Global Innovation & Technology Alliance

सत्यमेव जयते
Department of Science and Technology
Ministry of Science and Technology
Government of India

Sal BioSc

Personalized Light Solution based Growth Environment Platform for Plant Factory.

for India-Republic of Korea RFP 2019

Presented by

Sumanth Vasista
Director, Sal Biosciences Pvt Ltd

Schedule

Date: 3 Dec 2020
Approx 15 mins

1. Project Overview

- About Sal BioSc
- What we want to achieve
- Need for technology
- Project Workflow
- Responsibility sharing

2. Technology Deep-dive

- TESSERACT Workflow Components
- V1.0 structure & function
- V2.0 capabilities
- Opportunities in food tech, biotech and pharma-tech
- Validation deck

3. Team & Roadmap

- Team & Capabilities
- Expert Consult
- Current collaborations
- Current & future projects

4. Commercialization Plan

- Market overview
- Opportunities in Korea-India trade partnerships
- Revenue Projections

Sal BioSc

About us

Sal Biosciences (previously Sal Agrotech) is a speciality research and development company in Agro-tech and bio-tech project

We specialize in photo-biology data development, collection and modelling for scientific and industrial applications

We have had extensive validation and proof-of-concept through a vast network of national and international clientele in both academia and industries

We have developed the Tesseract Workflow - methodology which uses high-throughput spectral stimulation (HTSS) combined with data analytics to identify and develop novel “light recipes” or “protocols” that can enhance the growth of plants as well as production of biomolecules of interest.

Project Overview

Project Overview

Objectives we want to achieve

Why?

Indoor farming is dependent on artificial grow light sources that constitute over 50% of the energy operating costs.

What?

There is a need and opportunity to identify the unique, synergistic "recipes" of light that can be used in very low quantities to get the similar effect to exposing plants with high energy lights in V/I Farming.

How?

Co-develop a platform to optimize light recipe and environment variables for a crop to grow. The solution that we would like to develop is the one that would be functioning well for vertical farming systems

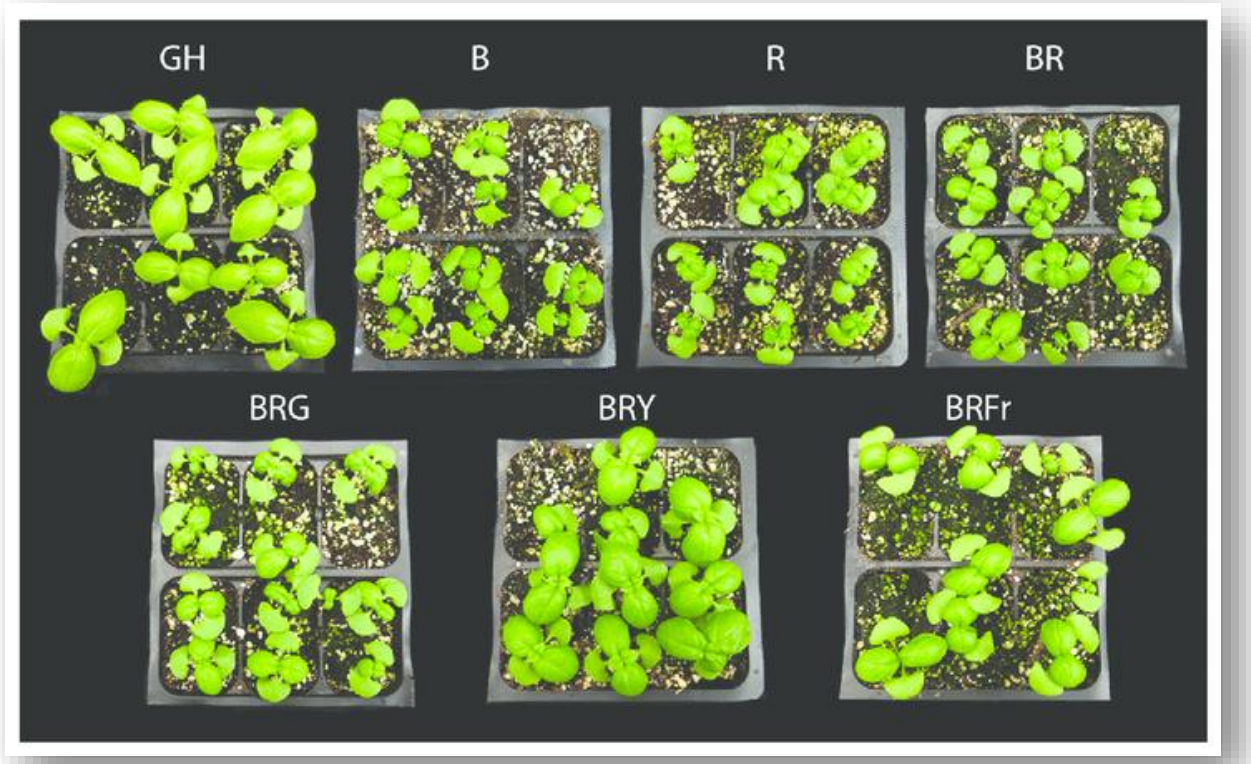
So that

We develop a unique optimization workflow and product that significantly influence future LED product manufacturing & improve profit margin and sustainability in indoor farming & related ventures

Project Overview

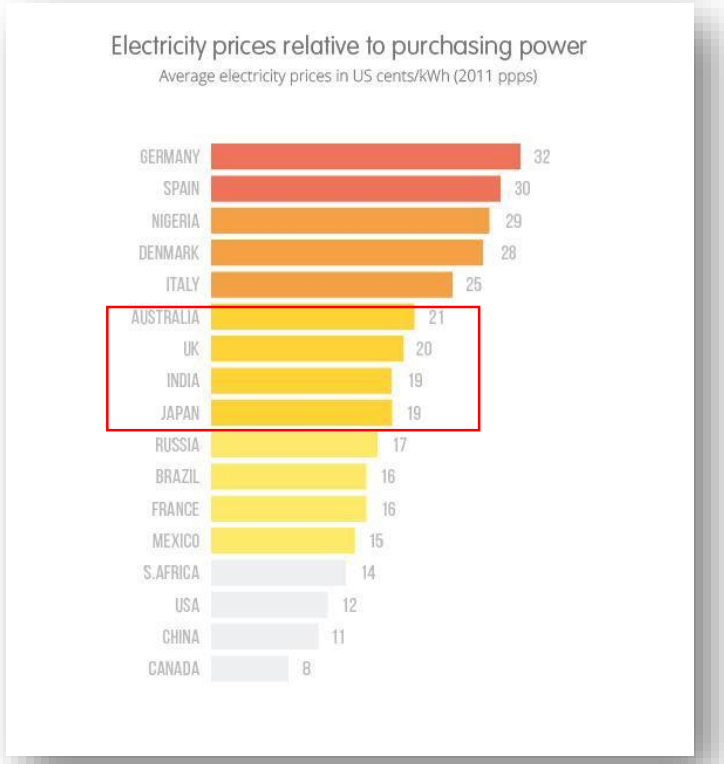
Need for the technology

Qualitative Need



Differential light quality (combinations) drastically change the end phenotype of plants grown indoors, and no one spectrum works for all types of plants to product quality output.

