PROBLEM SOLVING USING ANALYTICAL AND DESIGN THINKING

Project Title: Building Trust in Smart Agriculture

Project Domain: Smart Agriculture

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Problem Breakdown

Issue

1

- Farmers do not trust the accuracy and reliability of the system outputs
- Hesitation to rely on ML-based recommendations

Cause

2

- Insufficient farmer training on system usage
- Lack of transparency and explainability in ML predictions

Technology

3

- Smart agriculture systems using machine learning for crop and farming predictions.

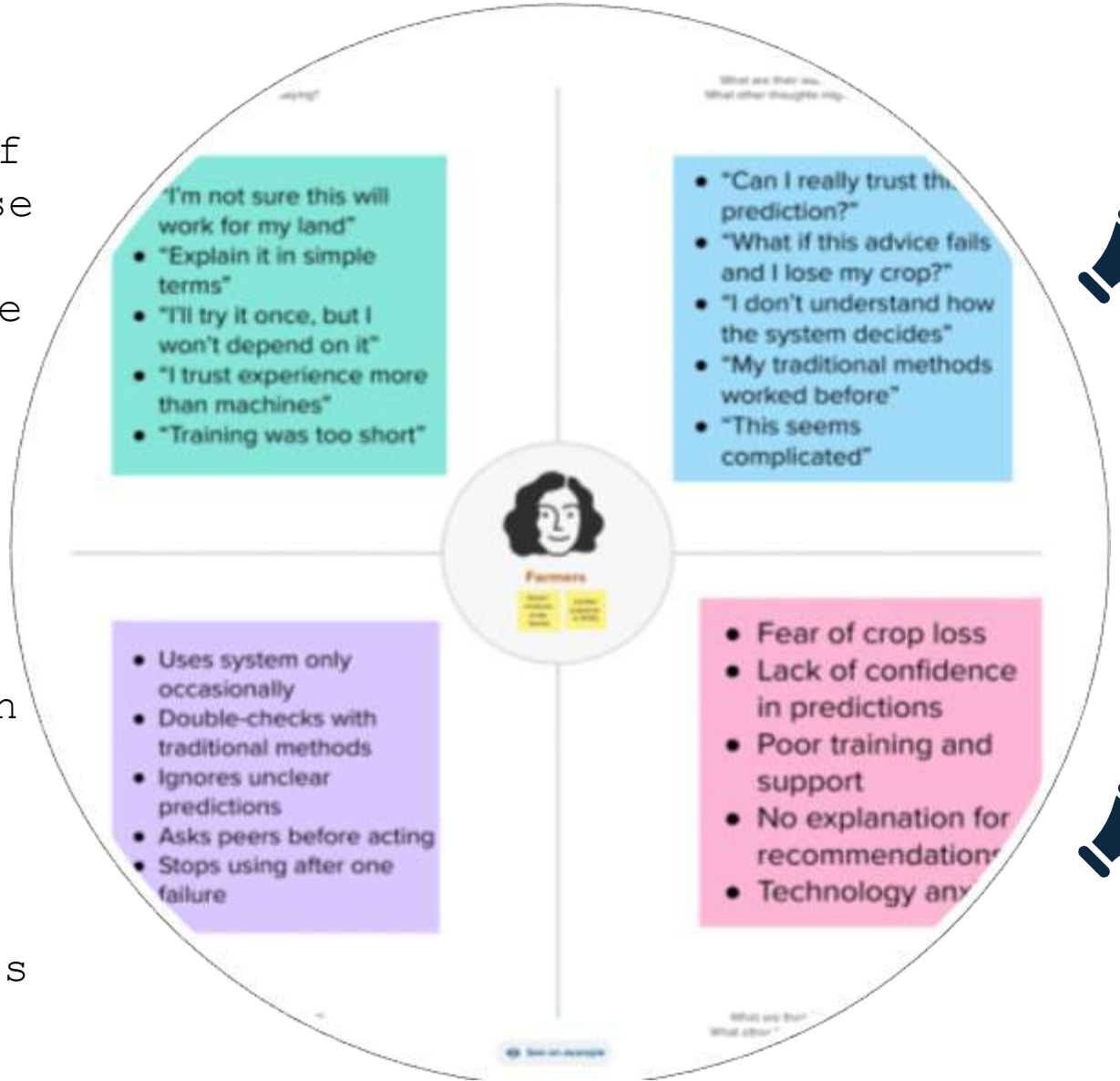
Impact

4

- Low adoption of smart agriculture solutions
- Data-driven farming benefits remain unrealized
- Reduced improvement in productivity and decision-making

User Understanding

Empathy mapping



1. Says

•"I don't know if I can trust these predictions."
•"I need guidance in my own language."

