluating options, selecting a solution, implementing it, and monitoring results (Jonassen, 2011). This approach works well when environments are stable and information is complete, and it supports clarity by helping individuals distinguish facts from assumptions, identify causal mechanisms, and evaluate evidence logically. Similarly, classical **decision-making theory** emphasises defining the problem, generating options, evaluating consequences, and selecting the most rational choice (Simon, 1978; Kahneman & Tversky, 1984).

However, CSA environments rarely meet these conditions. Climate variability introduces uncertainty, temporal instability, and conflicting signals, requiring learners to complement linear logic with critical thinking (questioning data quality, identifying bias, seeking alternative explanations) and adaptive reasoning (revising decisions as new evidence emerges). Adaptive reasoning enables continuous revision of hypotheses and actions in response to new stimuli (IPCC, 2022; Rockström et al., 2010). Research shows that farmers in climate-affected regions rely on iterative adjustments rather than fixed plans - what Rockström et al. (2010) refer to as "**dynamic management** under water-stress uncertainty."

To support this, an **Integrated Problem-Solving Framework** is offered, which:

- introduces the essential linear logic of problem solving;
- shows how this logic evolves under uncertainty and incomplete information;
- prepares learners for decision-making in dynamic CSA conditions.

This framework, consisting of three inter-related Tables (see below) serves as the conceptual foundation for Activities 1 and 2.

How to use this Framework:

- **Before Activity 1:** Learners explore the Framework and understand the shift from linear to adaptive reasoning.
- **During Activity 1 (Adaptive Scenario Lab):** The Framework helps them classify information, build a working problem statement, choose initial strategies, and revise decisions when new update prompts appear.
- **During Activity 2 (Solution Prototyping & Rapid Testing):** The adaptive elements guide iterative design, testing, and refinement of CSA solutions.

3. Integrated Problem-Solving Framework

Table 3. Integrated Problem-Solving Framework

PHASE	LINEAR STEP	CRITICAL THINKING	LIMITS UNDER CSA UNCERTAINTY	ADAPTIVE RESPONSE
1. Understanding the Situation	Observe the situation; define the problem	Distinguish facts from assumptions; identify biases	Information incomplete or misleading	Use a flexible, revisable problem statement
2. Gathering Inputs	Collect information; analyse causes	Check source reliability; test alternative explanations	Conflicting signals; evolving conditions	Classify info (reliable/unclear/assumed); update causes iteratively
3. Generating Options	Brainstorm solutions	Encourage creativity, analogy, lateral thinking	Standard solutions may fail under erratic conditions	Develop multiple adaptive pathways
4. Deciding & Acting	Evaluate and choose option; implement plan	Compare trade-offs; justify choices	Criteria may shift quickly	Select "low-regret", flexible solutions; adjust early
5. Learning & Iteration	Monitor and learn	Reflect objectively; revise mental models	Linear monitoring assumes stability	Continuous learning, rapid adjustment

Table 4. Linear vs Adaptive Problem-Solving

LINEAR PROBLEM SOLVING	ADAPTIVE PROBLEM SOLVING (UNCERTAINTY-READY)

Sequential	Iterative
Requires full information	Works with incomplete and conflicting information
One "best" option	Multiple robust, low-regret options
Predictable conditions	Variable and unpredictable conditions
Analysis → Action	Analysis ↔ Action (continuous feedback)
Optimises for efficiency	Optimises for resilience

Table 5. Example: Linear and Adaptive Responses in a CSA Scenario

PROBLEM-SOLVING STEP	LINEAR PROBLEM-SOLVING	ADAPTIVE PROBLEM-SOLVING (UNCERTAINTY-READY)
1. Observe the Situation	Notice animals drinking more water and showing mild heat stress during mid-day.	Observe signs, but also expect conditions to worsen unpredictably with temperature spikes.
2. Define the Problem	"Livestock are experiencing heat stress due to limited water supply during hot hours."	Define a *provisional* problem: "Heat stress risk increasing, but water needs may fluctuate unpredictably."
3. Collect Information	Check daily water quantity, trough levels, and temperature forecasts.	Combine multiple sources (local observations, app forecasts, neighbours' information), classify as reliable/unclear/assumed.
4. Analyse Causes	Conclude heat stress is caused by high temperatures + insufficient midday water.	Consider multiple evolving causes: possible pump failure, unexpected demand increases, forecast uncertainty.

