

Summary of 3 Years IBM-IORF Sustainability Program

Phase I : 2021-22 ; Phase II : 2022-23; Phase III : 2023-24



Adoption of a Cluster of Villages for Agricultural Sustainability and Food Security through Clean Food Program

Implemented By

Inhana Organic Research Foundation (IORF)

168 Jodhpur Park, Kolkata – 700068, West Bengal, India

Email : inhana.rftprojects@gmail.com

Website : www.inhana.in

IBM - IORF SUSTAINABILITY PROJECT

Key Outcomes of IBM-IORF Sustainability Project (2021 – 2023)

Modern agriculture has changed dramatically since the end of World War II and the development helped to increase food production **at a significant ecological cost** resulting in threats to food security as well as to human health and safety. Top of it climate change impact enhances the risk of crop failure and cost of cultivation which causes significant loss of yield and income to the farmers. Many incidents have already registered where specially small and marginal farmers which represents > 86 % of farmers community in India had to bear severe lose which leads to force migration and livelihood displacement.

With Climate Change Impact, Food Security Challenge will only become more difficult, as the world will need to produce about 70 percent more food by 2050 to feed an estimated 9 billion people.

Some 97.85 million hectares (29.7%) of India's total geographical area (TGA) of 328.72 mha underwent land degradation till 2018-19; out of which 47 % is agricultural land.

To make matters worse, almost **all Indian states have recorded an increase in degraded land in the past 15 years**, with the most rapid increase being noted in the biodiversity-rich northeastern states as well as prominent agricultural areas. Land degradation threatens agricultural productivity by reducing soil health, thus in turn impacting the livelihood of rural people.

In this background, IORF conceived the Safe & Sustainable 'Clean Food' initiative in the early part of 2020 in collaboration with Nadia KVK (ICAR) with introduction of **Inhana Rational Farming (IRF) Technology**, an exclusive innovation of IORF. IRF Technology is a Comprehensive Crop- Technology which facilitates Safe & Sustainable Agriculture through its unique Energy Management Approach towards Plant Health Management along with Rejuvenation of Soil Health through its unique Novcom composting technology – meaning, utilization of **'Clean Energy to Produce Clean Food' – A Resource independent cultivation model.**

IORF always wanted for a right partner for the dissemination & never used its exclusive potential for mere commercial gain. In the year 2021 IORF & IBM get engaged in Clean Food Project in 100 ha of area- 100 % belongs to small and marginal farmers due to commitment on Sustainability.

Bringing Sustainability in Agriculture is undebately the biggest concern specially under Climate Change

The objectives of **'Clean Food' Program** is in accordance **with Sustainable Development Goals** of UN specially **SDG 2 (End Hunger, Achieve Food Security and Improved Nutrition and Promote Sustainable Agriculture)**

Clean Food Movement is probably the first initiative toward Healthy Life & Farmers' Empowerment; through the development of Safe & Sustainable 'Clean Food' (**Elimination of Chemical Pesticides**), i.e. crop sustainability without raising the cost of production and

establishment of a transparent supply mechanism from farmers' field to consumers in order to ensure affordable safe food for all.

Clean Food is the First & Only Offer in the direction of Safe & Sustainable Food - enables **LARGE SCALE PRODUCTION of SAFE FOOD**, ensure **PRODUCERS' PROFITABILITY & enables VALUE ADDED PRODUCT at AFFORDABLE PRICING**

Comprehensive Soil Test Protocol with 26 Parameters analysis was developed; 5 Soil Quality Indices with Colour Coding to facilitate better understanding of Soil Health by the farmers through the **Improved Soil Health Card (SHC)** .
Generate >400 SHC along with 96 SOIL RESOURCE MAPS & 10 SWOT MAPS to benefit > 1000 farmers in project villages.

Clean Food Program : 360 Degree Care for Farming Community with SEED to SEED Sustainable Solution with a new direction in HEALTH & LIVELIHOOD Development

Technological intervention with IRF technology will provide 360 degree care from seed treatment to seed production, help to enhance crop productivity by upto 20 % (as validated through actual field trials), Reduce cost of cultivation with better resource utilization & technological support and enhance plant immunity towards increasing their resilience to environmental fluctuations & reduce the risk of pest & disease invasion.

