

# Feasibility of Bioethanol Production from Cassava as an Alternative Cooking Fuel in the Bo Region of Sierra Leone

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# Background and Situation

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Post-civil war, post-ebola country, 97% of population use wood to cook their meals

- Deforestation rate about .7%/yr (USAID 2010)

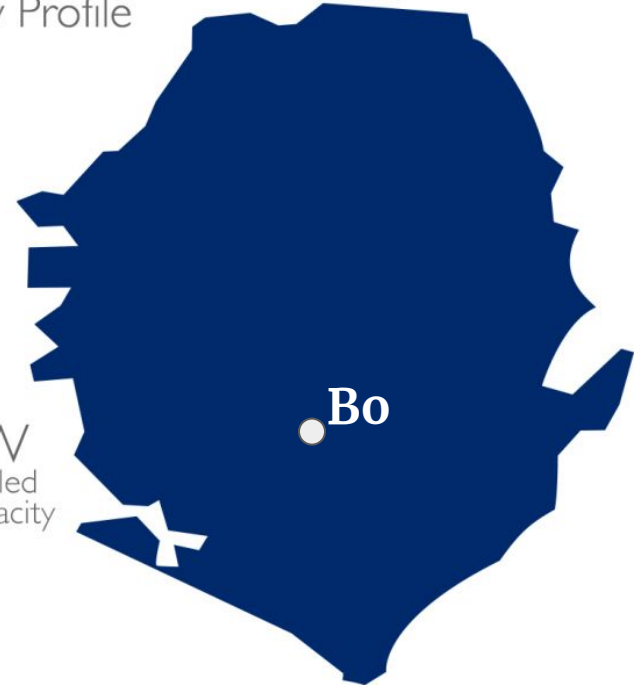
## Sierra Leone

Electricity Profile

13%  
Access to  
electricity

1%  
Rural access  
to electricity

100MW  
Current installed  
generation capacity



# Project Objectives

**Introduce stoves** to 0.01% of the population, or 1,000 households in Bo and other urban areas where people are otherwise buying firewood.

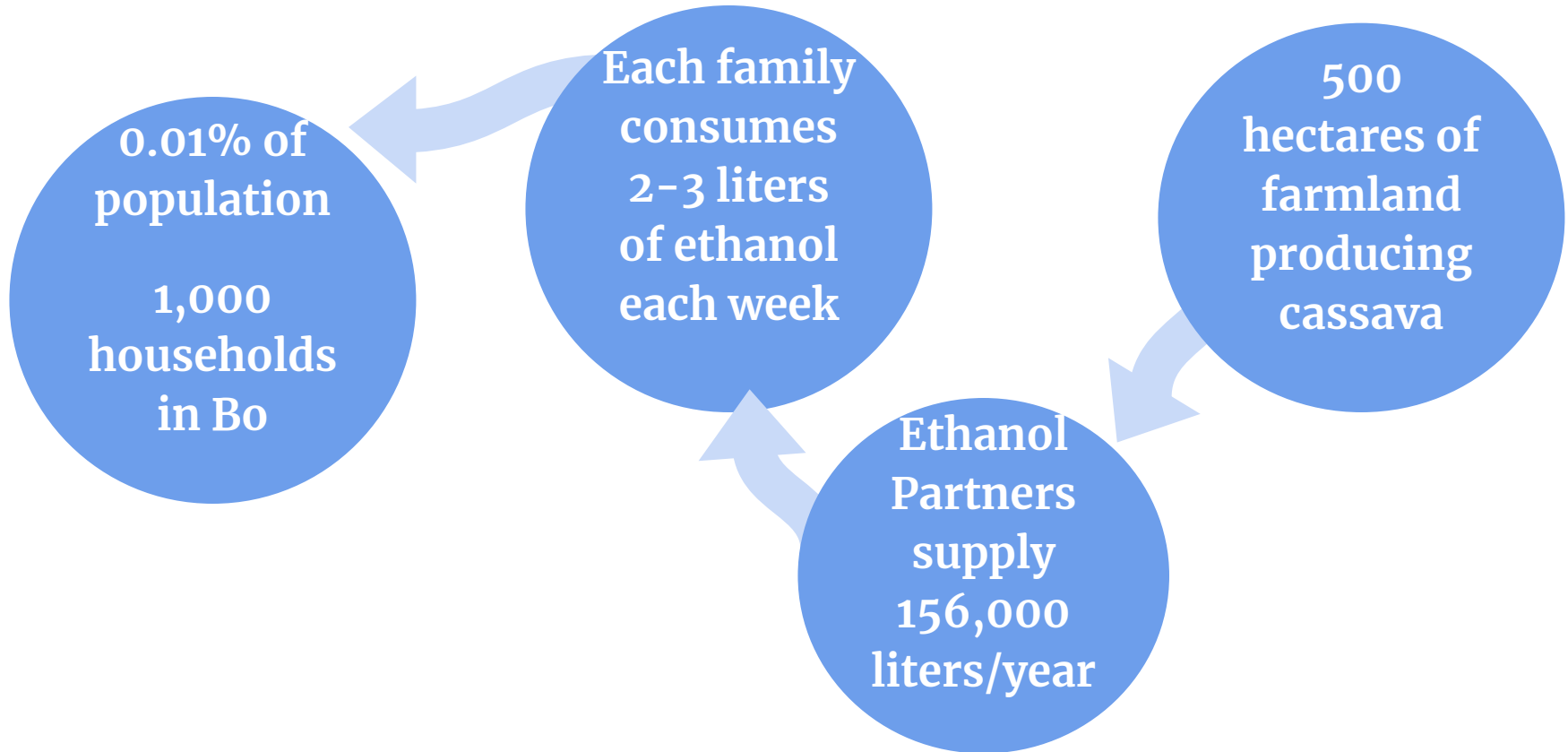
**Introduce high-yield strain of cassava** from SLARI that allows 20 tons/ha of production (current strain yields around 8 tons/ha).

