GALY Resource Optimization Wizard

GROW

Team: Sustainobots

MIT ENERGY &
CLIMATE HACK

Galy

Team Sustainobots!

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SustainoBot

(Honorary Member)

01

Sustainable Agriculture is key

29%

GREENHOUSE GAS EMISSIONS COMES FROM AGRICULTURE

70%

FRESHWATER WITHDRAWAL IS FOR AGRICULTURAL USE

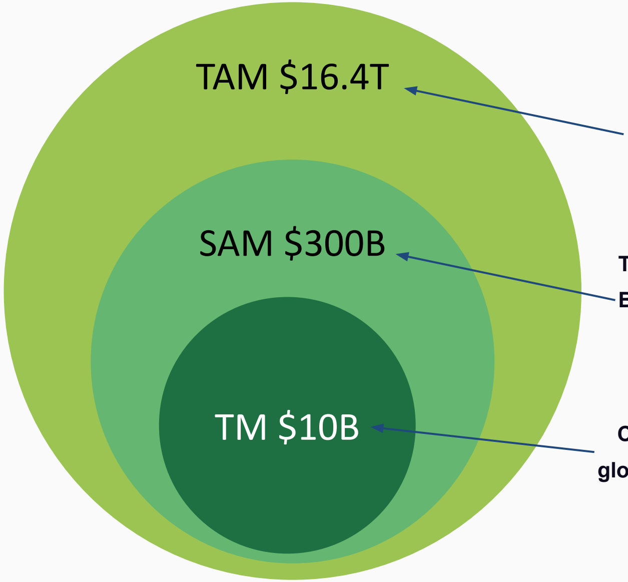
37%

OF EARTH'S TERRESTRIAL SURFACE IS OCCUPIED BY AGRICULTURE

33%

OF THE WORLD'S SOIL IS DEGRADED DUE TO INTENSIVE AGRICULTURE

The Market (2030)



The total market for sustainable agricultural practices as a whole

The market for other Plant-Based Biomaterials is much bigger than just Cotton

Cotton Market Size is ~$200B globally, Galy aims to address 5%

03

Problem Statement

How can we identify the best crop options for GALY?

GALY is a climate tech company dedicated to developing novel cellular agriculture products. Recognizing the potential of its platform through its work with cotton, GALY has expanded its foundational technology to other crops in industries such as food and beverages, among many other possibilities.

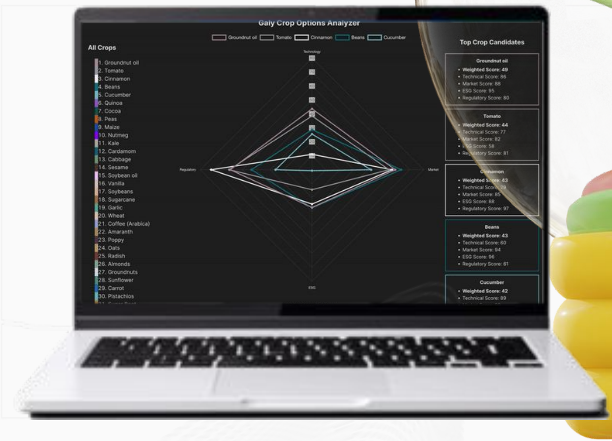
04

Solution

Introducing GROW

GALY Resource Optimization Wizard

GROW leverages AI to identify crops for cellular agriculture and makes it easy for GALY researchers to find the optimal crop options



Galy Crop Options Analyzer

All Crops

1. Groundnut oil
2. Tomato
3. Cinnamon
4. Beans
5. Cucumber
6. Quinoa
7. Cocoa
8. Peas
9. Maize
10. Nutmeg
11. Kale
12. Cardamom
13. Cabbage
14. Sesame
15. Soybean oil
16. Vanilla
17. Soybeans
18. Sugarcane
19. Garlic
20. Wheat
21. Coffee (Arabica)
22. Amaranth
23. Poppy
24. Oats
25. Radish
26. Almonds
27. Groundnuts
28. Sunflower
29. Carrot
30. Pistachios

Top Crop Candidates

Groundnut oil
- **Weighted Score: 49**
- Technical Score: 86
- Market Score: 88
- ESG Score: 95
- Regulatory Score: 80

Tomato
- **Weighted Score: 44**
- Technical Score: 77
- Market Score: 82
- ESG Score: 58
- Regulatory Score: 81