5. Generate Options	Increase water availability; provide shade; adjust feeding times.	Generate "low-regret" options valid under multiple scenarios: temporary shade + shift activities + prepare backup containers.
6. Evaluate Options	Compare the cost and effectiveness of each option with current conditions.	Evaluate robustness: which option works even if temperatures rise faster or water access decreases suddenly?
7. Choose a Solution	Provide extra water at noon + add shade.	Implement a flexible bundle: morning + evening watering, mobile shading, reserve water containers in case of sudden shortages.
8. Implement	Apply the chosen plan exactly as defined.	Implement gradually, monitor early responses, adjust quickly if temperatures spike or water availability changes.
9. Monitor Results	Check animal behaviour and water levels daily.	Monitor continuously; revise assumptions; prepare for rapid adjustments if heatwave persists.
10. Learn & Document	Note what worked; repeat next season.	Document triggers, early-warning signs, and successful adaptive strategies to build resilience for future shocks.

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Learning Objectives

KNOWLEDGE	SKILLS	ATTITUDES
Students will know: ● The principles and differences between structured/linear and adaptive problem solving. ● How to deal with uncertainty affecting agricultural decisions. ● Key Tools for breaking down problems and evaluating partial or conflicting information. ● Key tools for analysing incomplete information and generating feasible solutions. ● The purpose of rapid prototyping for CSA solutions.	*Student will be able to:* ● Apply linear reasoning to define and analyse problems. ● Use adaptive reasoning when conditions change. ● Analyse CSA challenges using structured and adaptive reasoning. ● Make justified decisions using incomplete or evolving information. ● Generate context-appropriate, creative, low-cost solutions. ● Build and test simple prototypes or process models. ● Revise solutions, incorporate feedback and iterate solutions.	*Student will develop the following mindset:* ● Confidence in decision-making under uncertainty. ● Openness to revising ideas when new evidence emerges and iterative learning. ● A practical, resourceful, experiment-oriented mindset. ● Adaptability and resilience in responding to climate stress. ● A constructive, solution-oriented mindset.
TRANSVERSAL SKILLS INTEGRATED: ● **Analytical thinking** ● **Problem solving** ● **Teamwork and communication** ● **Creative ideation**		

● **Adaptability**
DIGITAL SKILLS INTEGRATED: ● **Basic mobile-based weather tools** ● **Photo documentation of prototypes** ● **Online verification of agronomic information**
GREEN SKILLS INTEGRATED: ● **Water-saving reasoning and practices** ● **Soil moisture management** ● **Sustainable resource use and innovation** ● **Ecological thinking** ● **Climate-resilient decision-making**

Implementation plan of pedagogical activities - Scheme of work

Duration: 1h 30 min				
Target: Farmers / TVET learners				
No. of Activity	**Duration**	**Training Methods / Activity**	**What the trainers do**	**What the participants do**
1.	45 min	Adaptive Scenario Lab – Erratic Rainfall & Soil Moisture Stress	● Introduce framework ● Present scenario ● Guide reasoning ● Provide new information ● Facilitate decision revision.	● Analyse scenario information ● Classify inputs ● Use and apply PS framework ● Decide under uncertainty ● Revise decisions as new info appears ● Justify reasoning.
2.	45 min	Solution Prototyping & Rapid Testing	● Introduce simple prototyping	● Generate ideas

			approaches ● Provide materials ● Facilitate testing & feedback rounds.	● Build basic prototype/mock-up ● Test solutions ● Integrate feedback ● Present refined solutions.
Materials (What trainers need to have prepared): ● Problem Solving Framework (see tables 3-5 above); ● Scenario overview + 12 Information cards (INFO CARDS) + 10 Update cards (see Appendix 3); ● Flipcharts; ● Markers, paper, string, small containers, sticky notes; ● Smartphones.				