Adoption of Inhana Rational Farming (IRF) Technology for development of Crop specific Soil and Plant Health Management Package of practice helps towards the development of healthy plant and reduction of pest/disease incidents *vis-à-vis* Reduction of External Chemical Inputs while enabling Crop Sustenance/Improvement. Energization of plant physiological functioning through IRF technology helps to activate plants immunity against biotic and abiotic stresses to sustain crop yield .

1600 – 2000 tons of Safe and Sustainable 'Clean Food' was produced encompassing > 20 different variety of vegetable crops by 400 project farmers encompassing 5 project villages in Nadia District of West Bengal, India.

Colorimetric Pesticide Assay Test can be a Game Changer in Food Safety Analysis - Speedy ($1/10^{\text{th}}$ of Conventional Time), Effective & Economic ($1/10^{\text{th}}$ to $1/15^{\text{th}}$ of the Cost under present HPLC methods).

Pesticide residue testing for > 1200 samples comprising 30 Major Vegetables (produced in India) were done under the Colorimetric Pesticide Assay Test

Development of colorimetric pesticide assay test will help to analysis the food safety in real time which is a prime quality standpoint under clean food program. The newly standardized protocol can enable both Qualitative & Quantitative Estimation of the Major Pesticide Groups in Vegetables, detect presence of Heavy Metals as well as Other Toxic Substances of known/unknown origin related to human health and safety.

After successful demonstration of large scale production of pesticide free safe and sustainable “Clean Food’ Production under Phase-I IBM-IORF Sustainable program which is basically resource independent and more converse to small and marginal farmers - **we have conceptualized Clean Food ZERO CARBON ’ (CFZC) under Phase-II IBM-IORF Sustainable program which not only deliver SAFEST FOOD (Safe for Human health, Soil & Environment) but also have a meaningful contribution towards climate change mitigation and soil health upliftment.** Thus a switch over from Conventional Farmers’ Practice to Clean Food ‘ZERO CARBON’ Model, can totally transform the present GHG Emitting Agriculture to a GHG Sink Agriculture.

Clean Food ‘Net Zero’ is an initiative which not only exhibits **CROP SUSTAINABILITY** under climate change impact but at the same time **Effectively Mitigates Green House Gases (GHG) and Creates More Carbon Sink**

Transformation from ‘Clean Food Zero Carbon’ to ‘Clean Food Net Zero’ – Resource availability (for soil management) is the only pre-condition & sourcing of abundant & economically viable input is the major challenges

To do the Net Zero agriculture & develop our soil as carbon sink, finding source of abundant and economic raw material is most challenging for large scale Clean Food Net Zero program specially for farmers adaptation- which was attended most successfully under Phase-II IBM-IORF Sustainable program

There is scarcity of composting technology which is practically feasible, economically viable and socially acceptable to turn the waste into quality organic manure to attend the requirement of any Agri-Net Zero Program. We selected coir pith- a waste generated from coir industry as our source. Due to inherent complexity of coir pith and lack of conversion technology, it become a major methane emitter (6 ton CO₂e/ton coirpith) and source point of environmental pollution when dumped as waste.

Recycling of landfill waste to quality organic manure with suitable & adoptable technology is the only way to mitigate the challenges- which was addressed under Phase-II IBM-IORF Sustainable Program

Coir pith is most underrated and unaccounted Agro Industry waste which is a potent source of Soil & Water pollution and Methane emitter but hard to recycle without an Effective Technological Intervention

Present of high lignin part in coirpith which contains aromatic and aliphatic components and various functional groups, including phenolic, hydroxyl, carboxyl, benzyl alcohol, methoxy, and aldehyde groups, which can cause phytotoxicity when applied untreated in agricultural soil. The present practices / mal practices in many parts of South India with application of these materials as organic manure with no /little intervention enhance the threats – which needs an established mechanism for proper recycling and agricultural usage.