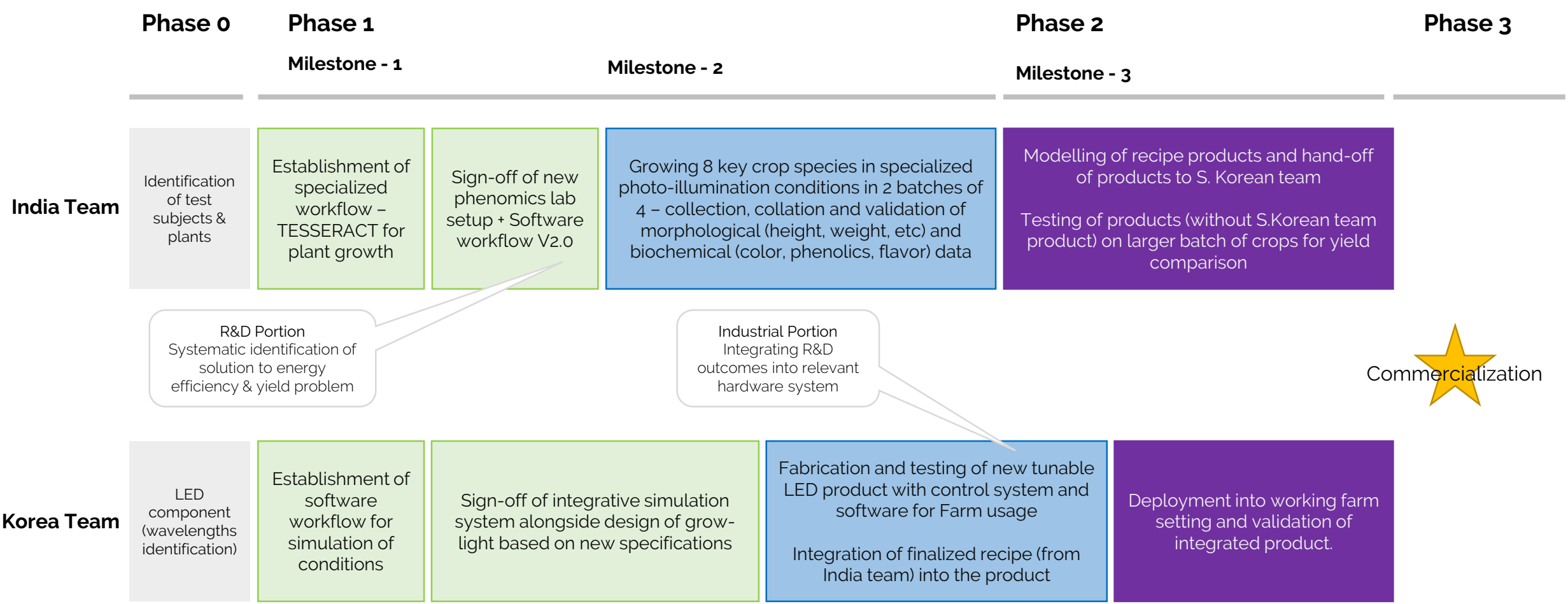
Quantitative Need



Countries, usually in the APAC like India spend more per unit energy, hence there is an incentive to identify low-energy solutions for indoor farms especially in emerging markets.