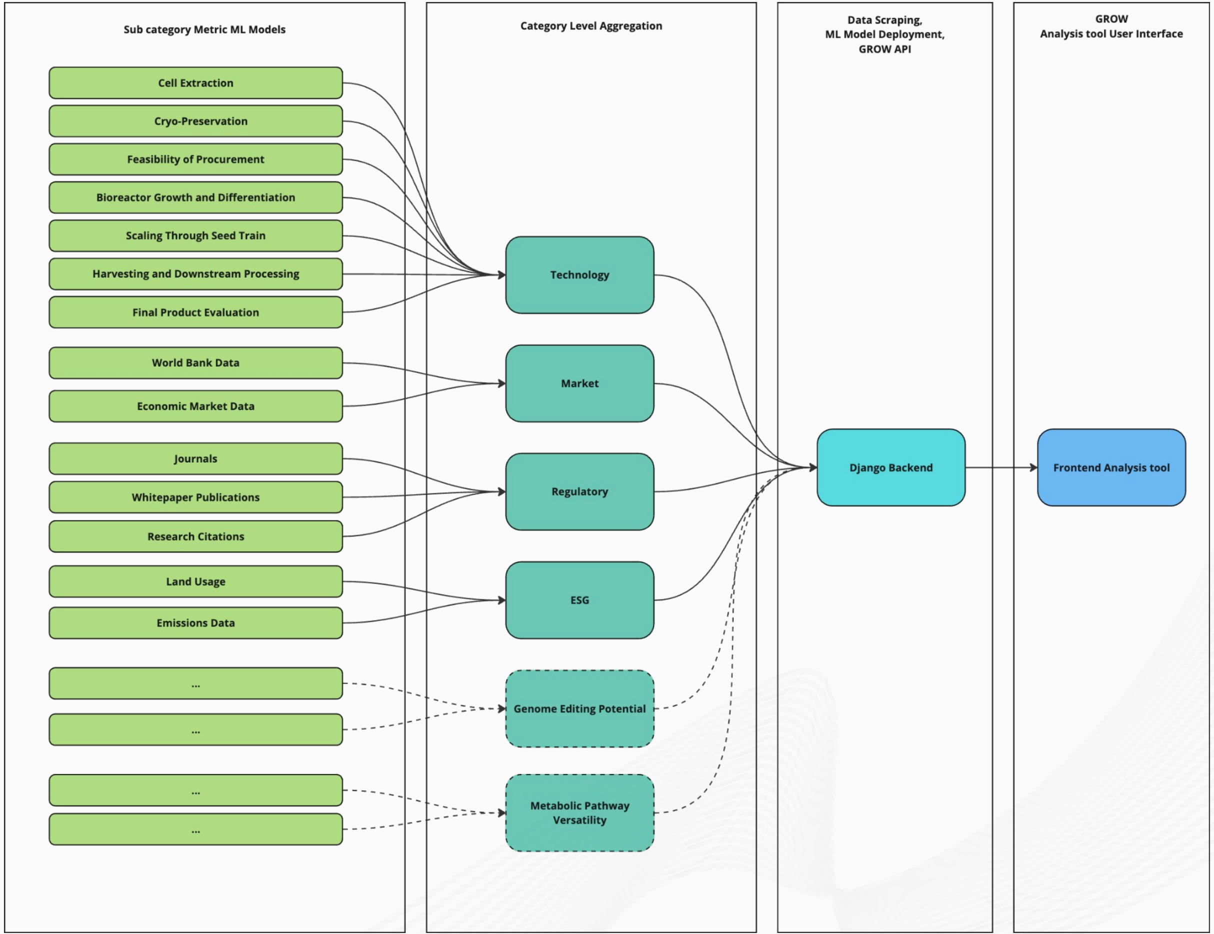
Cinnamon
- **Weighted Score: 43**
- Technical Score: 29
- Market Score: 85
- ESG Score: 88
- Regulatory Score: 97

Beans
- **Weighted Score: 43**
- Technical Score: 60
- Market Score: 94
- ESG Score: 96
- Regulatory Score: 61

Cucumber
- **Weighted Score: 42**
- Technical Score: 89

System Overview

- Identified key metric categories and divided them up into sub categories
- ML Models built for each subcategory
- Category level score aggregated based on the data predictions
- Served through our Django Backend API
- Displayed to the researcher by our frontend