2. Thinks

•"What if I make a wrong decision and lose my crops?"
•"Is this technology really worth using?"

3. Does

•Mostly relies on traditional farming methods
•Occasionally checks digital tools but ignores recommendations

4. Feels

•Confused and skeptical about ML outputs
•Anxious about crop yield and financial loss

Target User Persona

Name: Ramesh Kumar
Occupation: Small to medium-scale farmer
Location: Rural India
Age: 55–60 years
Tech Comfort: Basic smartphone usage, limited exposure to digital tools
Goals: Improve crop yield, reduce losses, make informed farming decisions

Pain Points

Trust

Farmers are skeptical of recommendations and cannot verify outputs

Training

Limited guidance on using smart agriculture tools or interpreting results

Technology

Farmers prefer traditional methods due to fear of mistakes and unclear benefits

Smart Agriculture ML System

User journey

Step-by-step of user interactions

User Journey – Farmer Using Smart Agriculture System

1. Awareness

•Farmer hears about the ML-based agriculture system

•Initial curiosity but limited understanding

2. Onboarding & First Use

•Tries the system with minimal training

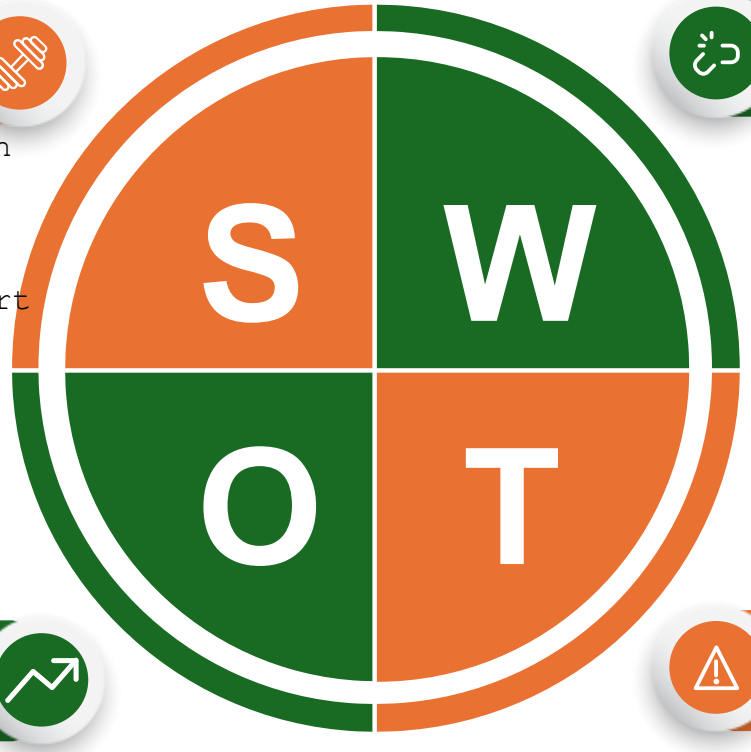
•Finds predictions difficult to interpret

3. Decision-Making

•Hesitates to follow ML recommendations

•Prefers traditional farming methods

SWOT



STRENGTHS

•Builds farmer trust through explainable ML outputs
•Local language and voice-based support
•Data-driven decision support improves accuracy

WEAKNESSES

- Requires initial training and onboarding effort
- Dependence on data quality and system availability