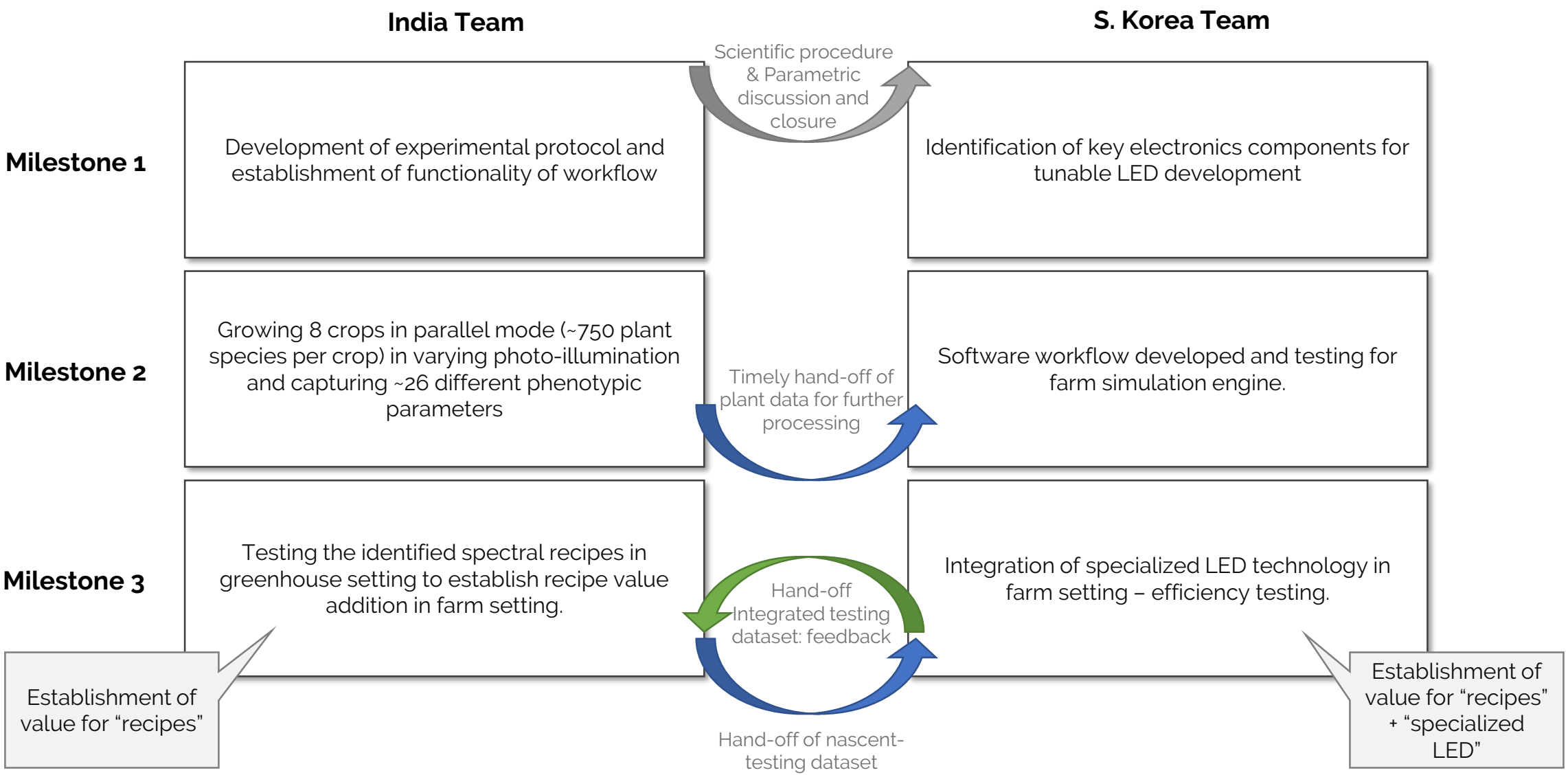
Project Overview

Overall Process-flow



Project Overview

Responsibility Sharing



Project Overview

Novelty of our technology

Our process-flow identifies spectrum-activity relationship in a high-throughput manner – making it extremely fast in identifying a solution.

The process can be used to create more solutions to other, similar problems of interest

Our technology significantly benefits manufacturing technologies in increasing biomass and yield of interest.

Project Overview

Recipe Development Pipeline

Butterhead Lettuce

Key Improvement Metric: Weight, Vitamin K synthesis

Strawberry

Key Improvement Metric: Weight, Fruiting rate, Anthocyanin content

Wasabi

Key Improvement Metric: Weight, 6M-isothyocyanate

Bok Choy

Key Improvement Metric: Weight, Leaf-area

Cherry Tomatoes

Key Improvement Metric: Weight, Fruiting rate, Licopene

Kale

Key Improvement Metric: Weight, Leaf Area

Pennywort

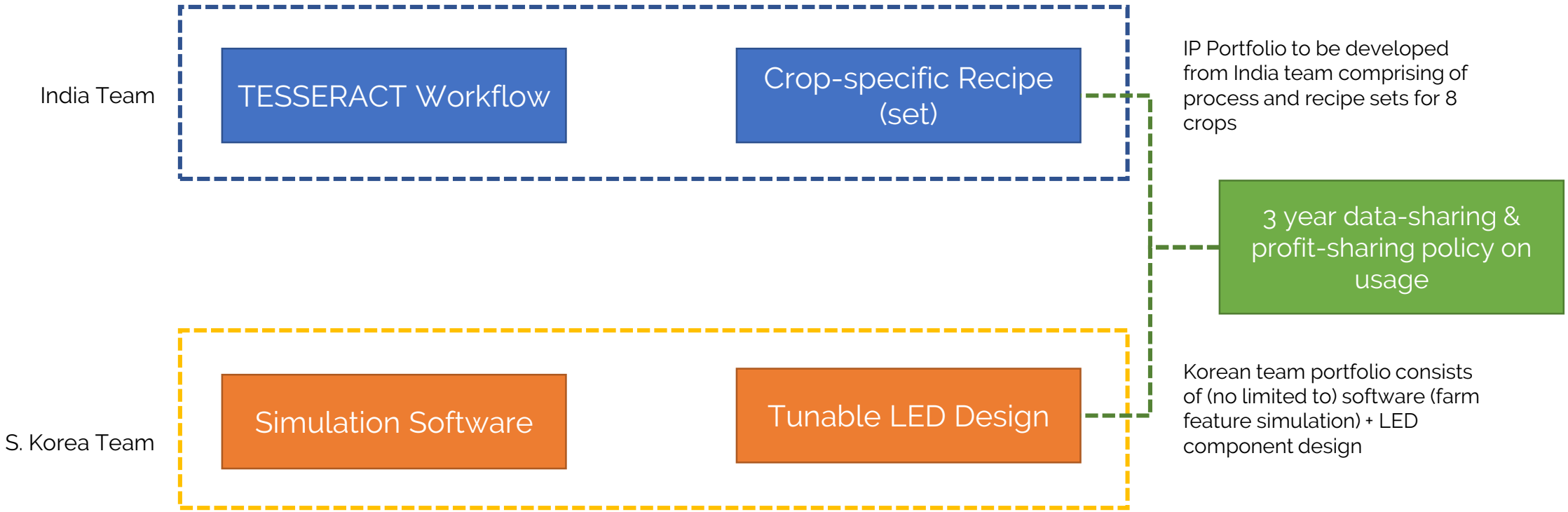
Key Improvement Metric: Madacassocide, Asiatic acid