PART 3 – ACTIVITY GUIDE

DESCRIPTION OF THE ACTIVITIES

1. Adaptive Scenario Lab: Erratic Rainfall & Soil-Moisture Stress

This activity introduces learners to the application of the Integrated Problem-Solving Framework under conditions of uncertainty. This activity immerses learners in a realistic CSA problem where decisions must be made despite incomplete, conflicting, or changing information. Erratic rainfall and rapid soil moisture loss are among the most widespread climate-related challenges across Sub-Saharan Africa. Learners work with a realistic and cross-country CSA scenario: the rainy season has started irregularly, soils dry quickly after short rains, and forecasts are inconsistent — a shared challenge documented across Nigeria, Kenya, Uganda, and Mozambique (FAO, 2013; IPCC, 2022). The trainer may use the template provided in Appendix 3, supporting the activity. The trainer presents the scenario orally:
➞ *The rainy season has started irregularly; short, uneven rains dry rapidly; neighbouring seedlings show signs of moisture stress; and weather predictions are inconsistent. Farmers must decide whether to plant now, delay planting, or adopt moisture-conservation practices.*

Participants receive an initial set of information cards, each containing a short, concrete piece of information about the situation. Some cards present factual data (e.g., soil texture, recent rainfall patterns), others provide partial observations (e.g., neighbour predictions), others contain contradictory indications (e.g., two different weather forecasts), and some highlight resource constraints (e.g., limited mulch, restricted labour availability).

Using the Integrated Problem-Solving Framework, learners must:

1. Identify what they know, what remains uncertain, and what is based on assumptions;
2. Formulate a working problem statement;
3. Generate several plausible decisions (e.g., early planting, delayed planting, partial mulching, creation of simple water-harvesting pits);
4. Choose one initial strategy and justify it based on evidence and reasoning.

Midway through the activity, the trainer introduces a new set of update prompts (formerly “variable update cards”), which represent changes or developments in the situation. These may include:

- a brief unexpected rainfall event,
- an updated weather alert forecasting a dry spell,
- early reports of pest activity, availability of additional mulch or labour,
- or shifts in market expectations.

Learners must then revise their initial strategy, explain the trade-offs, and justify how their adapted decision is more robust given the updated conditions. This reflects the principle that, in CSA contexts, good decisions often emerge through iteration, not certainty (Asfaw & Lipper, 2016; Rockström et al., 2010).

This activity mirrors how real farmers operate under climate uncertainty: acting with imperfect information, adjusting actions as new evidence appears, and making decisions that balance risk, resource constraints, and potential benefits. It strengthens analytical reasoning, rapid decision-making, communication, and adaptive thinking while grounding these transversal competencies in concrete agricultural situations. Learners gain confidence in navigating uncertainty—an essential skill for sustainable and climate-resilient farming systems. This activity builds learners’ capacity to make decisions with imperfect information, recognise how new data affects reasoning, and justify adaptive choices — reflecting CSA principles of iterative, risk-aware management (Asfaw & Lipper, 2016; Rockström et al., 2010).

1. **Aim of the activity**: To strengthen learners’ ability to analyse information, make evidence-based decisions, and revise strategies under uncertainty in a CSA context.

2. **Duration**: 45 minutes

3. **Material required**:

- Integrated Problem-Solving Framework sheet
- Scenario description (oral + short written summary)
- Information cards (factual + uncertain + conflicting + constraints)
- Update prompts (new, evolving situation changes introduced mid-session)
- Flipcharts, markers
- Smartphones.

4. **Step-by-step instruction of the task/practical exercise/case study:**
   - **Framework Recap** – The trainer briefly revisits the Integrated Problem-Solving Framework.
   - **Scenario Presentation** – The trainer narrates the erratic rainfall and soil-moisture-stress scenario.
   - **Information Sorting** – Groups classify information cards into: reliable, unclear, and assumed.
   - **Initial Decision** – Groups choose and justify an initial strategy using the framework.
   - **Update Prompts Introduced** – Additional information is provided to simulate evolving conditions.
   - **Decision Revision** – Groups adapt the strategy using adaptive reasoning.
   - **Short Presentations** – Each group explains its reasoning and revised decision.
   - **Trainer Debrief** – Highlight differences between linear and adaptive problem solving and reflect on real-world parallels.