**Contract farmers** to produce cassava on 500 hectares (1000 ha considered for current strain)

**Create Organizational Model** to determine staffing, budget, and partnership needs



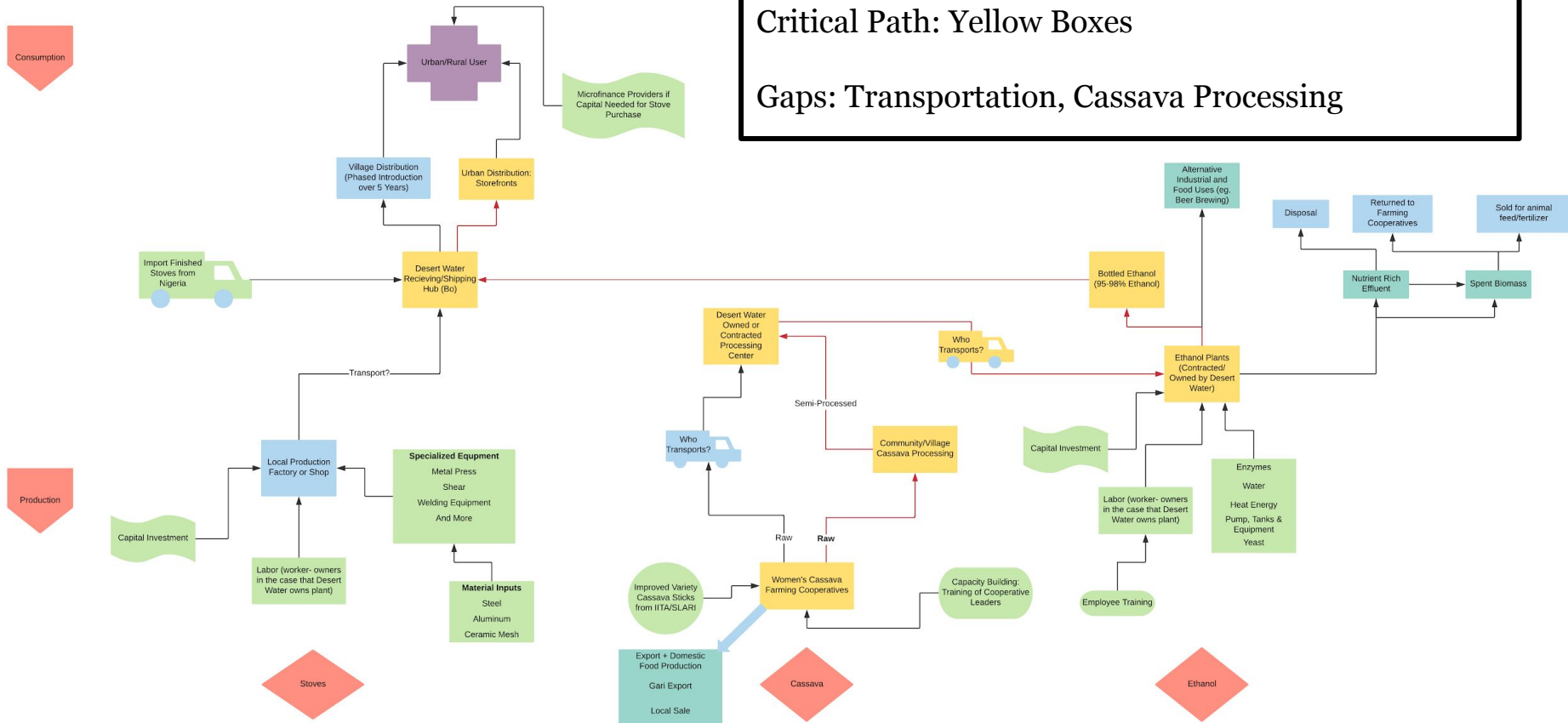
# Target Values



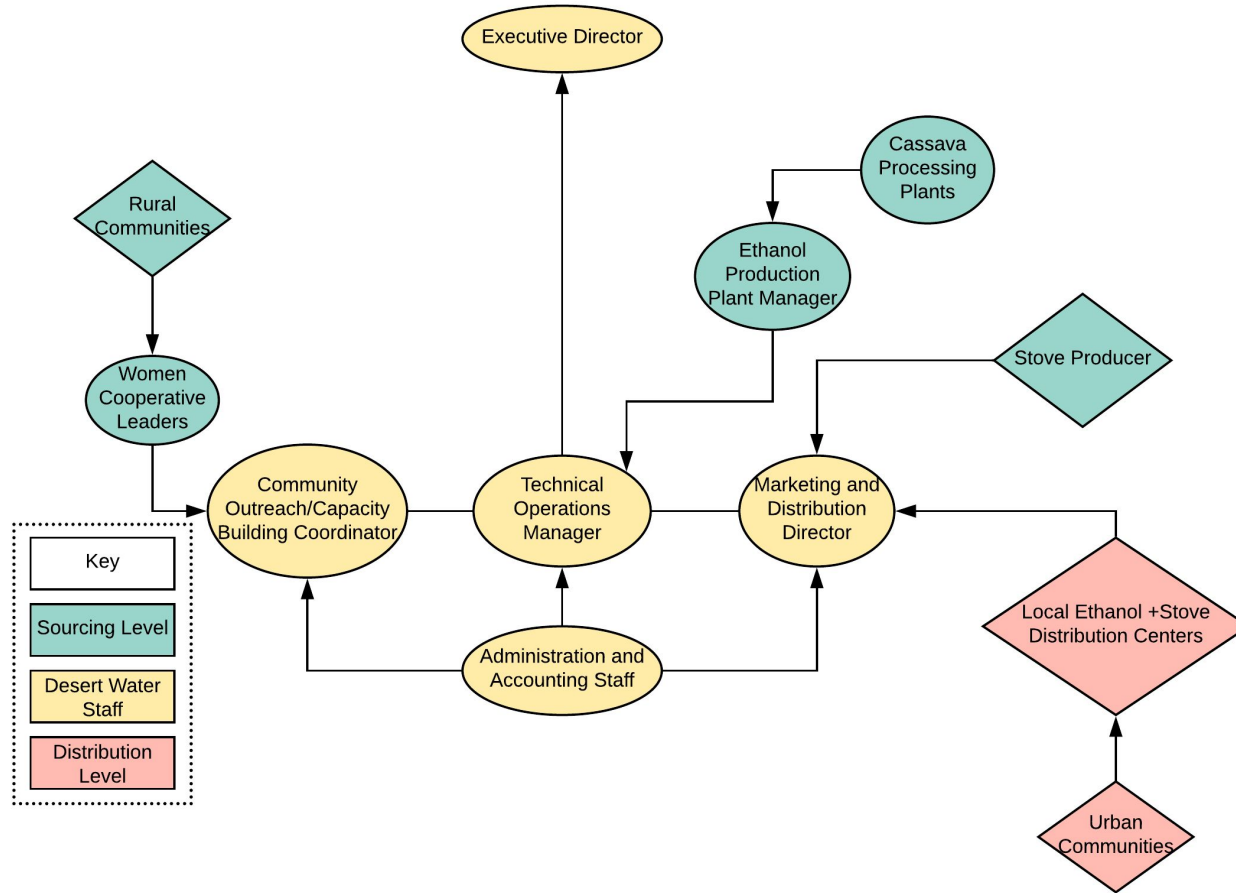