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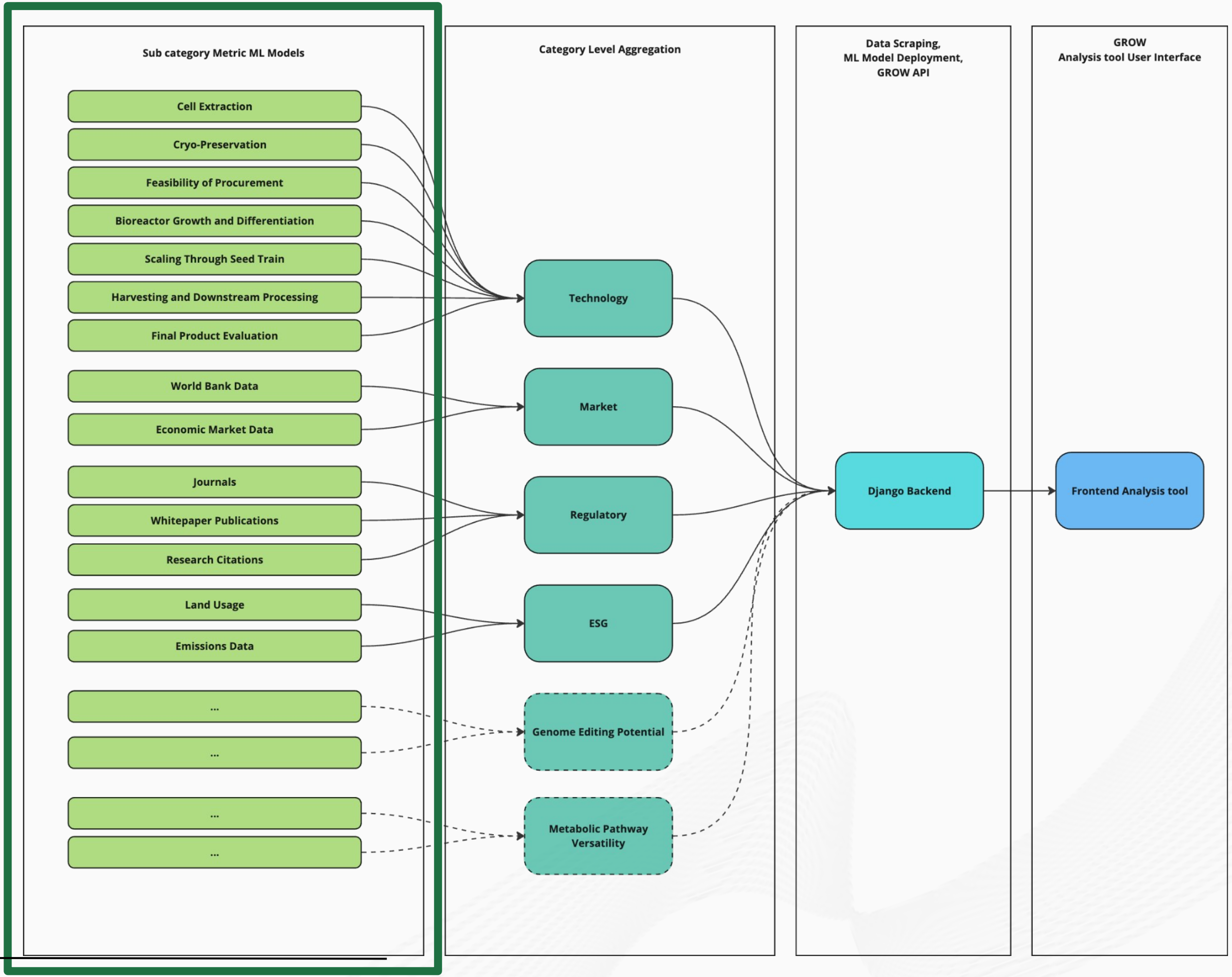
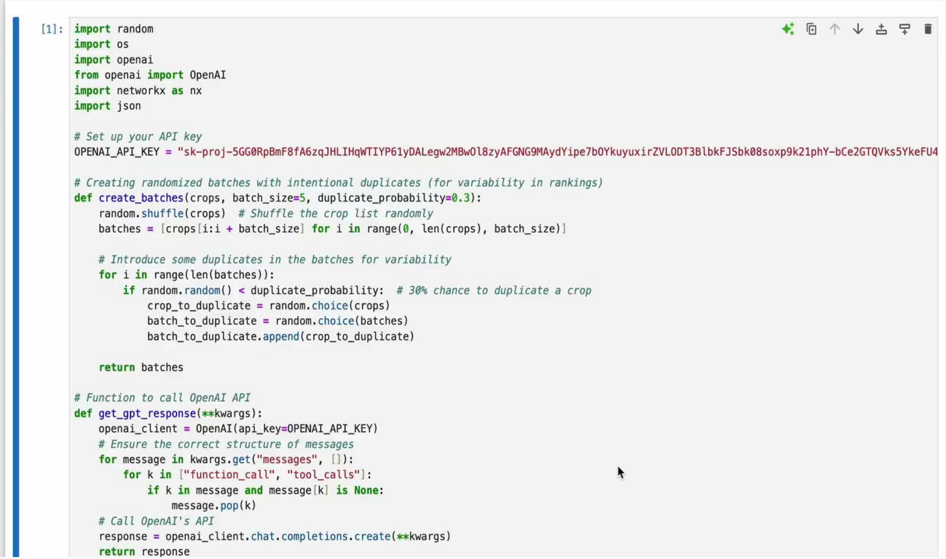