Under Phase –II IBM-IORF Sustainability Project (2022-23) at Mandya, Karnataka, an effort was initiated utilizing Novcom Composting Technology, towards bioconversion of coir pith into safe, mature and qualitative compost for sustainable soil management, especially looking at the stony red soils of the area which are erosion prone, and have a poor productive potential.

Periodical study of Novcom coir pith compost confirmed effective degradation as demonstrated by the rapid decline of C:N ratio from 1:100 to < 1:25, appreciation of total nitrogen by 98 percent and 60 % degradation of lignin within a 30 days' time period. The facts are corroborated by the respective very high (in the order of 10^{16} c.f.u. per gm or one trillion billion population of bacteria, fungi and actinomycetes. Phytotoxicity Bioassay test values confirmed that this compost can actually accelerate seed germination and root growth process.

Novcom composting Technology developed by IORF, has enabled bioconversion of **2000 ton of Coir pith to Safe–Stable-Mature Compost rich in self generated microflora** (one trillion billion Microflora per ton Novcom compost) **within 30 days - Bioconversion of Toxic Methane Emitter to an Excellent Resource for Soil-C Sequestration .**

The Study indicated that bioconversion of coir pith under Novcom Composting Technology, can enable a **Methane mitigation of about 6000 ton CO₂ eq. per 1000 ton waste**

The evaluation indicated that coir pith when dumped untreated (as most often witnessed) can potentially emit methane in the range of 5897 – 6025 kg CO₂ equivalent (taking GWP_{24 years} of methane: 75). GHG emission during biodegradation of coir pith utilizing Novcom Composting Technology, was found to be about 31 times lower (6.47 kg CO₂ equivalent/ ton treated waste) than the reference values recorded in respect of any other standard biodegradation process

Agriculture Carbon Footprint Assessment Tool (ACFA – Version 1.0) developed by IORF in collaboration with ICAR-ATARI, is probably the 1st Carbon Calculation Standard for Agricultural GHG Estimation in India

The study in both the agro-ecosystem in West Bengal and Karnataka showed that in terms of crop productivity, all the Clean Food models (in different soil integration & organic plant management) including 'Clean Food Net Zero' performed well as compared to conventional farmers' practice. On an average the crop productivity increased upto 19.5 % under Clean Food Model indicated that that plant health management under IRF Technology, the most ignored component under conventional farming, can actually hold the key to crop sustainability especially under the climate change impact.

Coconut based 'Net Zero' Intercropping Model under IBM-IORF Sustainability Project **enhanced System Productivity By 442 %**

Inhana Plant Health Management (IPHM) schedule, that utilizes various Potentized and Energized Botanical Solutions as well as on-farm developed Plant Tonics and Plant Elixirs towards activation of plant physiological functions viz. photosynthesis, metabolism, nutrient assimilation etc. & better host-defense mechanism against pest/ disease. This leads to reduction of free amino acid and reducing sugars in the plant cell sap and enables better secretion of bio-chemicals; that on one hand reduces pest susceptibility and improves disease resistance and alternately improves crop quality due to enrichment of the secondary metabolites.

Higher crop productivity under 'Clean Food Net Zero' model indicated that the dual approach of plant health management and soil health management under Inhana Rational Farming (IRF) Technology helped to improve crop productivity irrespective of crop variety or soil or agro-ecological settings. At the same time, it helps to eliminate/reduce pest/disease pressure through improvement of plants immunity and host defense mechanism

REGENERATIVENESS & RENEWABILITY components under Clean Food Net Zero Program was understood with Energy Usage & GHG Mitigation potential.

Clean Food Net Zero Program recorded 57 % Energy Transition with 432% Higher Energy Efficiency in crop production per unit energy investment.

Clean Food Net Zero Program is probably India's 1st Agri Net Zero Project which showed a potential of mitigate about 25000 MT CO₂ from 100 ha

replacing conventional farmers' practice with CFNZ Program has the potential to mitigate about 13.78 kg CO₂ equivalent per kg vegetable produced. So a 100 ha CFNZ Program, can offset about 24,833 MT of CO₂ equivalent, enabling significant climate action while also creating opportunities for higher employment and income generation.