Swiss Chards

Key Improvement Metric: Weight, leaf area, Histamine-betalain

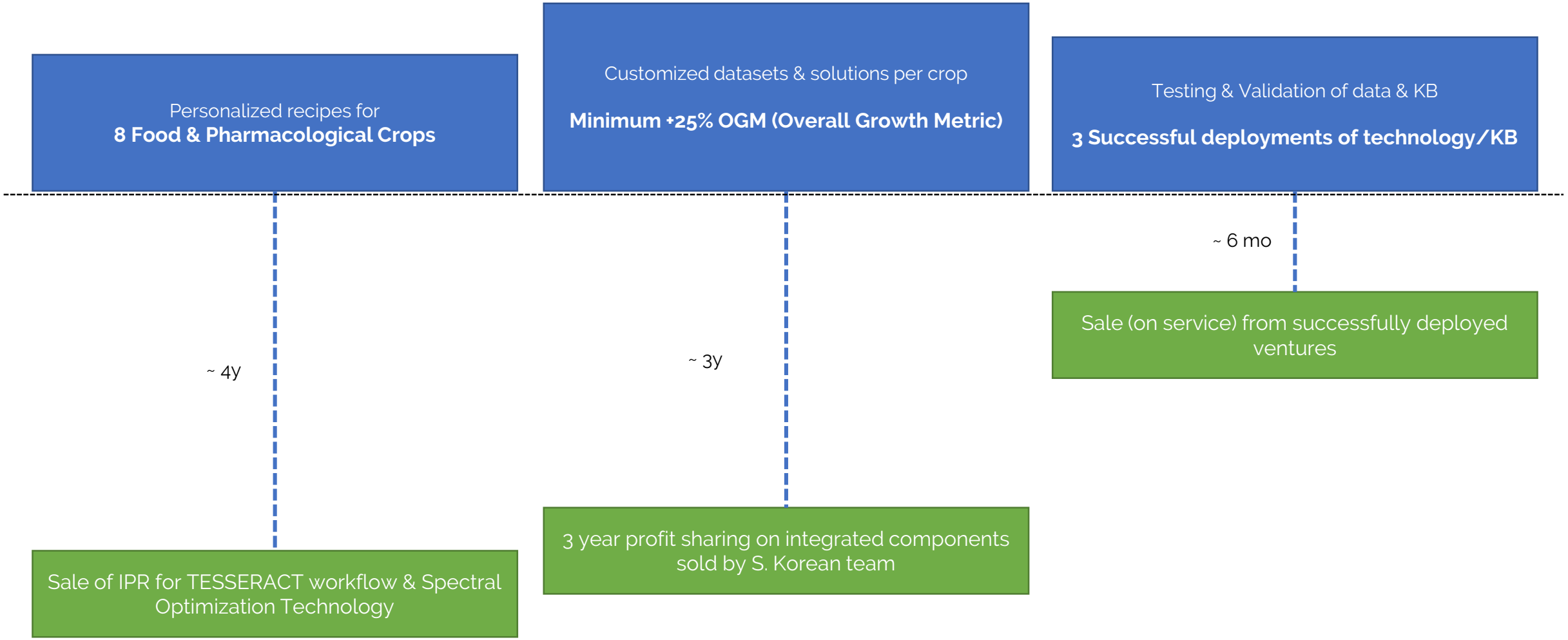
Project Overview

IP Development & Sharing Matrix



Project Overview

Project end-points & Commercialization end-points

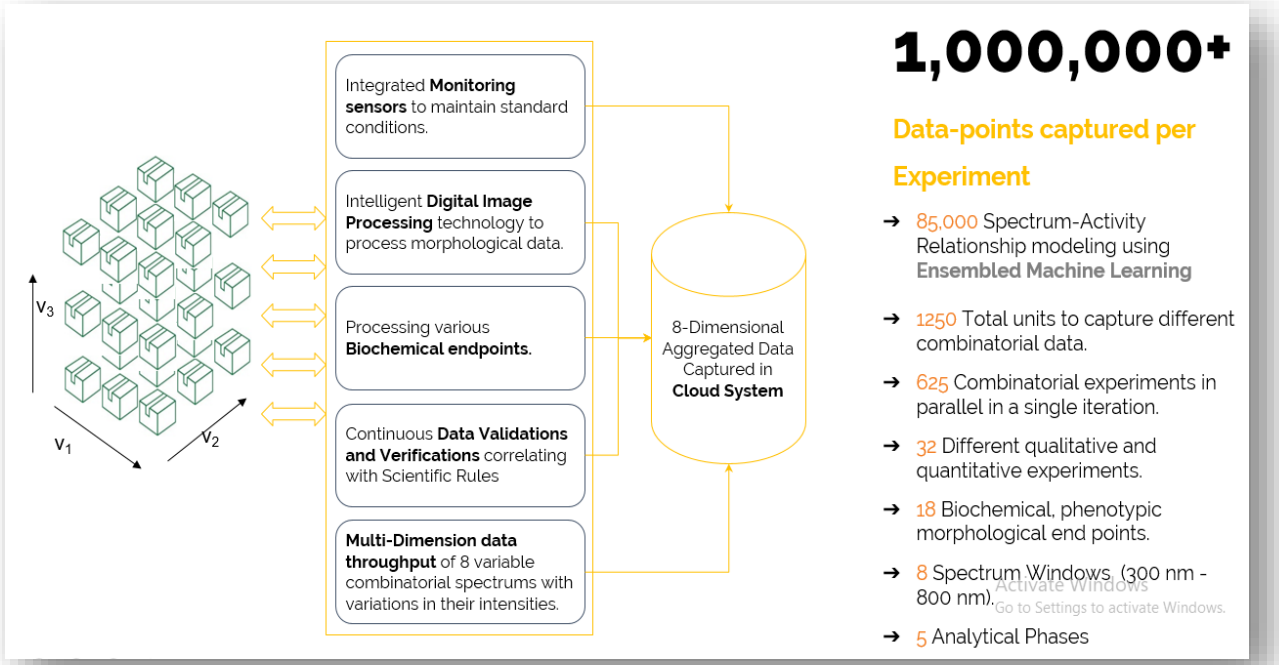



Technology
Deep-Dive

Technology : Spectral Optimization

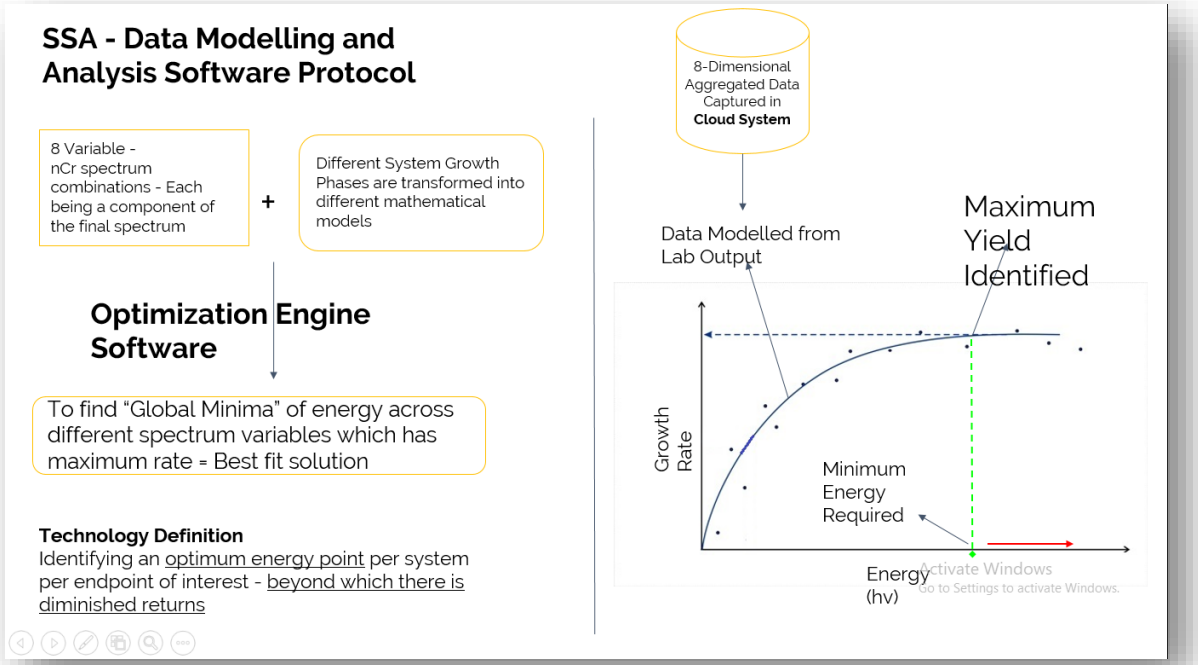
Workflow components

The Tesseract Workflow



Tesseract Workflow is a specialized setup where plants/cultures are grown simultaneously under different spectral combinations | 8 spectral variable of differential intensities are used| $^{8}C_{5}$ different combinational intensities simulated | Morphological & Biochemical data is captured

Spectral Optimization Algorithm



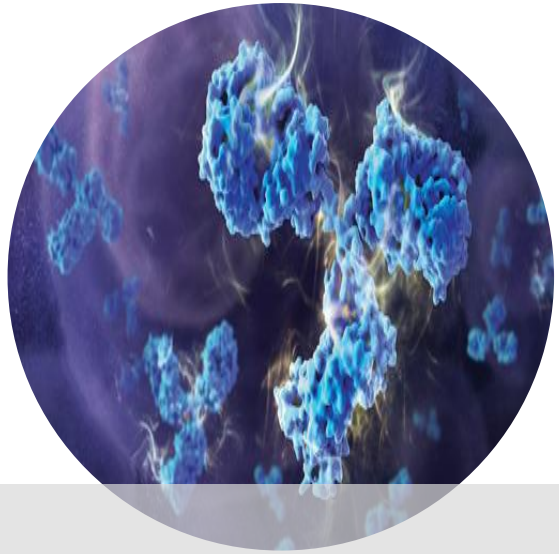
The SSA (Spectral Signature Analysis) uses Deep Learning Protocols to develop thousands of SA Relationships and identifies ideal combinations for optimization