# Project Chain Analysis

Critical Path: Yellow Boxes

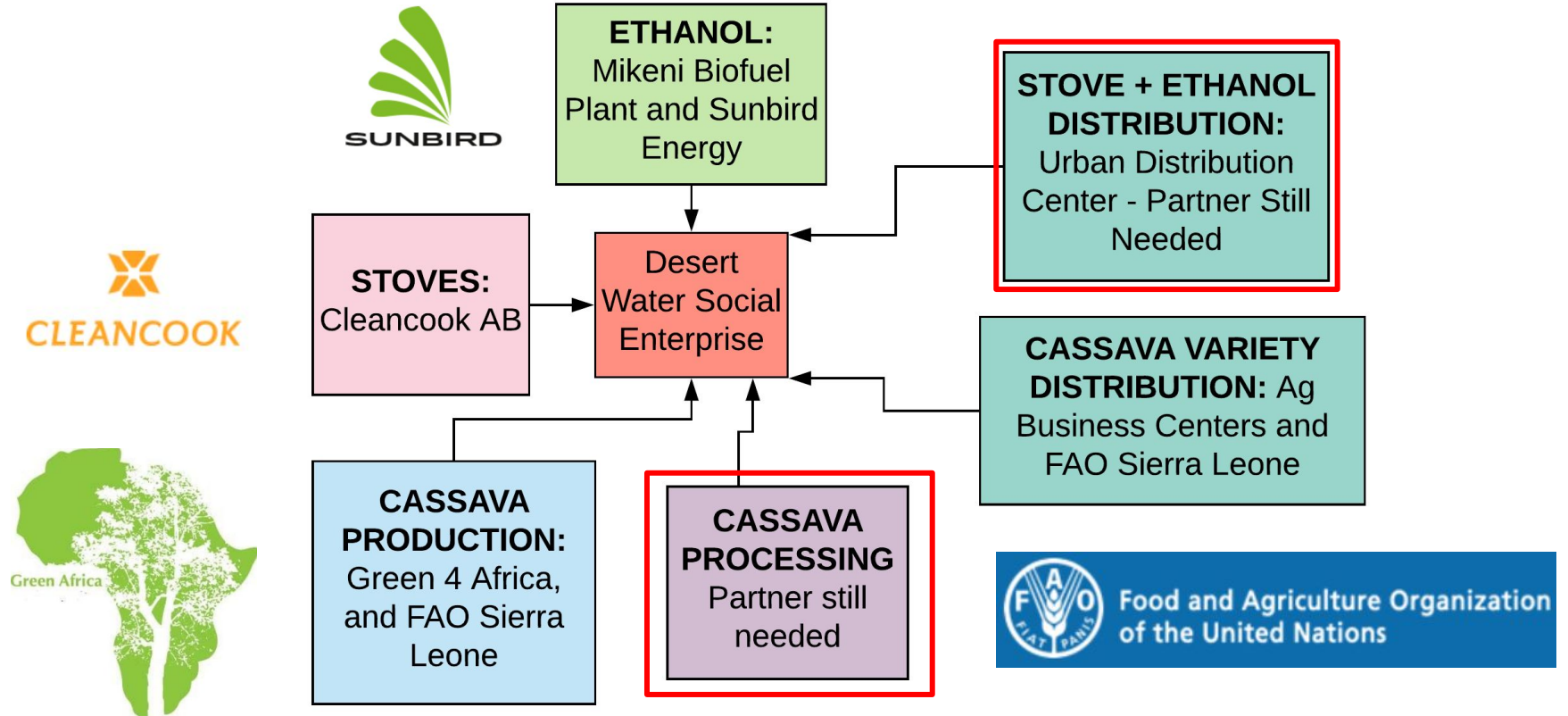
Gaps: Transportation, Cassava Processing