Comparative study of Energy usage showed net energy gain was 29,000 to 40,000 MJ/ha Energy gain under different CF models. Comparative Study of Nutrient Energy Productivity (NEP) of major crops under different management Practice showed on an average CFNZ Program was found to be 432 % more efficient in terms of crop productivity per unit energy invested.

GHG evaluation in respect of vegetable production under Clean Food Net Zero program (CFNZ), was done through ACFA (Version 1.0) tool and it was found that

Ref: SACFA00000004
Period Certified: 01 April 2022 to 31 March 2023

AGRI - NET ZERO

SUSTAINABLE AGRICULTURE CARBON FOOTPRINT CERTIFICATE
This document certifies that the agricultural GHG emissions of the project were calculated using the Sustainable Agriculture Carbon Footprint Assessment (SACFA) Toolkit developed by iNoCarbon Limited.

Farmer/Project Name and Location: IBM-IORF Sustainability Project at Mandya District, Karnataka, India

Project Details: Clean Food - Net Zero (CFNZ) Project in 252 ha area using NOVOCOM Coir Pith compost under INHANA Soil Health Management (SHM) & Inhana Plant Health Management (IPHM) through Inhana Rational Farming (IRF) Technology of Inhana Organic Research Foundation (IORF), Kullachi, India (Phase II: 2022 - 2023).

Chemical-intensive Agriculture was practiced in the above project area wherein Sustainable Agriculture under IRF Technology was introduced and the Carbon Footprint from on-farm activities were calculated using the SACFA Toolkit for both the practices.

Established Agricultural practice followed:	Conventional (Chemical Fertilizers & Pesticides)
Established Carbon Footprint:	(+) 1.478 mt CO ₂ /ha
Present Agricultural practice followed:	Inhana Rational Farming (IRF) Technology
Present Carbon Footprint:	(-) 0.000 mt CO ₂ /ha
NET Carbon Footprint Achieved	from 25.20 ha (-) 6,339,060 mt CO ₂ e

This means that this IBM-IORF Sustainability Project has shown the potential of REDUCING 251.55 mt CO₂/ha for such De-carbonization Programme towards Net Zero compliance.

Vijay L. Narasimhan
Authorized Signature
Date of Issue: 18 September 2023

iNoCarbon Limited
(Change Today for a Better Tomorrow)
Anthony van Nieuwen, United Kingdom