Technology : Spectral Optimization

Opportunities in
Food, Bio & Pharma tech

In Food-tech, Vertical Farming is an accelerating technology trend where more and more plant types are being grown for food in urban centers – this leads to more demand for spectral optimization technologies to make VFs profitable and grow better food crops.

In bio-technology applications, we can use spectral optimization to enhance production of important phytochemicals such as Oils. Dyes, Anti-oxidants, flavor compounds and Pharmaceutical APIs derived from plant/fungal source

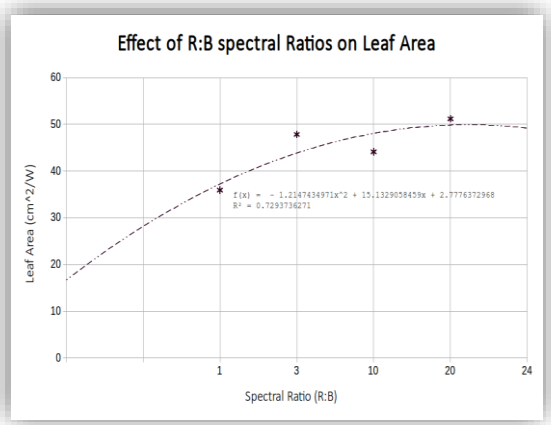


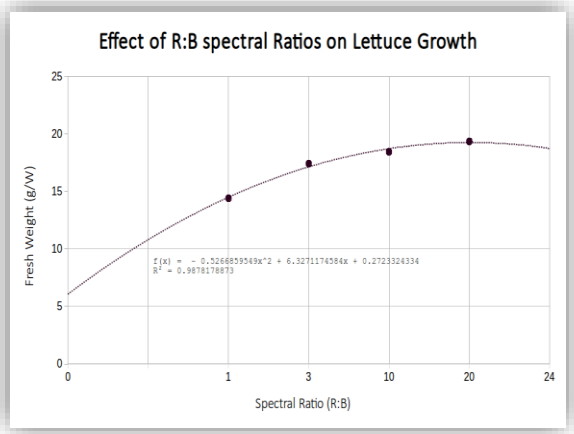
Spectral optimization technology has shown to be key in regulating secondary metabolism in both plants and other photosynthetically active organisms such as bacteria and fungi, which can lead to developing protocols for better production of commercially valuable biologics and biosimilars in the future