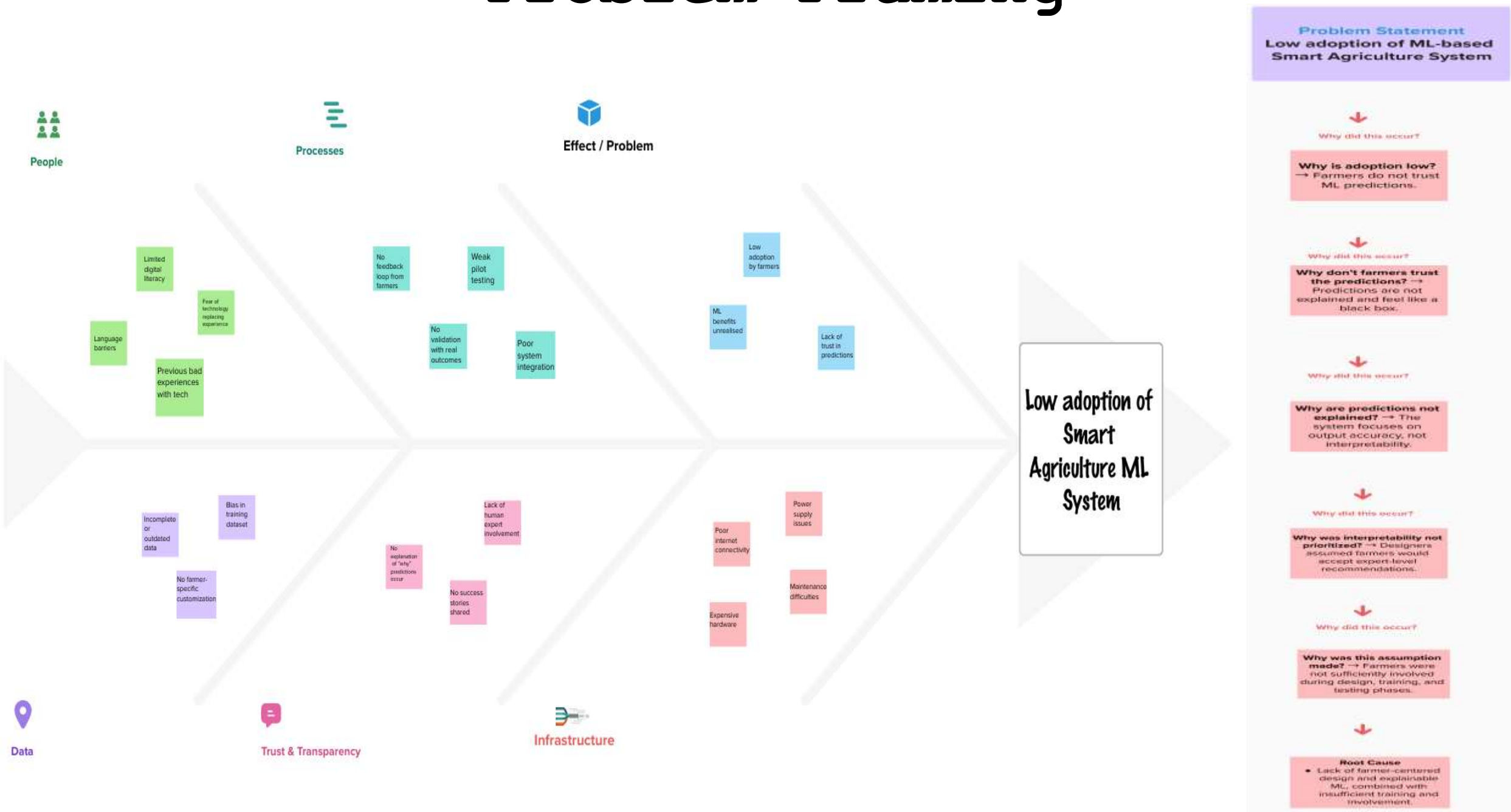
OPPORTUNITIES

•Growing adoption of digital tools in agriculture
•Government support for smart farming initiatives
•Scalability across crops and regions

THREATH

•Resistance to change from traditional practices
•Low digital literacy in rural areas
•Infrastructure limitations (internet, devices)

