BRIEF OUTCOME
&
SCIENTIFIC OFFSHOOTS
of the IBM-IORF Sustainability Accelerator Project

Development of

9 SUSTAINABILITY TOOLS

for Effective Sustainability Outreach especially to the Small & Marginal Farmers

Inhana Organic Research Foundation (IORF)

Background for the IBM-IORF Sustainability Accelerator Project

The Input Intensive Chemical Agriculture has formed the basis of our Food production System since the last few decades. It has also become the prime reason behind the depletion of the soil resource base on which Agriculture rests. The existential Climate Change impact further increases agricultural vulnerability.

The FAO emphasizes that **'A profound change of the global food and agriculture is needed if we are to nourish the additional 2 billion people expected by 2050'.** **In this context the relevance of 'Sustainable Agriculture' has increased manifolds.**

But at the same time the following statement of UN "**It is currently not clear or well defined what constitutes productive and sustainable agricultural practice**"- **vividly demonstrates the Need for an EFFECTIVE PATHWAY that can ENSURE SAFE & SUSTAINABLE Crop Production**.

The IBM - IORF Sustainability Accelerator 'Clean Food' Project was driven with the above objective and has provided exclusively insights w.r.t. Indian Agriculture, be it the critical land fragmentation of small and marginal farmers, the extreme pressure on land due to high cropping intensity, leading to acute **dependency on Unsustainable Inputs and therefore very High Vulnerability w.r.t. Climate Change.**

The IBM - IORF Sustainability Accelerator 'Clean Food' Project has made Significant Contributions towards the objective of **Safe and Sustainable 'Clean Food Production' for Empowerment of Small and Marginal farmers especially in the backdrop of Climate Change**

IBM-IORF Sustainability Accelerator Project to comply the Requirement for SDG-2

The IBM-IORF Sustainability Accelerator Project is a **first endeavor to comply the requirement for SDG-2** of the United Nations (*Sustainable food production and resilient agricultural practices*).

The Primary Deliverables :

- **Clean Food Production**- a First ever **Tangible Demonstration of Safe Product** that is also **Sustainable – Producers, Consumers, Environment**.
- First ever Batch wise **End Product Safety Assessment** using a **Scientific yet an Economical Process – Colorimetric Pesticide Assay Test**.
- Development of a **1st Ever 'Sustainability Deliverable Model'** towards **Empowerment of Small and Marginal farmers**.

To ensure Safe & Sustainable "Clean Food" development, Soil & Plant Health Mgt. were the primary components of interest for which IRF Technology intervention was done.

IORF Accomplished the Set Project Milestones - 1

As per the Scope of Work IORF took up different Objectives which were set as Project Milestones.

Milestone 1 : Initiation to collaborate with Agrolly Weather App. – *The objective was to utilize weather predictability from Agrolly App. towards Crop Management under this Project. IORF did not restrict only to this and went ahead to get* ***400 Project Farmers Registration in the Agrolly App.***

Milestone 2 : Soil Resource Mapping through SQI & SQS – *The Objective was to provide about 5 Maps.* ***We have finally submitted 96 RESOURCE MAPS***

Milestone 3 : SWOT Study maps of the Project Area – *The Objective was to provide 1-2 Maps.* ***We submitted 10 SWOT INTERACTIVE MAPS***

Milestone 4 : Development of Clean Food – *This achievement was a Tangible demonstration of Safe & Sustainable Agriculture*

Milestone 5 : Production of Clean Food and their Safety Assessment- *Standardization of a Pesticide Assay Test to enable* ***Safety Assessment of Vegetables at upto 1/15th of the Cost & 1/10th of the required Time for Chromatographic Testing Methods.***

IORF has ensured that each Milestone was achieved within the Stipulated time

IORF Accomplished the Set Project Milestones - 2

As per the Scope of Work IORF took up different Objectives which were set as Project Milestones.

Milestone 6 : Pesticide Footprint Study of Crop and Soil of the Study Area – *Standardization of a **1st Ever & Authentic 'Pesticide Risk Indicator'** especially for the Widely Diversified Indian Field Crop Sector.*

Milestone 7 : Quality Assessment of Clean Food & initiation of supply to consumer through Dedicated Pathway- *IORF has established an **Farmers' Producers Company- MAPCL**, the one and only of its kind pan India, being dedicated solely towards Safe & Sustainable agriculture; and a **Dissemination Wing- SafeU**, that is entirely focused on ensuring economic sustainability for the farmers as well as the consumers.*

Milestone 8 : Initiation of collaboration with IBM Food Trust w.r.t. the Traceability App – *IORF is ready with its 'Clean Food', and all other Project Deliverables required to Reach the Safe & Sustainable Story of 'Clean Food' Development at the Consumer Level – awaiting IBM collaboration.*

Milestone 9: Initiation of collaboration with Environmental Intelligence Suite w.r.t. the Development of Sustainable Agricultural Model- *– awaiting IBM collaboration.*

Milestone 10 : Publications (based on critical findings)- *One Research Article published, **7 more in the pipeline in the coming months**.*

IBM Sustainability Stimulus enabled Technology Interventions that have ensured Sustainability Outreach to the Marginal Resource Poor Farmers -1

Soil Health Assessment is the first step towards the objective of Soil Health Management.