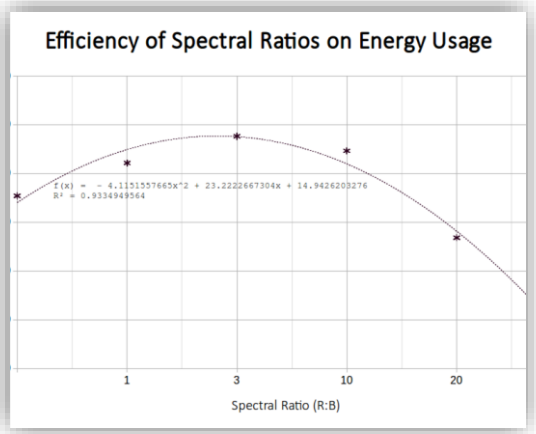
Technology : Spectral Optimization

Validation : Food Tech

Sal Experiment Data

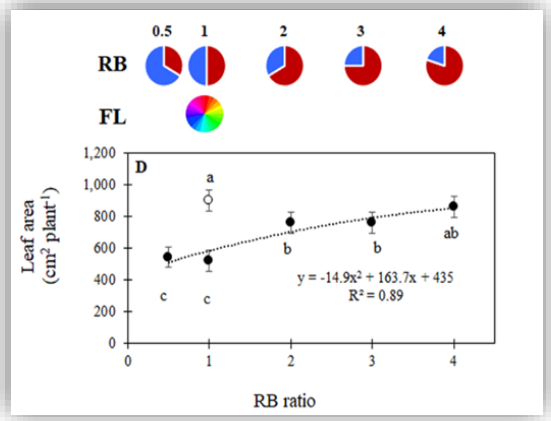


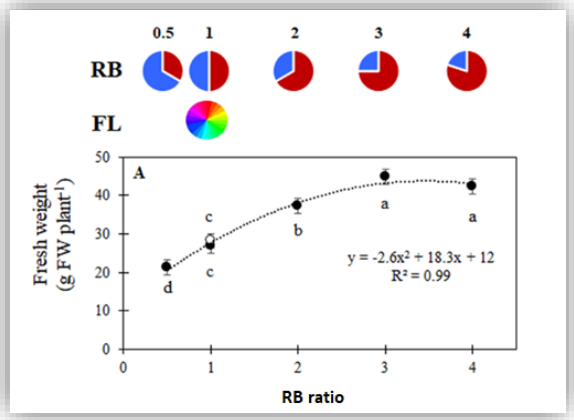


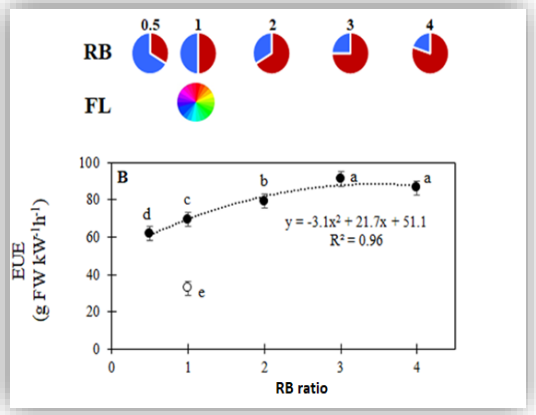


Ref: Pennisi, Giuseppina, et al. "Resource use efficiency of indoor (Lactuca sativa L.) cultivation as affected by red: blue ratio provided by LED lighting." *Scientific reports* 9.1 (2019): 1-11.

Francesco group







Reproduction Study of Francesco group's dataset – Nature Publication – Maximizing *Folic acid* production *in vitro*

Technology : Spectral Optimization

Validation : Food Tech

A

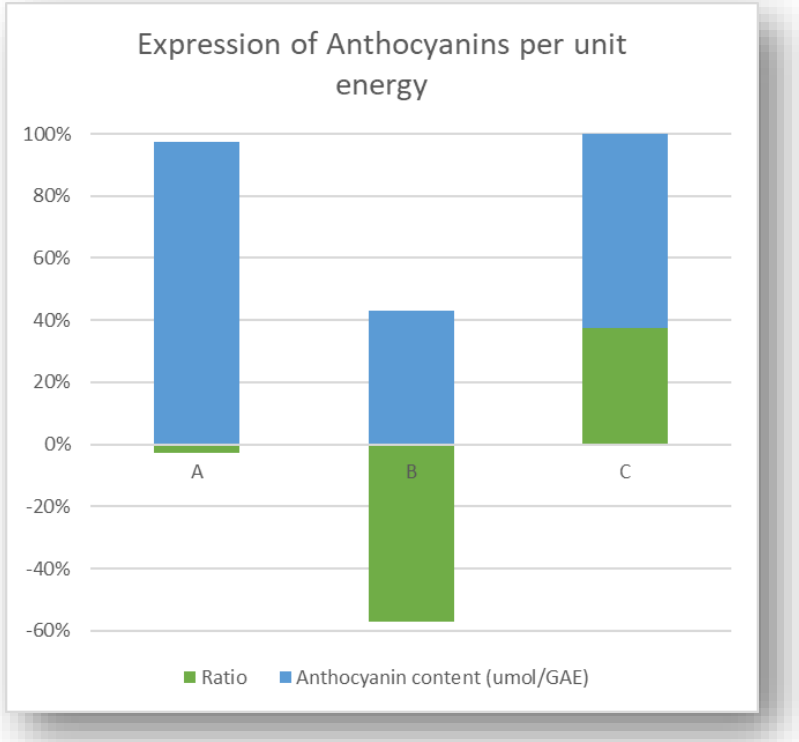
R:B bichrome spectrum – 70% Red – 30% Blue - ~50 umol/m2/s