Problem Framing



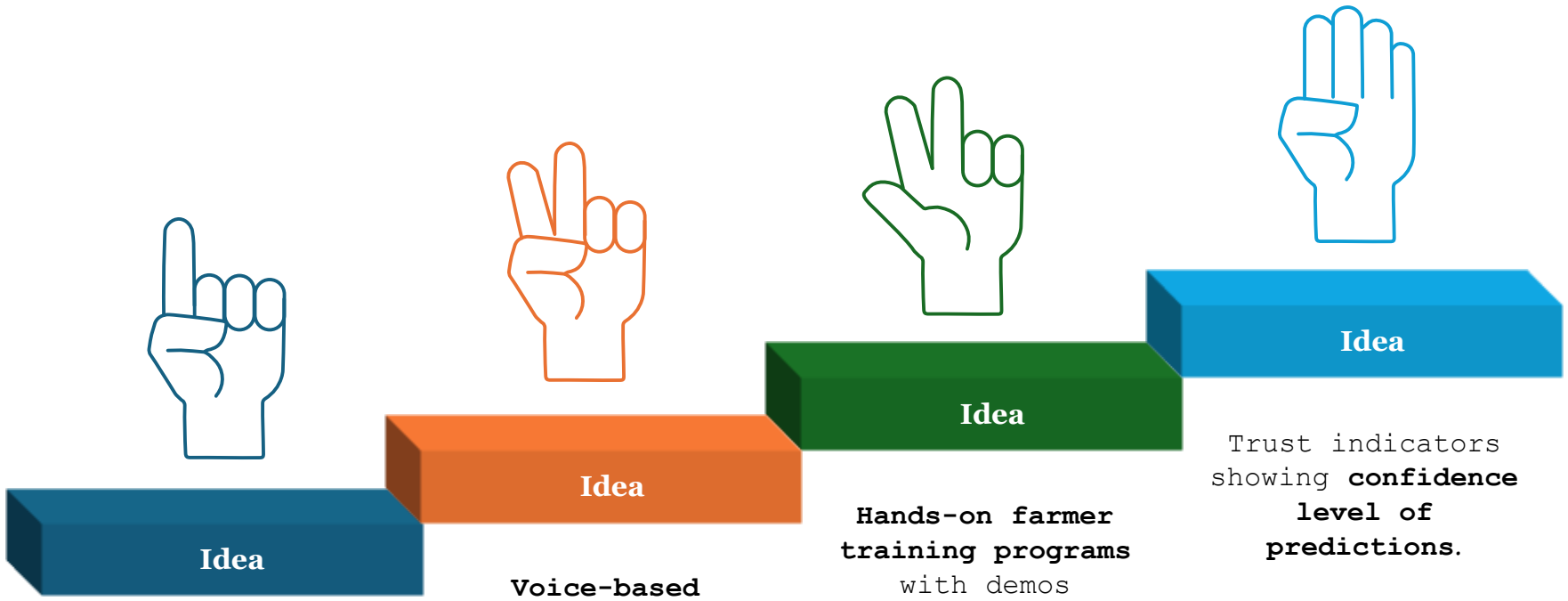
Root Cause

Absence of a farmer-centric, explainable, and well-supported ML system

- **Lack of Explainability in ML Outputs**
  Farmers cannot understand how predictions are generated, reducing trust.
- **Inadequate Training and Awareness**
  Limited hands-on training prevents effective use of the system.

- **Low Digital Literacy Among Farmers**
  Difficulty in navigating technology leads to hesitation.
- **Poor User-Centric System Design**
  Interfaces are not tailored to farmers' needs, language, or context.

Ideation and Solution Selection



Interactive ML dashboard with **simple visual explanations**

Voice-based guidance and local-language support

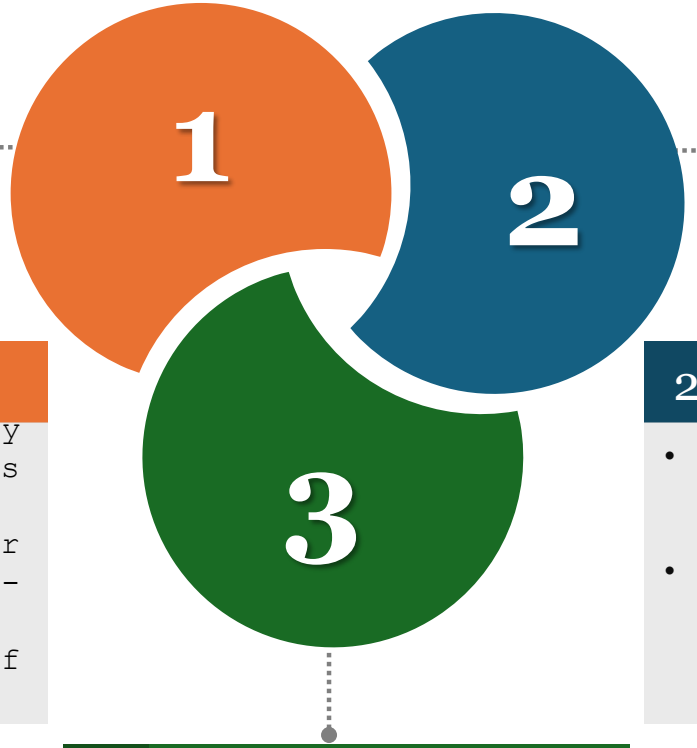
Hands-on farmer training programs with demos

Trust indicators showing **confidence level of predictions.**

★ Final Chosen Solution (Highlighted)