Sub category Metric ML Models
Cell Extraction
Cryo-Preservation
Feasibility of Procurement
Bioreactor Growth and Differentiation
Scaling Through Seed Train
Harvesting and Downstream Processing
Final Product Evaluation
World Bank Data
Economic Market Data
Journals
Whitepaper Publications
Research Citations
Land Usage
Emissions Data
...
...
...
...
Category Level Aggregation
Technology
Market
Regulatory
ESG
Genome Editing Potential
Metabolic Pathway Versatility
Data Scraping, ML Model Deployment, GROW API
Django Backend
GROW Analysis tool User Interface
Frontend Analysis tool

Backend - Score estimation for Regulatory attribute



```python
import random
import os
import openai
from openai import OpenAI
import networkx as nx
import json

# Set up your API key
OPENAI_API_KEY = "sk-proj-5GG0RpBmF8fA6zqJHLIHqWTIYP61yDALegw2MBwOl8zyAFGNG9MAydYipe7bOYkuyuxirZVLODT3BlbkFJSbk08soxp9k21phY-bCe2GTQVks5YkeFU4

# Creating randomized batches with intentional duplicates (for variability in rankings)
def create_batches(crops, batch_size=5, duplicate_probability=0.3):
    random.shuffle(crops)  # Shuffle the crop list randomly
    batches = [crops[i:i + batch_size] for i in range(0, len(crops), batch_size)]

    # Introduce some duplicates in the batches for variability
    for i in range(len(batches)):
        if random.random() < duplicate_probability:  # 30% chance to duplicate a crop
            crop_to_duplicate = random.choice(crops)
            batch_to_duplicate = random.choice(batches)
            batch_to_duplicate.append(crop_to_duplicate)

    return batches

# Function to call OpenAI API
def get_gpt_response(**kwargs):
    openai_client = OpenAI(api_key=OPENAI_API_KEY)
    # Ensure the correct structure of messages
    for message in kwargs.get("messages", []):
        for k in ["function_call", "tool_calls"]:
            if k in message and message[k] is None:
                message.pop(k)
    # Call OpenAI's API
    response = openai_client.chat.completions.create(**kwargs)
    return response
```

We employed a combination of randomization and GPT-based ranking to analyze a list of crops based on regulatory complexity.

We created randomized batches of crops, ranking them through GPT-4 based API calls, and further refining the rankings using a PageRank algorithm with added random noise to ensure unbiased final scores.

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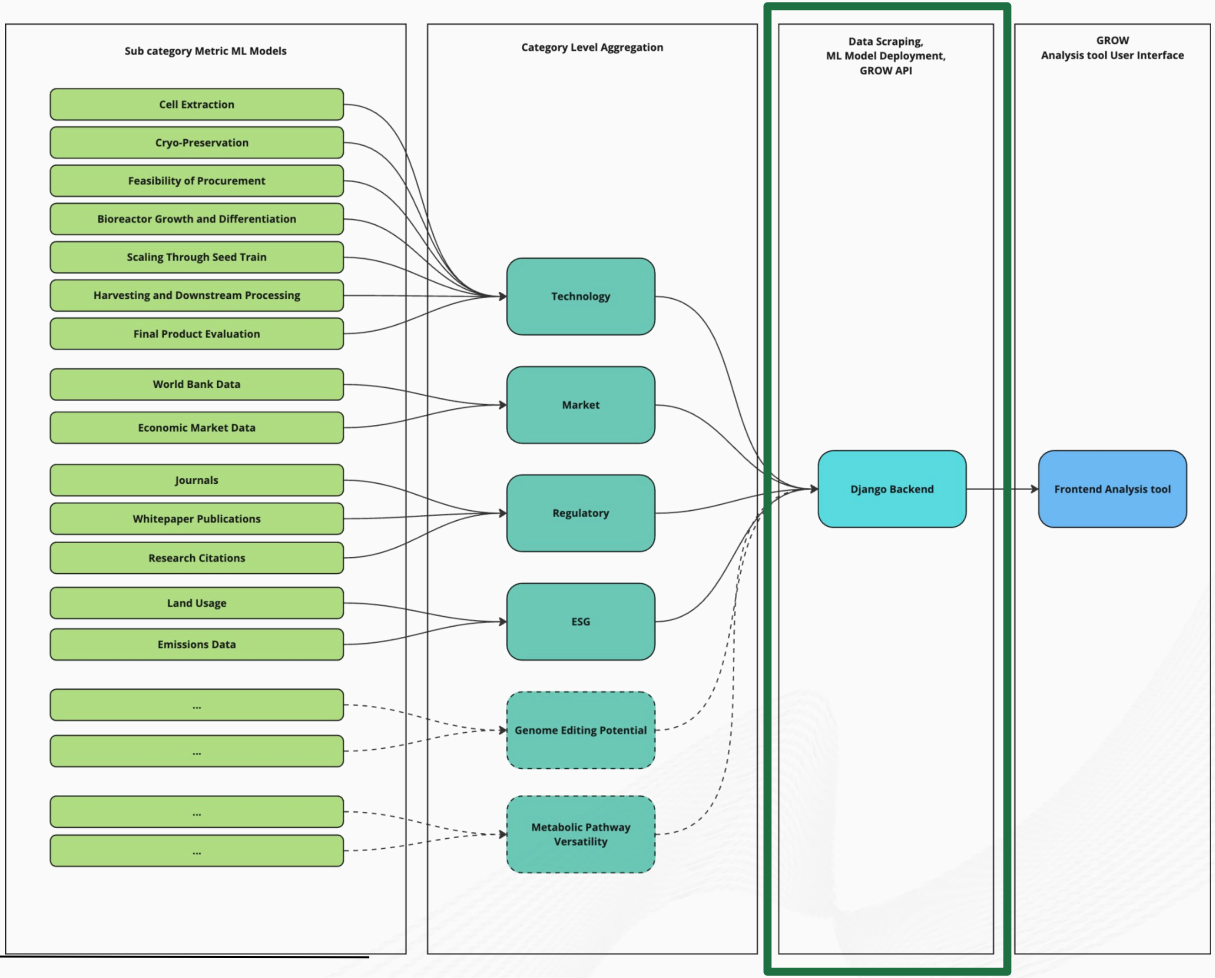