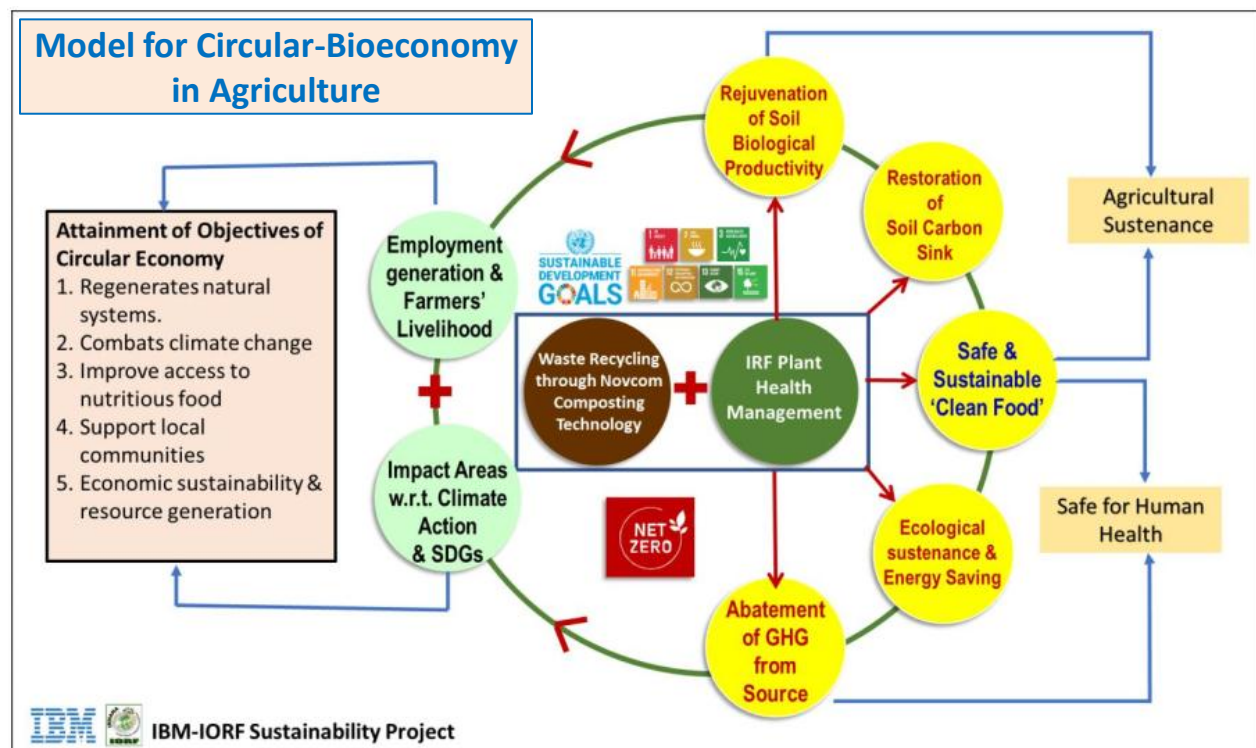
This SACFA Toolkit has been developed based on the Agriculture Carbon Footprint Assessment (ACFA) Version 1.0 expounded by Inhana Organisation Research Foundation (IORF) in association with iNoCarbon Limited (iNC). Based on relevant IPCC Guidelines and emission factors, research works.
This assessment was carried out remotely, using data provided by the client. All obligations of the accuracy of the data rest with the client.

Clean Food 'Net Zero' Program can successfully attend Seven Crucial Sustainable Developmental Goals (SDG)