References/Sources/Further materials:

Asfaw, S., & Lipper, L. (2016). *Managing climate risk using climate-smart agriculture*.

FAO. (2013). *Climate-Smart Agriculture Sourcebook*. FAO.

IPCC. (2022). *Climate Change 2022: Impacts, Adaptation and Vulnerability*.

Rockström, J., et al. (2010). Managing water in rainfed agriculture. *Agricultural Water Management, 97*(4), 543–550.

2. Prototyping Adaptive Climate-Resilient Solutions

This activity guides learners in transforming an adaptive idea into a simple, low-cost prototype that can respond to climate-related challenges in smallholder farming systems. Building on the decisions made in Activity 1, participants convert their chosen strategy into a visual or basic physical prototype, using the Prototyping Canvas (Appendix 4) and the Peer Testing Feedback Sheet (Appendix 5). Prototyping helps learners break down a solution into its essential components, visualise how it works, and test its feasibility before real-world implementation.

Working in small groups, participants sketch or construct simple mock-ups — using paper, string, stones, small containers, or other low-cost materials — to represent processes such as improved moisture retention, micro-catchments, low-cost drip irrigation, or temporary seedling protection. They use the Prototyping Canvas to articulate: the problem they address, their proposed solution, the materials needed, expected benefits, potential risks, and the steps needed to test their prototype. Once prototypes are drafted, groups engage in peer testing: they present their solution to another group, receive structured feedback using the Peer Testing Feedback Sheet, and use this input to refine and improve their prototype.

This iterative cycle mirrors CSA principles of farmer-led innovation, continuous learning, and adaptation under uncertainty (FAO, 2013; Rockström et al., 2010). It reinforces transversal skills such as creativity, analytical reasoning, communication, and collaborative problem solving, while grounding them in practical, context-relevant agricultural challenges. By the end of the activity, learners gain confidence in designing and improving climate-resilient solutions that are affordable, feasible, and adaptable across diverse farming contexts in Sub-Saharan Africa.

1. **Aim of the activity**: To enable learners to design, test, and refine low-cost adaptive solutions for climate-related agricultural challenges.
2. **Duration**: 45 minutes
3. **Material required**:
    - Prototyping Canvas (Appendix 4)
    - Peer Testing Feedback Sheets (Appendix 5)
    - Flipcharts, markers
    - Recycled materials (paper, string, small containers, sticks, crop residues)
    - Smartphones for documentation (optional)
4. **Step-by-step instruction of the task/practical exercise/case study**:
    - **Introduction to Prototyping** – Trainer explains the purpose of rapid prototyping and introduces the Prototyping Canvas.
    - **Prototype Drafting** – Groups sketch or build a simple prototype representing their chosen adaptive solution in a template of “Prototyping canvas” (Appendix 4).

- **Prepare for User Testing** – Groups identify what aspects of the prototype they want feedback on (e.g., feasibility, labour, materials).
- **Peer Testing** – Groups exchange prototypes and use the Feedback Sheet (Appendix 5) to provide structured comments.
- **Prototype Revision** – Based on feedback, each group refines and clarifies its solution.
- **Short Presentations** – Groups present the improved prototype and explain what changed and why.
- **Trainer Debrief** – The trainer highlights iterative learning, feasibility challenges, and how prototyping supports adaptive problem solving.

References/Sources/Further materials:

FAO. (2013). *Climate-Smart Agriculture Sourcebook*. FAO.

FAO. (2019). *Farmer Field Schools Guidance Document*.

Rockström, J., Hatibu, N., Oweis, T., Wani, S., & Barron, J. (2010). Managing water in rainfed agriculture. *Agricultural Water Management, 97*(4), 543–550.

Schut, M., Klerkx, L., Sartas, M., Lamers, D., & Campbell, B. (2016). Innovation platforms: concept and experiences in agricultural research in Africa. *Experimental Agriculture, 52*(4).