Farmer-Centric Explainable ML Platform with Local Language & Guided Training

Why This Solution Was Chosen



1 Impact

- Builds trust by explaining *why* predictions are made
- Improves farmer confidence and decision-making
- Increases adoption of smart agriculture systems

2 Affinity Logic

- Directly addresses key pain points: trust, training, and usability
- Aligns with farmer needs and real-world constraints

3 Effort

- Uses existing ML models with improved interface design
- Moderate implementation effort with high usability gains

Impact–Effort Matrix: Smart Agriculture ML Adoption

High Impact – Low Effort (Quick Wins)
(Do first)

- Use **local language** for predictions and alerts
- Add **visual indicators** (colors, icons) instead of numbers
- Show **simple "why this recommendation" explanations**
- Share **local success stories** and testimonials

High Impact – High Effort (Major Projects)
(Plan & invest)

- Build **explainable AI (XAI)** for ML predictions
- Localize models for **region-specific crops and soil**
- Continuous **hands-on farmer training programs**
- Integrate **human expert support** (agri officers)

Low Impact – Low Effort (Fill-Ins)
(Nice to have)

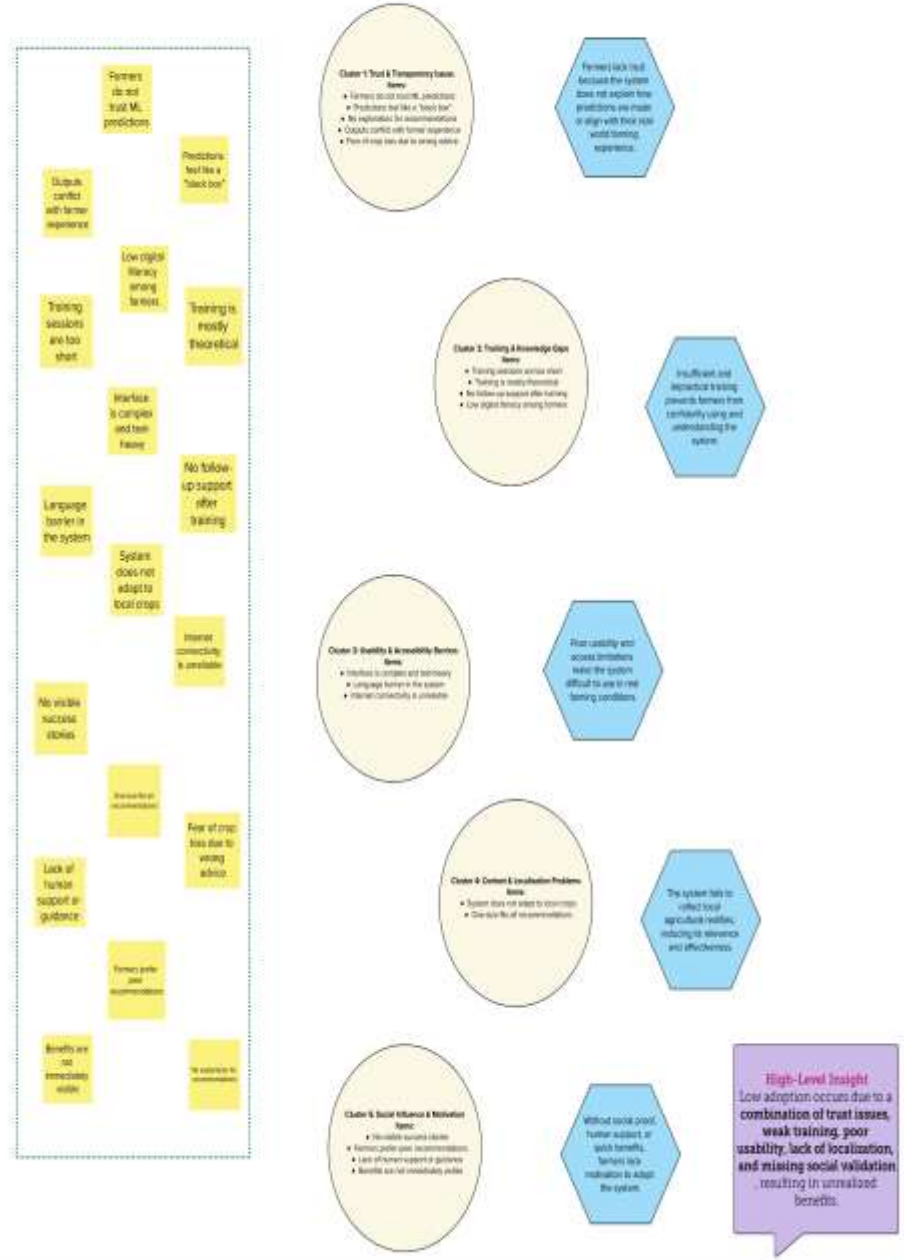
- Improve UI colors and font sizes
- Add tooltips and help icons
- Minor dashboard rearrangements
- Add reminder notifications