# Desert Water Organizational Plan

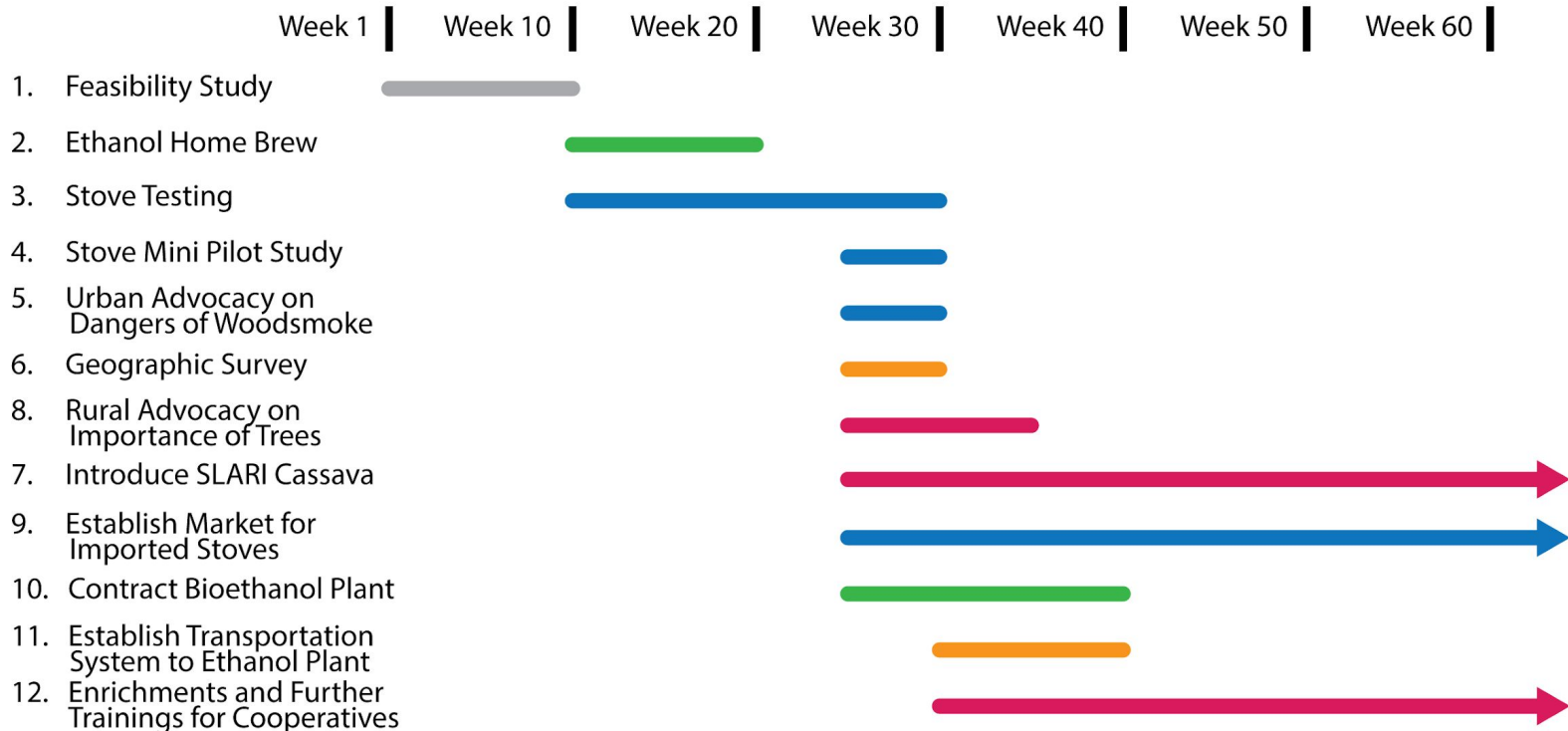


# Partner Map



# Gantt Chart

- Establish a market for stoves and ethanol
- Contract an ethanol production system
- Establish transportation system
- Empower cassava cooperatives