Initially it was decided that Soil Health Assessment will be done only for the Project Farms. But this 100 ha Project Area was scattered in 5 Villages considering Vegetable Farmers, **More than 96% farmers are small and marginal but in stark contrast to the Country's scenario, the land fragmentation in the Project Area was critical. The actual land size is less than 0.26 ha, further fragmented into 4-5 farms and that too are located in a scattered manner in a large radius of area.**

So Ultimately we were looking at a **soil sampling size of 1200 and with 26 Parameters Quality Analysis we generated a massive 32000 (approx.) data pool**. We provided Farm **Specific Soil Health Card to 400 Project Farmers – all of which were Exclusive in respect of the Indian Agriculture Scenario**

IBM Sustainability Stimulus enabled Technology Interventions that have ensured Sustainability Outreach to the Marginal Resource Poor Farmers- 2

In the process of Clean Food development we utilized the different Tools and Indices previously developed by IORF towards quantification of the Soil and Plant Health under the Sustainable Agriculture Initiative.

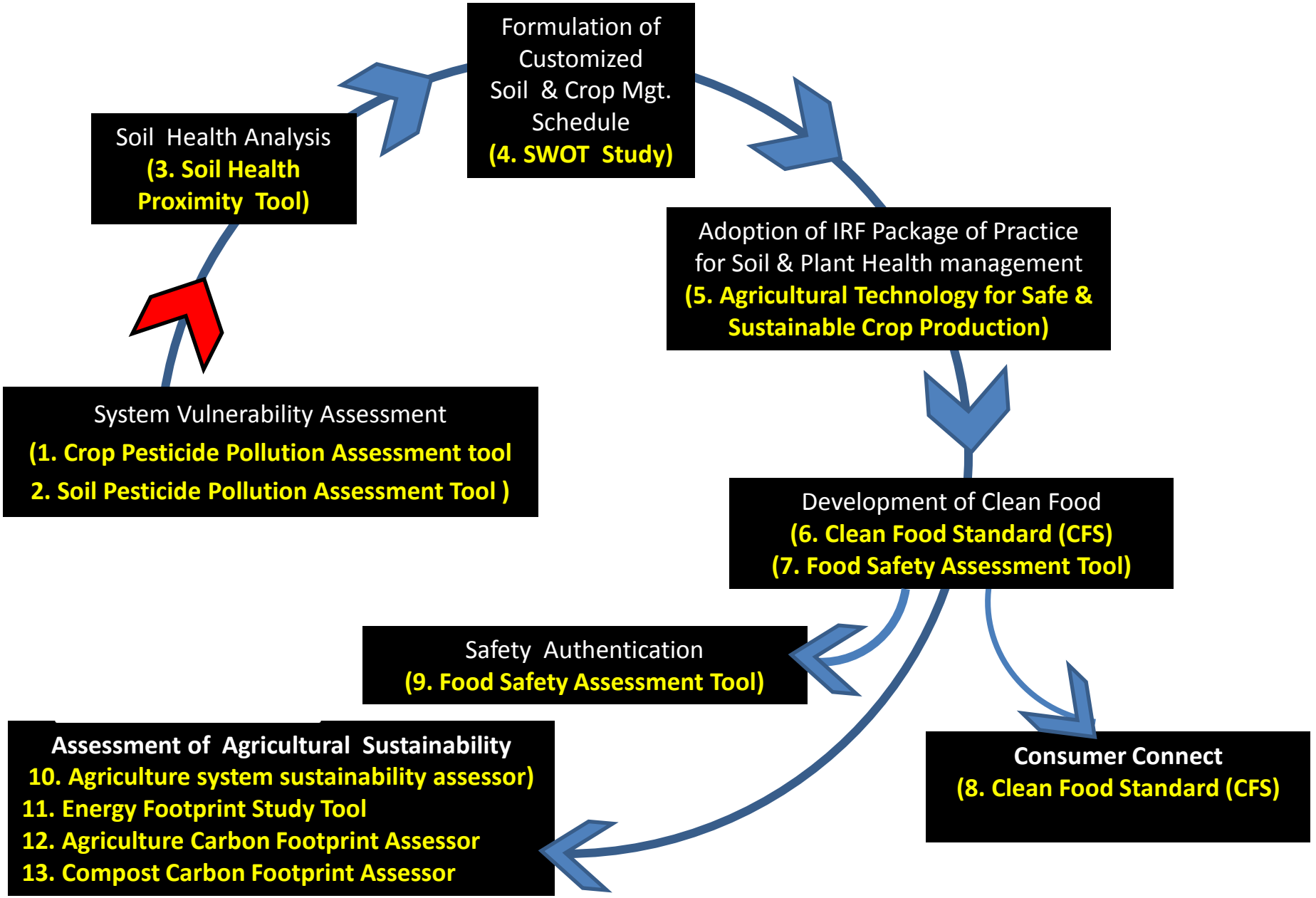
But the project also provided the opportunity to pursue the development of Specific Sustainability Tools that could enable Wide Scale Sustainability outreach especially to the Small and Marginal Farming Community.