Low Impact – High Effort (Avoid / Defer)
(Not priority)

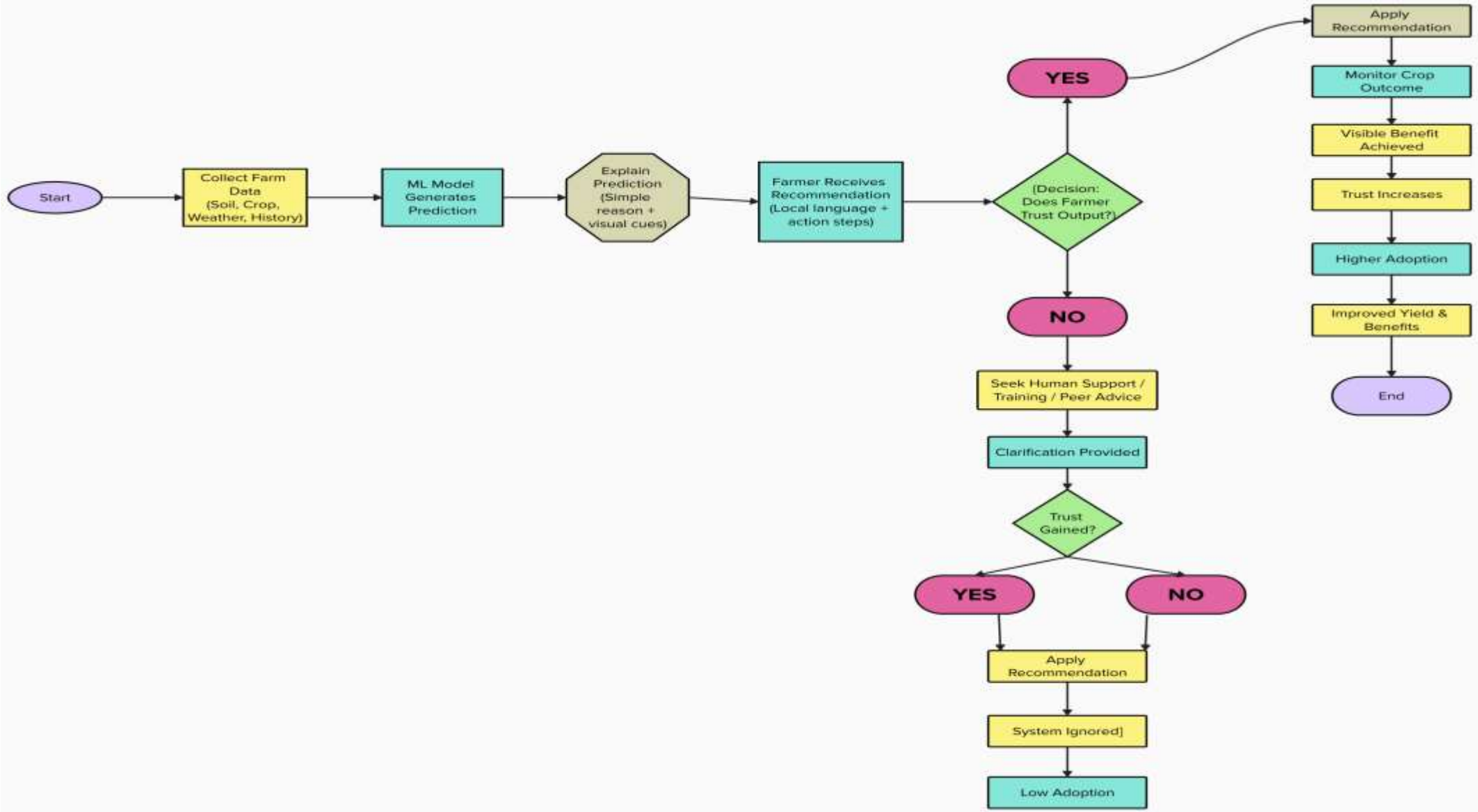
- Fully automated decision-making without human input
- Advanced analytics dashboards for farmers
- Complex data visualizations
- Cutting-edge ML models without explanation