# SWOT Analysis

**Strengths:** Necessary partnerships are underway

**Weaknesses:** potential for failure if market isn't feasible

**Opportunities:** Existing ag extension infrastructure can be utilized

**Threats:** poor infrastructure including roads, potential for unforeseen expense

Strengths	Weaknesses
<ul style="list-style-type: none"><li>• Dynamic organizational leader</li><li>• licensed to operate in California</li><li>• In-line with FAO and IITA mission; probable support from existing ethanol plant</li><li>• Startup stoves and sticks already donated (need to confirm)</li><li>• Existing Connections to farmer cooperatives</li></ul>	<ul style="list-style-type: none"><li>• High start up investment required for building ethanol production facility</li><li>• Each leg of the project relies on the other-- fuel market is needed for cassava production, but intensive cassava production needs an end point/destination market</li></ul>
Opportunities	Threats
<ul style="list-style-type: none"><li>• Women Farmers are already familiar with growing cassava</li><li>• High demand if produced affordably</li><li>• Similar initiatives begun in other countries</li><li>• Existing ag business centers potential base for farmer collaboration and cassava purchase</li></ul>	<ul style="list-style-type: none"><li>• Alcohol/ethanol may be a taboo in some rural areas</li><li>• Minimal infrastructure: roads, electricity, water</li><li>• Seasonal fluxes: droughts (may lower cassava production) and floods (roads may be impassible and harvest will be hard)</li><li>• Other stove fuel sources -- solar?</li><li>• Non-cooperation of Makeni/Sunbird biofuel plant?</li><li>• Potential for unforeseen project costs</li></ul>

# Recommendations...



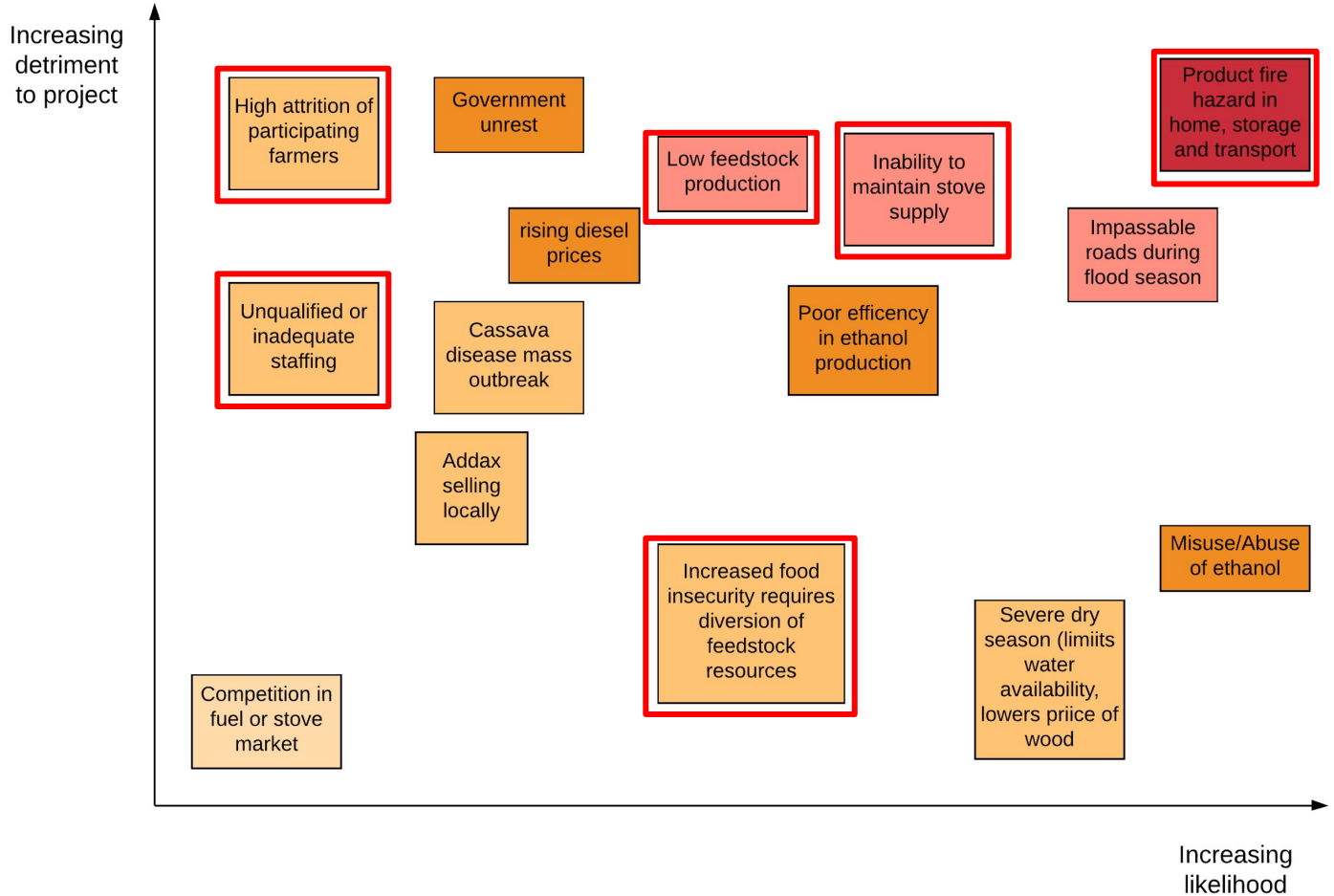
1. Partnership model rather than building ethanol and processing plants
1. Do a pilot study for stove interest
1. Integrate the Desert Water staffing model
1. Mapping of feedstock sources, ethanol production and market destination
1. Failure Analysis
2. Increase accuracy in budget (underway)