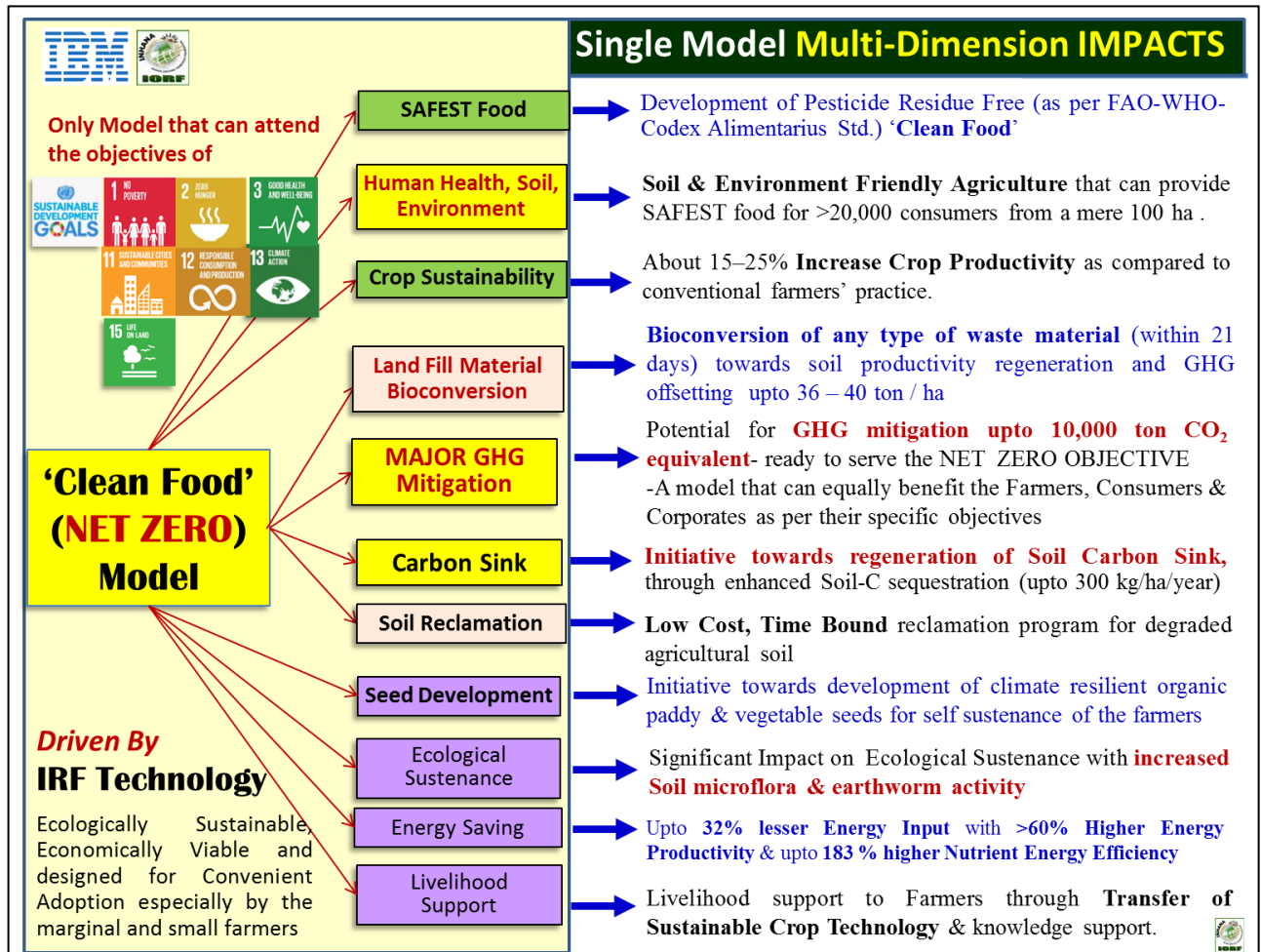


Clean Food 'Net Zero' Model attends Seven Crucial Sustainable Developmental Goals (SDGs). Among them, the Most Critical Area of Sustainability- **SDG 2**, (sustainable solutions to end hunger) and **SDG-13** (*Both Climate Change Mitigation & Adaptation*). **The CFNZ Model is also a model for Degraded Soil Reclamation** with clear impact area w.r.t. **SDG-15** - End desertification & restore degraded land. And finally this Model impacts **four other Crucial SDGs** i.e., **SDG-1** (Inclusive Agriculture & Food Production can Create Jobs and Eliminate Hunger in Rural Areas, giving people a chance to feed their families and live a decent life). **SDG-3** (Ensure Healthy Lives through Nutritional Security), **SDG-11** (Ensure Sustainable Farming Communities) and **SDG-12** (Achieve the Sustainable Management and Efficient use of Natural Resources and Achieve the Environmentally Sound Management of all wastes including landfill).

Clean Food Net Zero Model complies all the basic principles of circular bio-agriculture like regeneration of natural system, combat climate change, improve access to safe and nutritious food, support local communities (farmers), render economic sustainability and enable resource generation. The model helped to enhance resource usability, minimize unsustainable inputs, rejuvenate soil biological productivity and sustain crop yields that empowered the resource poor, economically vulnerable marginal and small farmers while improving the access of safe food for all. Thus, **the Model can serve as a practical model for circular agriculture central to the growth of circular economy to sustained livelihoods especially in respect of the economically vulnerable marginal and small land holders.**



Clean Food Net Zero Model have multidimensional impacts on food production, soil quality, environmental sustenance, human health , livelihood sustenance and climate change mitigation. With the adoption of this model, in a single intervention we can attain some serious problems related to food production and livelihood sustenance. Thus this model can be adopted in any program like CSR , ESG, Sustainability or even SDG Research .



The 'Clean Food' Program has received 4 Recognitions as the first entity which confirm its uniqueness, innovation & impacts on food production, livelihood development and climate change mitigation.