B

White LED Spectrum – 15% Red, 35% yellow, 25% green, 25% Blue ~ 50-55 umol/m2/s

C

Optimized spectrum ~ 50 umol/m2/s

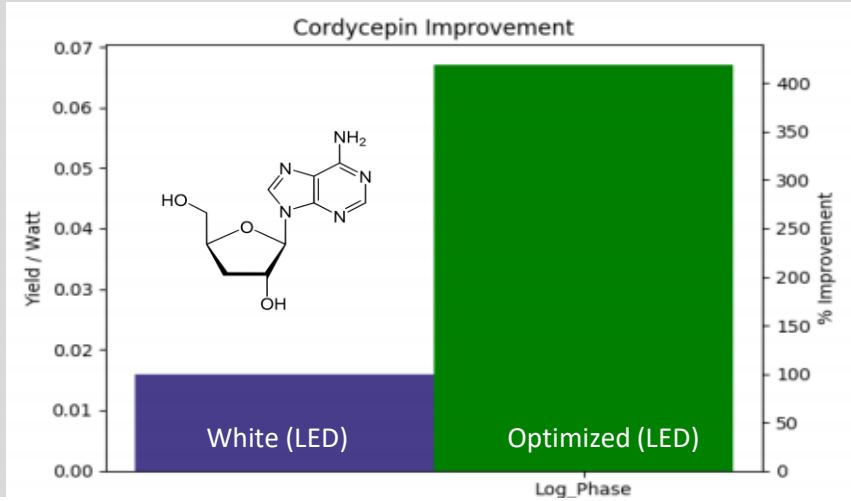


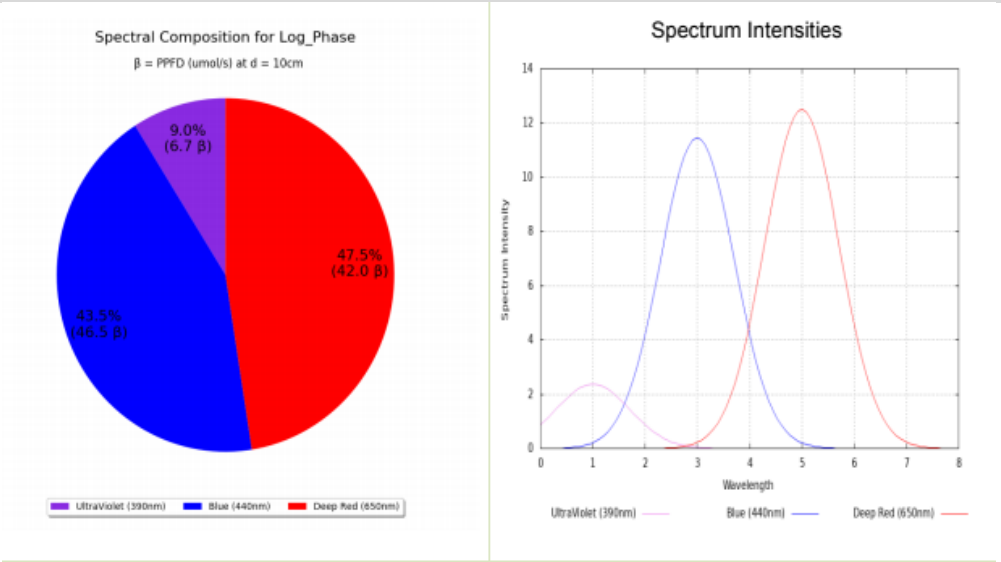
Specialized spectrum validated through client, for enhancing flavor and color profile for Red Lettuce.

Technology : Spectral Optimization

Validation : Bio/Pharma tech

Can we use the spectral optimization method to improve yield of Cordycepin in *C. militaris*?



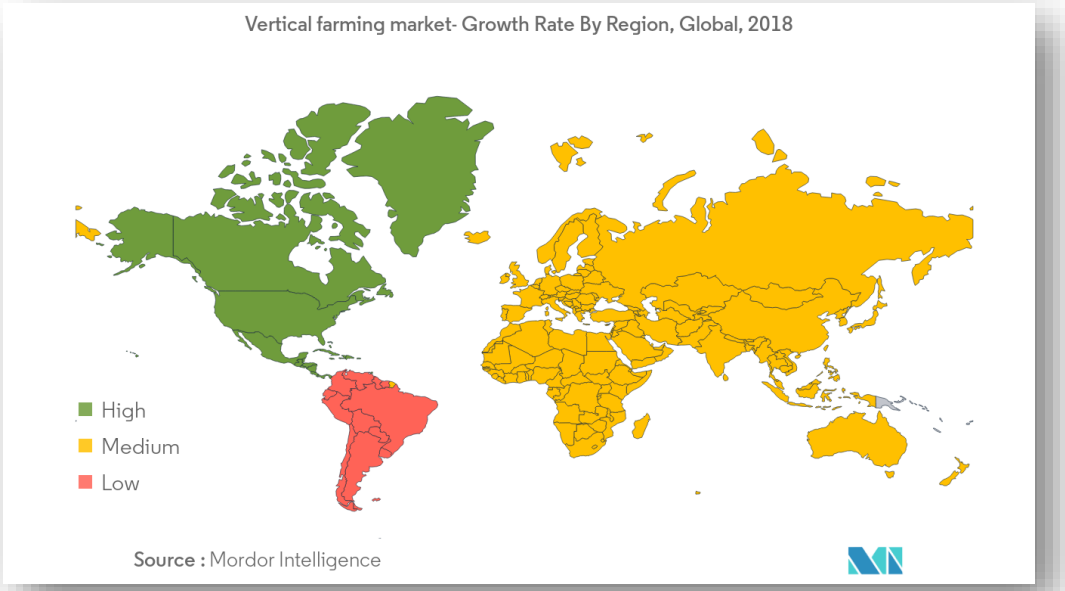


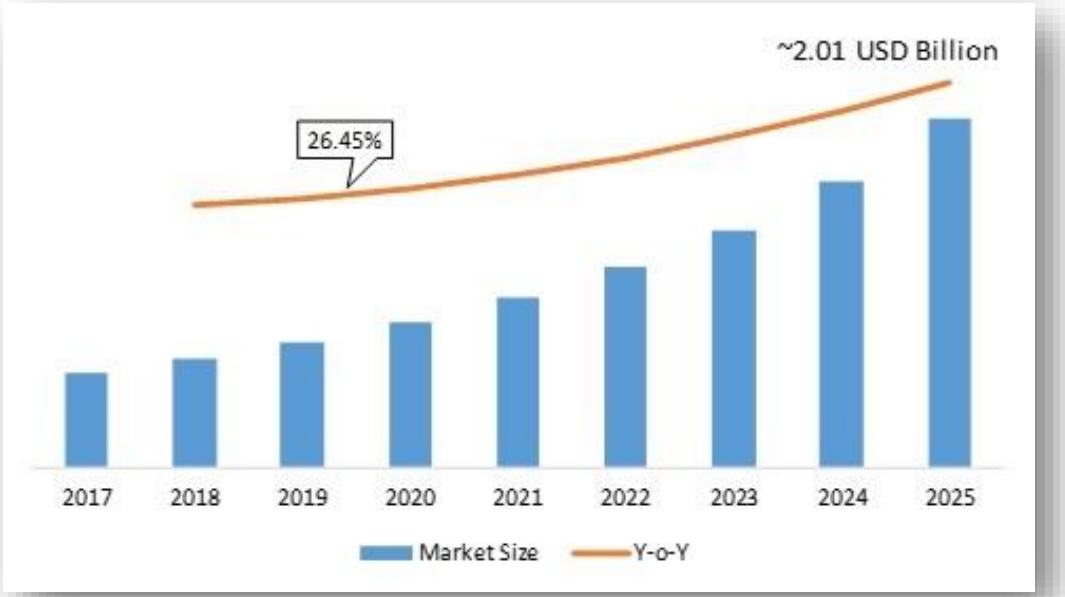
Yes! We Can!
We have identified the ideal spectral Recipe
to improve yield by up to 400%
compared to white control

Commercialization & Future Outlook

Commercialization Plan

Current Market Overview





India and APAC segment of the geography is the fastest growing Indoor/Vertical farming market in the world – although in terms of market maturity, North America leads currently.