THANK  
YOU!



# Tool 4: Risk Table

Desert Water has  
most control  
over



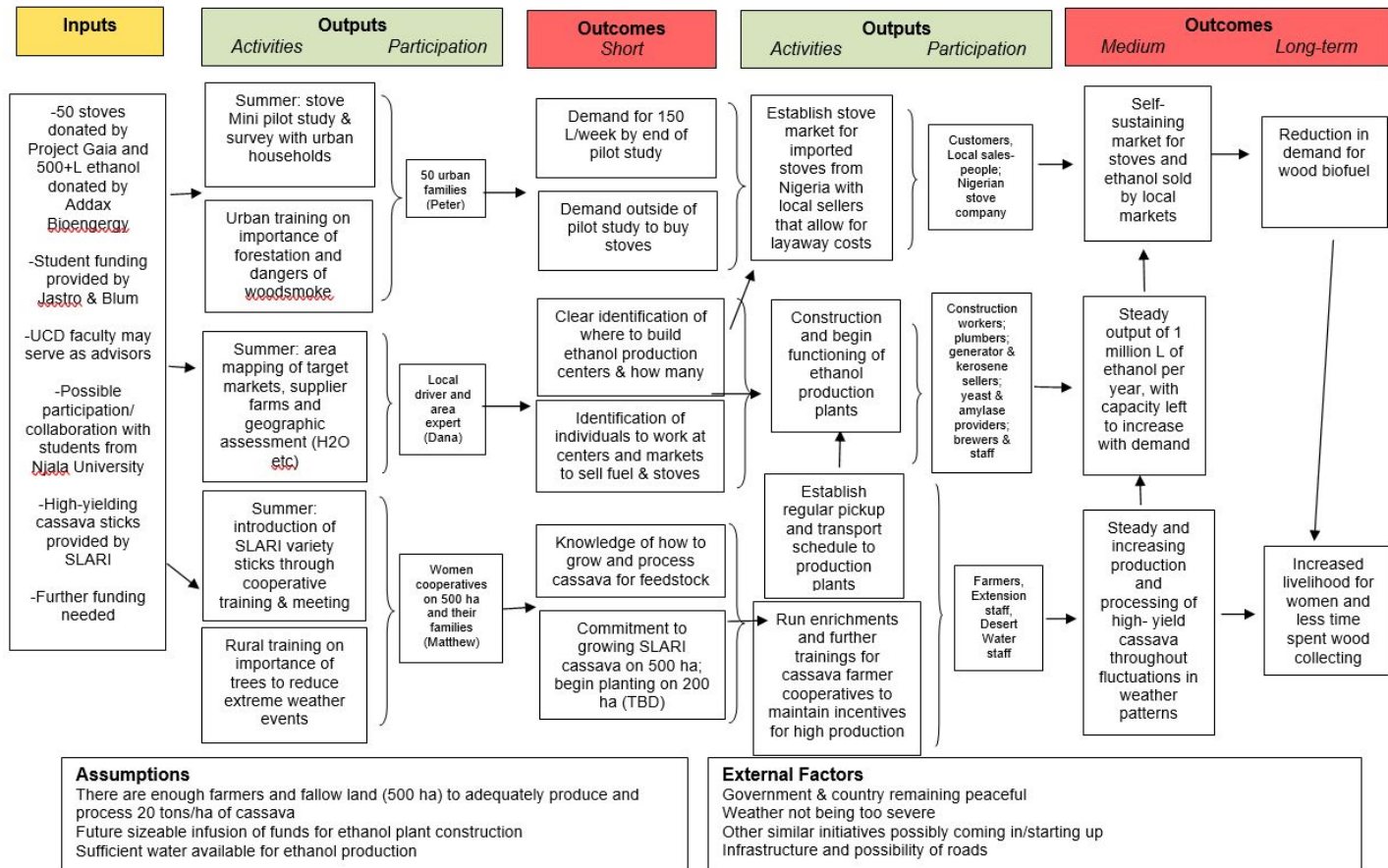
# Risk Table: Implications

1. Robust Farmer Participation will be necessary for sustainability
2. Staff will be comprehensively evaluated before hiring, training will follow
3. Backup stove source will be identified, potential local partner producer will be identified
4. fire hazard will be evaluated in feasibility study
5. Work with Ag business centers, FAO and Ministry of Ag to ensure access to natural/chemical fertilizers if higher production needed

# Results: Logframe flow chart for implementation plan

**Program:** Cassava Ethanol Logic Model (uses text boxes: add/change boxes and arrows as needed)

**Situation:** 95+% wood-burning stove use in Sierra Leone results in pulmonary disease, deforestation and gender equity issues and necessitates a need for fuel alternatives. Cassava-based ethanol burns clean and can be a value-added opportunity for a crop already grown by women in cooperatives.



# Our Scope: Sequencing and Timeline

## Winter Quarter: D Lab I

- confirm budget, apply for grants
- business plan/cleaner timeline
- determine scaling to more detail
- identify stove and ethanol plant designs
- identify supply chain for stoves
- identify cooperative capacity building needs and training curriculum

## Spring Quarter: D Lab II

- design and build a stove