Affinity Clustering – Smart Agriculture ML Adoption

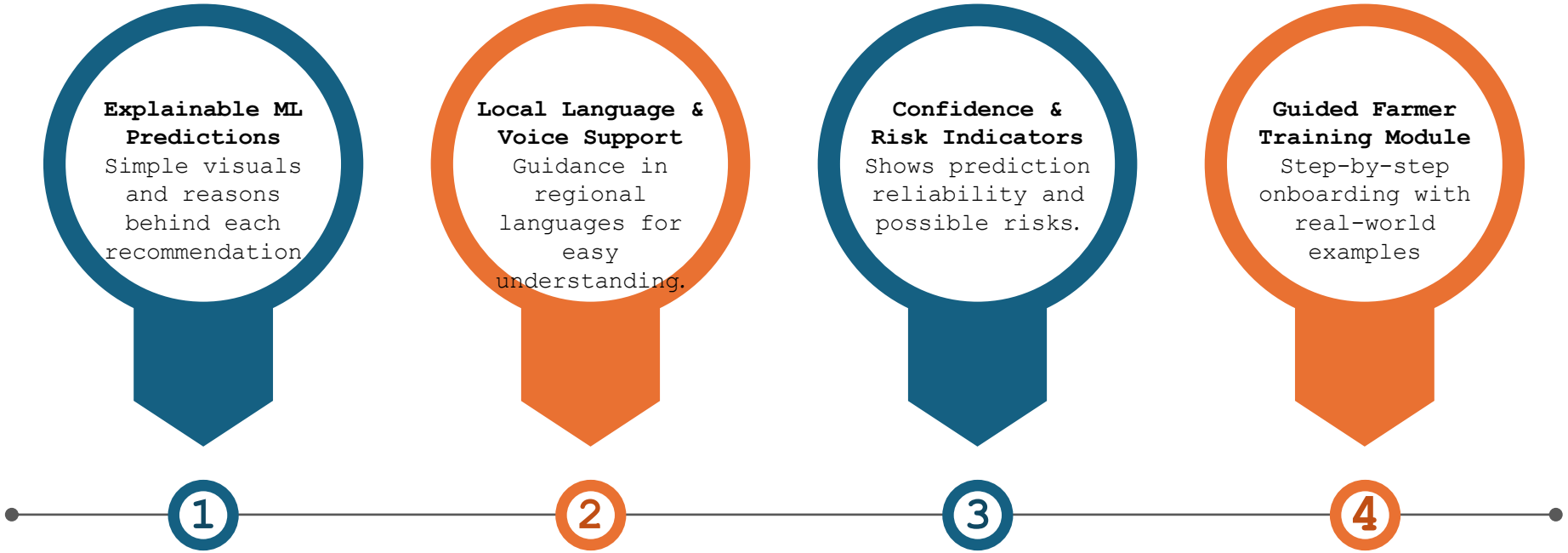
Data set



FLOW CHART


Start
Collect Farm Data (Soil, Crop, Weather, History)
ML Model Generates Prediction
Explain Prediction (Simple reason + visual cues)
Farmer Receives Recommendation (Local language + action steps)
(Decision: Does Farmer Trust Output?)
YES
Apply Recommendation
Monitor Crop Outcome
Visible Benefit Achieved
Trust Increases
Higher Adoption
Improved Yield & Benefits
End
NO
Seek Human Support / Training / Peer Advice
Clarification Provided
Trust Gained?
YES
NO
Apply Recommendation
System Ignored]
Low Adoption

Key Features



Feedback & Iteration

Before Feedback

- ML predictions shown using technical terms
- Text-heavy dashboard difficult to understand
- No clarity on why recommendations were given
- Limited guidance for first-time users

After Feedback

- Predictions explained using **simple visuals and icons**
- **Voice-based guidance** added in local language
- Clear reasons and confidence levels shown for each recommendation
- Step-by-step **guided onboarding and training** included

Testing Methods Used

Upstream & Downstream Environmental Aspects

Think-Aloud

- Farmers explained what they understood from each screen
- Helped identify confusion in ML predictions and terminology
- Revealed trust and hesitation during decision-making
- Highlighted usability and navigation issues in real time

Dot-Voting

- Farmers marked features they found **most useful**
- Identified **least understood or confusing elements**
- Helped prioritize features for improvement
- Enabled quick, collective decision-making

THINK-ALOUD TESTING

Smart Agriculture System – ML Prediction Trust & Adoption

Focus of testing session

Understand why farmers do not trust ML predictions, how insufficient training affects usage, and why adoption of the smart agriculture system is low, leading to unrealised benefits.