- Winner in the Category ENVIRONMENT under 8th CSR Impact Awards – CSR Box & Dalmia Bharat Foundation,
- Winner – Excellence in Climate Change Mitigation under CSR & Sustainability Summit & Awards – ASSOCHAM Southern Region,
- Bronze in Category LIVELIHOOD under National CSR & Summit Awards – Vision India Forum & CMAI and
- Winner in the Category 'Best Innovative CSR Project' under Corporate Responsibility Summit & Awards – UBS Forums.

Awards & Recognition for innovation & impacts on food production, livelihood development and climate change mitigation.

IBM-IORF Sustainable project enabled Technology Interventions that have ensured Sustainability Outreach to the Marginal Resource Poor Farmers and the project also provided the opportunity to pursue the development of Specific Sustainability Tools that could enable Wide Scale Sustainability outreach especially to the Small and Marginal Farming Community. **Nine Sustainability Tools have come out as the Scientific Offshoots of the IBM-IORF Sustainability Project**

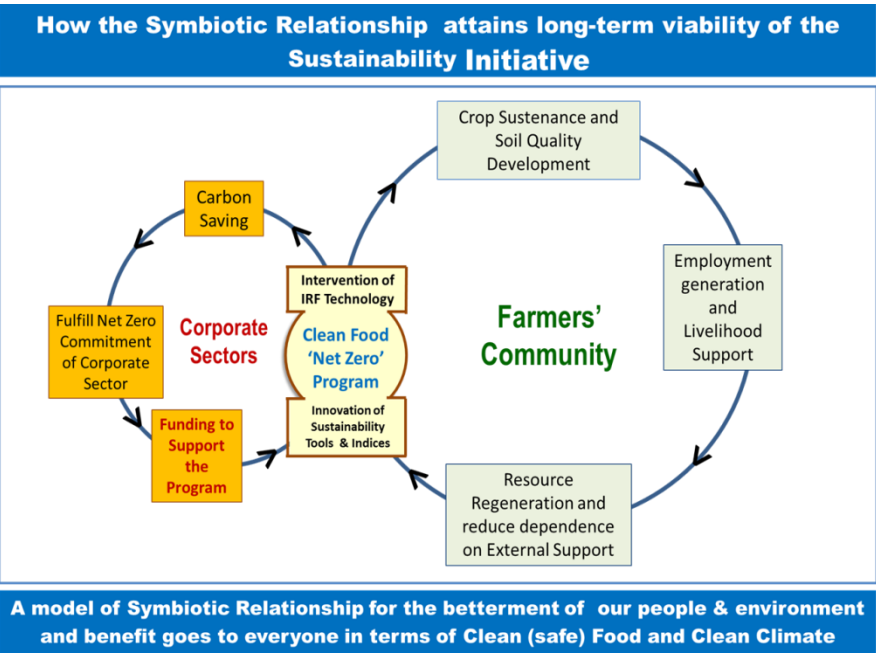
9 SUSTAINABILITY TOOLS

- 1. SOIL HEALTH PROXIMITY MODEL
- 2. FOOD SAFETY ASSESSMENT TOOL
- 3. ENERGY FOOTPRINT STUDY TOOL
- 4. AGRICULTURE CARBON FOOTPRINT ASSESSOR
- 5. COMPOST CARBON FOOTPRINT ASSESSOR
- 6. SOIL PESTICIDE POLLUTION ASSESSMENT TOOL
- 7. CROP PESTICIDE POLLUTION ASSESSMENT TOOL
- 8. CLEAN FOOD STANDARD (CFS) TOOL
- 9. AGRICULTURE SYSTEM SUSTAINABILITY ASSESSOR

9 Research Articles has already been published in different National/International Journal and Conference proceedings (Perhaps the only of its kind for any Sustainability project)

39 Milestones has been achieved in 3 years of project time period covering wide aspect of Sustainable Food Production, Livelihood Sustenance and Climate Change Mitigation & Adaptation

15 Sharing of Success Stories in Social media platform and in different forum and in farmers meet



Perhaps this is the only model which inter connect farmers need and Corporate sectors' objectives towards Net Zero Goal with multi dimensional impact on Agricultural, Social, Environmental Livelihood sector