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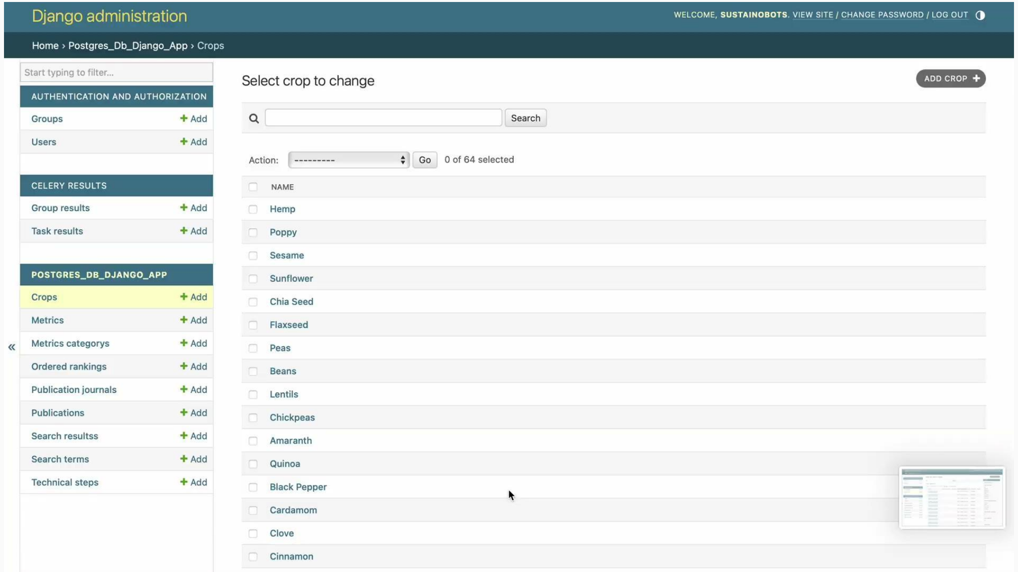
Backend - Django



Django administration

WELCOME, **SUSTAINOBOTS**. VIEW SITE / CHANGE PASSWORD / LOG OUT

Home › Postgres_Db_Django_App › Crops

Start typing to filter...

AUTHENTICATION AND AUTHORIZATION

- Groups + Add
- Users + Add

CELERY RESULTS

- Group results + Add
- Task results + Add

POSTGRES_DB_DJANGO_APP

- Crops + Add
- Metrics + Add
- Metrics categorys + Add
- Ordered rankings + Add
- Publication journals + Add
- Publications + Add
- Search resultss + Add
- Search terms + Add
- Technical steps + Add

Select crop to change

ADD CROP +

Search

Action: --------- Go 0 of 64 selected

NAME
Hemp
Poppy
Sesame
Sunflower
Chia Seed
Flaxseed
Peas
Beans
Lentils
Chickpeas
Amaranth
Quinoa
Black Pepper
Cardamom
Clove
Cinnamon

Reusable grocery bags

We used Django to create a backend interface to store our researched short list of crops, desired metrics, submetrics and categories, and outputs of web scraping across a list of publications.