- test small scale ethanol production
- Design research questions for household surveys
- Design mini pilot-study for stoves

**Summer:** mini pilot study (test marketability of ethanol+stoves), household surveys and ground research, begin to forge relationships with cooperatives and other associations,

**Fall and Beyond:** Implement Desert Water Cooperative Structure, contract farmer co-ops, build bioethanol plant(s), set up local manufacturing system for stoves



# Action Items For D-Lab 1

**Write business and organizational plan** for cooperatively-run social business enterprise

**Risk table:** assess severity and likelihood

**Research:** Perform a more rigorous meta-analysis of cassava bioethanol projects

**Stakeholder Outreach:** Stove Producers, UNFAO, Ministry of Trade and Industry Adax Bioenergy/ Mali/Nigeria initiatives

**Designing Mini-Pilot Study** in Country

**Grants:** Find and apply for grant funding





# Timeline

## Winter Quarter: D-Lab I

Continued Research  
of cassava + ethanol  
Production

Complete Feasibility Study

Business Plan

Grant application(s)

## Spring Quarter: D-Lab II

Stove and Ethanol Pilot

Design In-Country Market Study

## Summer

In Country Pilot Study

**Fall and Beyond:** Implement Desert Water Cooperative Structure, contract farmer co-ops, build bioethanol plant(s), set up local manufacturing system for stoves