Moderator

- Guide the farmer through the system tasks, encourage them to speak their thoughts aloud, and avoid influencing their decisions or opinions.

Note takers(s)

Observe user behavior, record exact phrases spoken by the farmer, note confusion points, hesitation, trust issues, and emotional reactions.

Participant

Small and marginal farmers who have access to the smart agriculture system but use it rarely or inconsistently.

Date: 21/01/2026

Time: 01.45 pm

Greeting and intro questions

Can you briefly describe your farming experience?

Have you used any mobile apps or digital tools for farming before?

What do you expect this smart agriculture system to help you with?

Tasks

Open the smart agriculture system dashboard.

View the ML-based crop or yield prediction.

Interpret the recommendation provided by the system.

Decide whether you would follow the recommendation in real farming conditions.

Try to find an explanation or reason behind the prediction.

Wrap-up

- What did you find confusing or unclear?
- What would make you trust this system more?
- What kind of training or support would help you use this regularly?
- Would you recommend this system to other farmers? Why or why not?

Notes

- While looking at the ML prediction, the farmer says that the system shows results but does not explain *why* those results are generated, which makes it difficult for them to trust the output.
- The farmer expresses confusion when technical terms, percentages, and graphs appear on the screen, stating that the information feels too complex and not connected to their day-to-day farming practices.
- The farmer mentions that they were never properly trained on how to use the system, and because of this, they are unsure whether they are using it correctly or interpreting the predictions the right way.

When asked if they would follow the system's recommendation, the farmer hesitates and explains that they prefer relying on personal experience or advice from fellow farmers rather than an unfamiliar digital system.

The farmer points out that if the system gives even one incorrect prediction, they would completely stop using it, as farming involves high risk and low tolerance for failure.

The farmer feels that the system talks to them but does not feel like it understands their local soil, weather conditions, or traditional knowledge.

The farmer notes that there is no easy way to verify or cross-check the prediction, which increases fear of loss and reduces confidence in adopting the technology.

The farmer concludes that without continuous guidance, local language support, and real-world demonstrations, the smart agriculture system feels unreliable and difficult to adopt.

- "I don't know how this prediction is calculated."
- "The numbers look advanced; I am not confident using this."
- "I prefer asking other farmers instead of trusting this output."
- "No one explained how this system works properly."
- "If it fails once, I will not use it again."

Your top pick

Of everything we reviewed, what's your top pick for where the team should focus their attention going forward?

Notable details

Of everything we reviewed, what are some details or nuances you think the team should not forget about?

Sheela	Kaviya
Kavibharathi	Lissa
Siddharth	Surya
Trisha	Vijay

Overall Conclusion

Until trust, training, and explainability are addressed together, the smart agriculture system will continue to face low adoption, preventing farmers from realising its intended benefits despite the presence of advanced ML technology.

Prioritising Key Issues in Smart Agriculture System

Concept 1: Lack of Trust in ML Predictions

- Farmers do not understand how the prediction is generated, which creates fear of hidden errors.
- Absence of explanation reduces confidence in acting on recommendations.
- One wrong prediction can permanently break trust in the system.
- Farmers prefer human advice over machine-generated outputs.

Concept 2: Insufficient Training and Onboarding

- Farmers are not guided step-by-step on how to use the system.
- Training sessions are either too short or too technical.
- No follow-up support is available after initial introduction.
- Farmers feel unsure whether they are using the system correctly.

Concept 3: Poor Explainability and Clarity

- ML outputs are displayed using complex graphs and terms.
- Information is not presented in a simple or local context.
- Lack of local language explanations increases confusion.
- Farmers cannot relate predictions to real farm conditions.

Concept 4: Low Adoption and Irregular Usage

- Farmers open the system only out of curiosity, not daily use.
- Lack of trust leads to hesitation in acting on recommendations.
- Benefits are not visible in the short term, reducing motivation.
- System is abandoned after initial trials.

Concept 5: Unrealised Benefits and Value

- Farmers do not see clear improvement in yield or cost savings.
- No success stories or peer validation are visible.
- Benefits are not demonstrated through real-life examples.
- Value proposition of the system remains unclear.

Concept 6: High Risk Perception

- Farming decisions involve financial and livelihood risks.
- Farmers fear losses if predictions are wrong.
- No safety net or fallback option is provided by the system.
- Risk outweighs perceived benefit in decision-making.

Thank You