We use keywords pertinent to the crop, metrics and submetrics to extract research papers from these publications.

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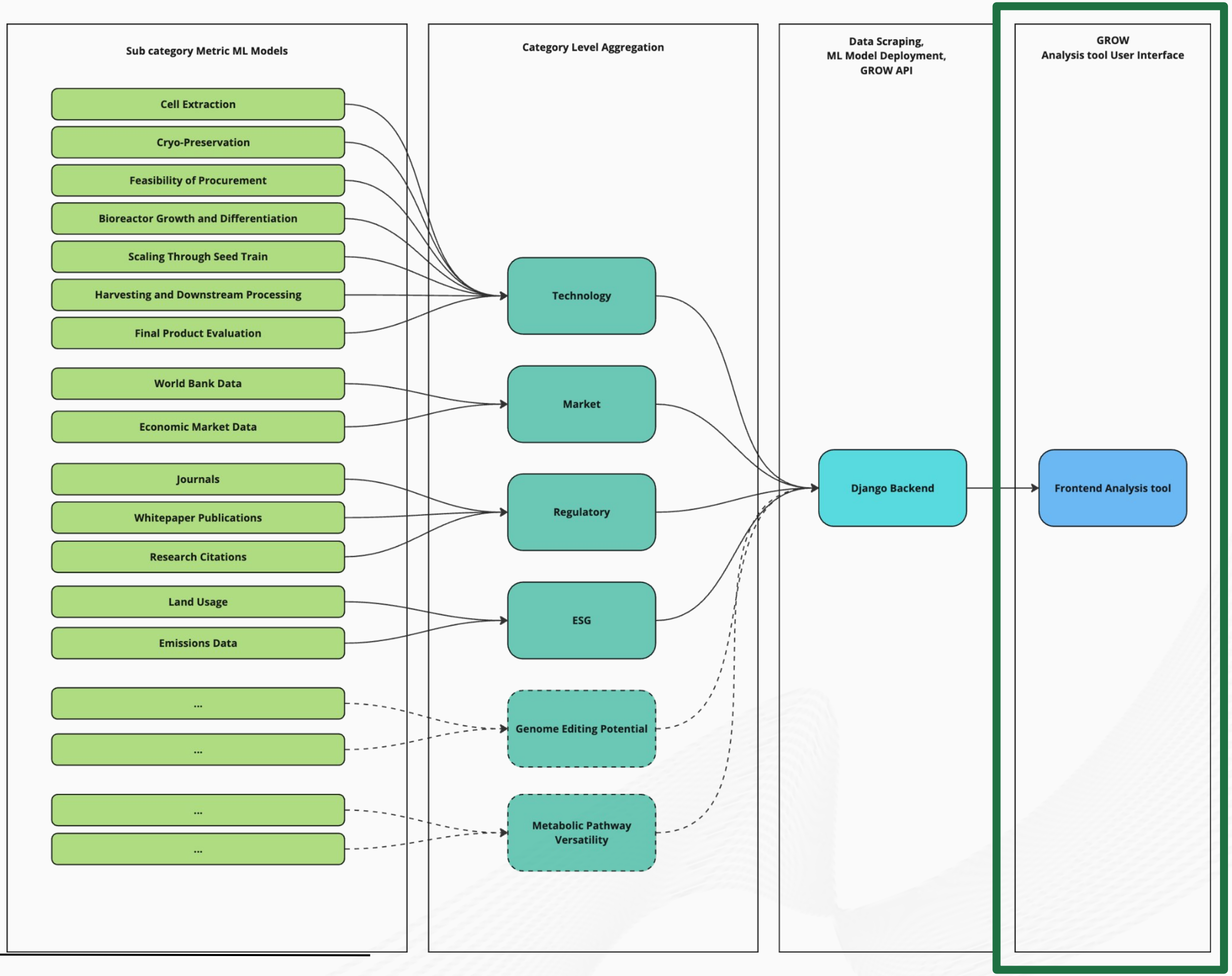
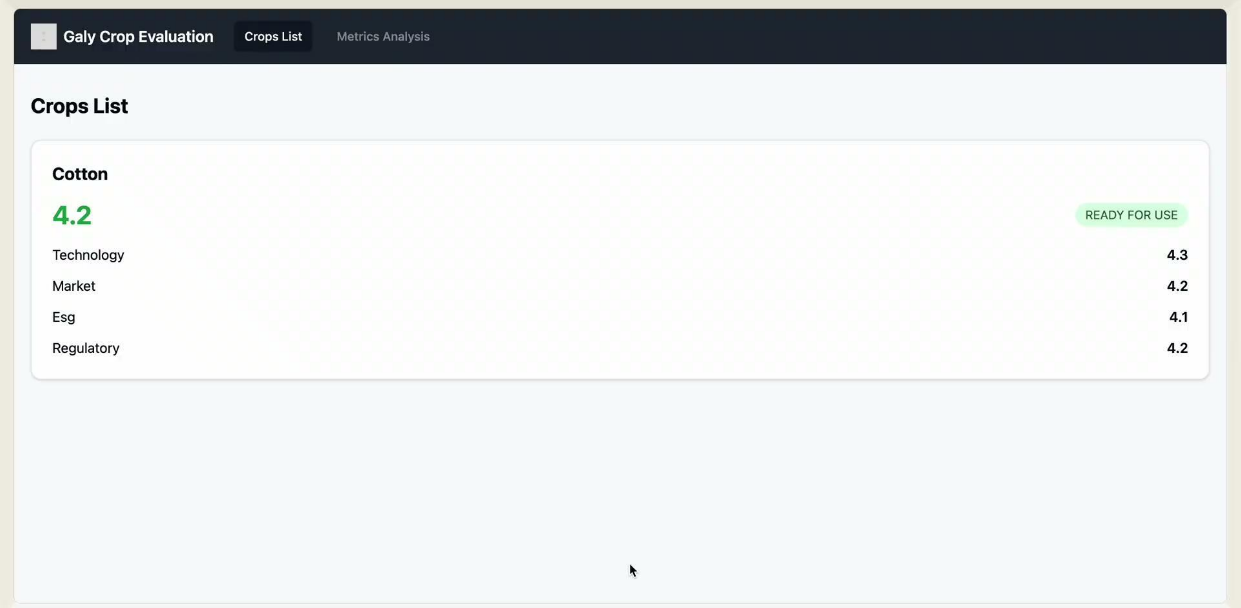