There is an estimated 2.8 million square feet of Indoor Farming venture worldwide.

Grow lights and associated markets consists of Hydroponics technologies, automation technologies, greenhouse manufacturing & deployment and LEDs

Currently, the combined market is worth about **$4B** and grow-lights take about **50%** of the total share.

Key pain point existing in the VF market is affordability and profitability, especially in India and other Asian countries.

Commercialization Plan

Opportunities for Korea-India Trade Partnership

India has the fastest growing Hydroponics and Indoor/Technology driven agriculture market.

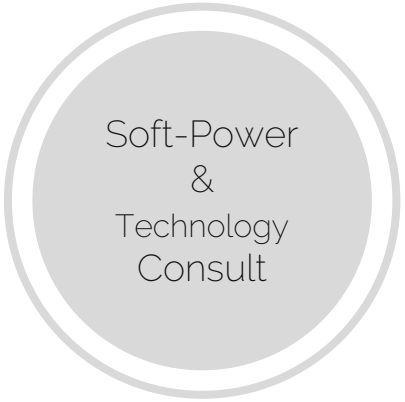
This opens up opportunities to equipment, expertise and technology service providers

Total estimated area than needs to be illuminated for indoor agriculture in India

An integrated technology equipment with predefined recipes is a best fit for Indian consumers who are more cost conscious

Working on exotic crop research, and metabolites research

This is another market segment that can use our specialized technology for optimal synthesis.

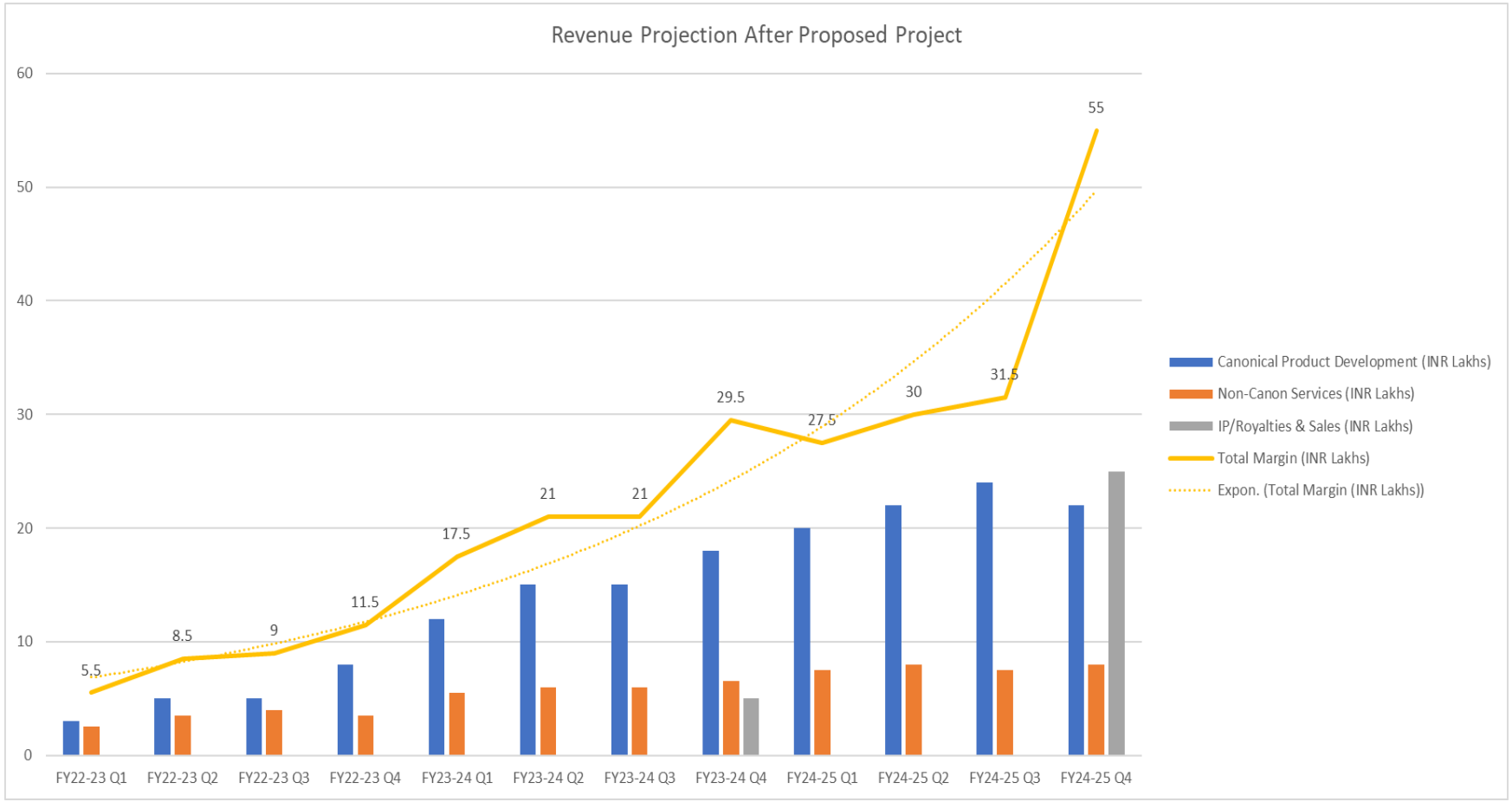


Technology consultancy is one of the fastest growing vector in technology farming and agritech

Total market exceeds $50,000,000 USD in various segment of agri-tech and indoor farming

Commercialization Plan

Revenue/Sales Projection



Estimated Break-even in **2 years** (by FY23-24 Q3)

~150% YoY increase in revenue for the **first 3 years**

Key Takeaways

- We have developed and validated, through first principles, a novel workflow that can impact plant growth and in turn help design and develop better grow lights and make plant factories more profitable.

- The technology can not only influence food tech but also specific biotech applications in improving production of phytochemicals, dyes and other usable plant materials

- The technology has been successfully integrated and made profitable through our network of clients and testing partners.

- We have developed a working plan for commercializing the technology through grow-light and farm integrating with the S. Korean consortium team to validate recipes and productization in the next two years.

- Our commercialization strategy is to develop newer recipes and collaborations where VFs / LED manufacturers can derive value and hence create profit sharing opportunities.

Thank You

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