Frontend - Mock Prototype



Crops List

Cotton

4.2

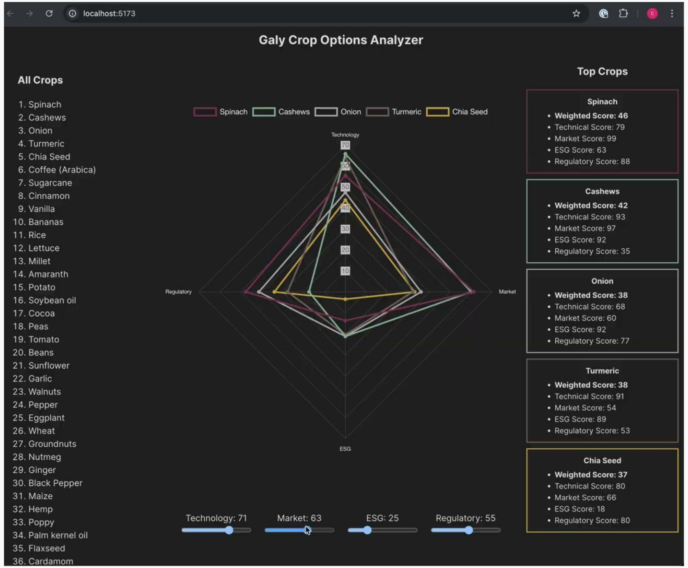
READY FOR USE

Technology	4.3
Market	4.2
Esg	4.1
Regulatory	4.2

We made a quick mockup of our tool using an AI tool Claude to iterate on what the interface could look like for the analysis tool.

We then built out the tool as a webapp using React.

Frontend - GALY Crop Options Analyzer



Galy Crop Options Analyzer

All Crops

1. Spinach
2. Cashews
3. Onion
4. Turmeric
5. Chia Seed
6. Coffee (Arabica)
7. Sugarcane
8. Cinnamon
9. Vanilla
10. Bananas
11. Rice
12. Lettuce
13. Millet
14. Amaranth
15. Potato
16. Soybean oil
17. Cocoa
18. Peas
19. Tomato
20. Beans
21. Sunflower
22. Garlic
23. Walnuts
24. Pepper
25. Eggplant
26. Wheat
27. Groundnuts
28. Nutmeg
29. Ginger
30. Black Pepper
31. Maize
32. Hemp
33. Poppy
34. Palm kernel oil
35. Flaxseed
36. Cardamom

Technology: 71 Market: 63 ESG: 25 Regulatory: 55

Top Crops

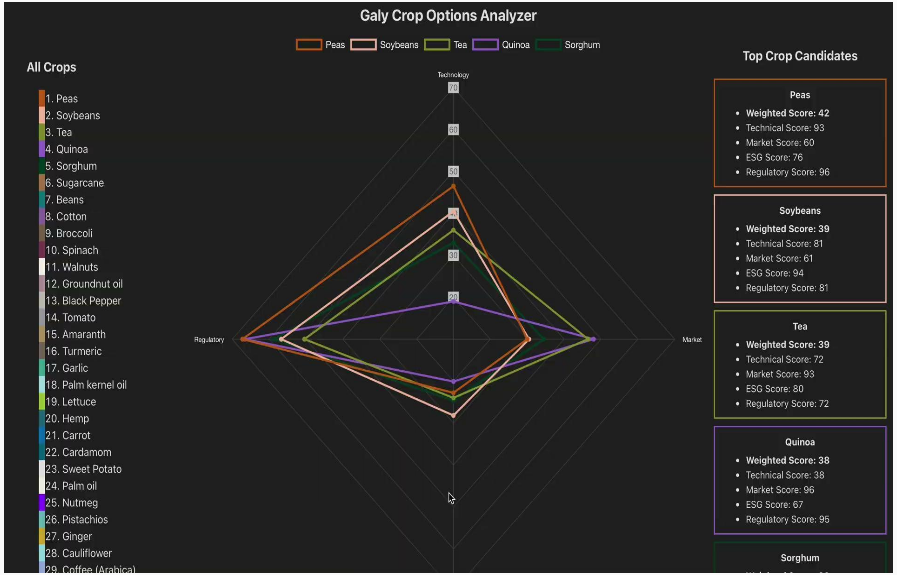
Spinach
- **Weighted Score: 46**
- Technical Score: 79
- Market Score: 99
- ESG Score: 63
- Regulatory Score: 88

Cashews
- **Weighted Score: 42**
- Technical Score: 93
- Market Score: 97
- ESG Score: 92
- Regulatory Score: 35

Onion
- **Weighted Score: 38**
- Technical Score: 68
- Market Score: 60
- ESG Score: 92
- Regulatory Score: 77

Turmeric
- **Weighted Score: 38**
- Technical Score: 91
- Market Score: 54
- ESG Score: 89
- Regulatory Score: 53

Chia Seed
- **Weighted Score: 37**
- Technical Score: 80
- Market Score: 66
- ESG Score: 18
- Regulatory Score: 80



Galy Crop Options Analyzer

All Crops

1. Peas
2. Soybeans
3. Tea
4. Quinoa
5. Sorghum
6. Sugarcane
7. Beans
8. Cotton
9. Broccoli
10. Spinach
11. Walnuts
12. Groundnut oil
13. Black Pepper
14. Tomato
15. Amaranth
16. Turmeric
17. Garlic
18. Palm kernel oil
19. Lettuce
20. Hemp
21. Carrot
22. Cardamom
23. Sweet Potato
24. Palm oil
25. Nutmeg
26. Pistachios
27. Ginger
28. Cauliflower
29. Coffee (Arabica)

Top Crop Candidates

Peas
- **Weighted Score: 42**
- Technical Score: 93
- Market Score: 60
- ESG Score: 76
- Regulatory Score: 96

Soybeans
- **Weighted Score: 39**
- Technical Score: 81
- Market Score: 61
- ESG Score: 94
- Regulatory Score: 81

Tea
- **Weighted Score: 39**
- Technical Score: 72
- Market Score: 93
- ESG Score: 80
- Regulatory Score: 72

Quinoa
- **Weighted Score: 38**
- Technical Score: 38
- Market Score: 96
- ESG Score: 67
- Regulatory Score: 95

Sorghum

Features of the Front End

User Friendly

The user can adjust the importance of each metric in determining the overall score

Research Backed

Analysis based on research availability on the distinguished science journals online

Use of Keywords

Web scraping depends on keywords that best describe the metrics and sub-metrics

Ranking

The user can see the top five ranked crops based on our analysis and their assigned weightage to each metric

05

Next Steps

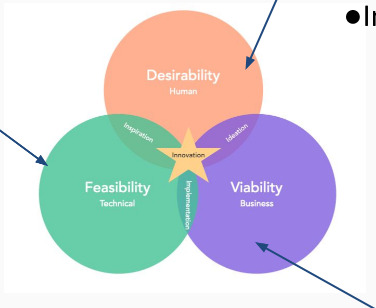
The future looks bright for GROW

Q1 - Desirability

- Run usability tests with Galy
- Interview Researcher

Q3 - Feasibility

- Build more ML models
- Deploy ML and build complete API in backend
- Attach data to Frontend



Q2 - Viability

- Cost Assessment of scaling up the platform
- Market Research

Team: Sustainobots

Thank You

for doing good for the planet.

MIT ENERGY & CLIMATE HACK

Galy