Nine Sustainability Tools have come out as the Scientific Offshoots of the IBM-IORF Sustainability Accelerator Project, some fully developed and some due for completion within the coming 2 - 3 months.

9 Sustainability Tools that are already developed or are under Process (completion expected within 2-3 months) with assistance from IBM Sustainability Accelerator

SUSTAINABILITY TOOLS	PRESENT STATUS
1. SOIL HEALTH PROXIMITY MODEL	PROTOTYPE DEVELOPED
2. FOOD SAFETY ASSESSMENT TOOL	PROCESS STANDARDIZED
3. ENERGY FOOTPRINT STUDY TOOL	UNDER PROCESS
4. AGRICULTURE CARBON FOOTPRINT ASSESSOR	UNDER PROCESS
5. COMPOST CARBON FOOTPRINT ASSESSOR	UNDER PROCESS
6. SOIL PESTICIDE POLLUTION ASSESSMENT TOOL	ALREADY DEVELOPED
7. CROP PESTICIDE POLLUTION ASSESSMENT TOOL	ALREADY DEVELOPED
8. CLEAN FOOD STANDARD (CFS) TOOL	UNDER PROCESS
9. AGRICULTURE SYSTEM SUSTAINABILITY ASSESSOR	UNDER PROCESS

Transition to Sustainable Agricultural System through utilization of Different Tools under IBM-IORF Sustainability Accelerator Project



Scientific Offshoots of the IBM-IORF Sustainability Accelerator Project – NINE SUSTAINABILITY TOOLS

1. SOIL HEALTH PROXIMITY MODEL - PROTOTYPE DEVELOPED

NECESSITY : Soil Health Assessment is a critical component towards Sustainable Crop production. But in India, majorly represented by small and marginal farmers, Soil Health Report for individual farm land is a difficult proposition considering that land fragmentation is a major problem with an average marginal landholding size of <0.38 ha. That means to provide Soil Health Report even for a small area, the number of Soil Samples will be huge, only a limited number of soils can be analyzed in a specific time span even if the facility is enhanced to its optimum and the cost would also be much higher. These simultaneously restricts the dissemination potential.

This was the background behind IORF's endeavour to develop a Scientific Solution for providing complete soil analysis in the form of **customized 'Soil Health Card' for individual farm land holding** with an **INPUT (*Soil Sample Analysis*) : OUTPUT (*Soil Health Card*) RATIO of 1:10 to 1:15 at primary level to 1:20 to 1:25 in final phase of development**; that will **enable enhancement of resource utilization efficiency up to 25 times.**

UTILITY : This Model can open up the Scope for undertaking Large Scale Soil Quality Analysis of Individual Farm Lands; because of the less time requirement and scaling down of the analytical cost - **unavailable so far in Indian Agriculture**. Can enormously **enhance the reachnes / dissemination potential of Precise & Detailed Soil Quality Report especially relevant for small and marginal farmers** for Resource based-Sustainable Soil Health Management.

Scientific Offshoots of the IBM-IORF Sustainability Accelerator Project – NINE SUSTAINABILITY TOOLS

2. FOOD SAFETY ASSESSMENT TOOL - PROCESS STANDARDIZED

NECESSITY : Analysis of pesticide residues in food is the governing criteria for ensuring food safety. But **the Chromatographic Techniques are hugely expensive, complex and time-taking process**. **So batch wise testing of Vegetables for Consumer Safety Compliance is out of question for small and marginal farmers**. The Colorimetric Pesticide Assay Test can be a Game Changer in this respect and was Standardized for Vegetables under this Project by IORF in collaboration with KVK (ICAR, Nadia).

UTILITY :

- This method will Provide Qualitative & Quantitative Estimation of the Major Pesticide Groups in Vegetables.
- This method will enable the detection of heavy metals as well as other toxic substance of known/unknown origin related to human health and safety.

But Most Importantly all these at 1/10th to 1/15th of the Cost & 1/10th of the required Time under Chromatographic Testing Methods.

Scientific Offshoots of the IBM-IORF Sustainability Accelerator Project – NINE SUSTAINABILITY TOOLS

3. ENERGY FOOTPRINT STUDY TOOL - UNDER PROCESS

NECESSITY : The FAO has reiterated that to achieve SDG-2, Sustainable Agriculture with intervention of Modern Technologies is the ONLY PATHWAY. Sustainable Agriculture is critical for another Goal SDG-13 referring Climate Action. Higher energy usage in crop production indicates higher GHG emission. Hence, to define any process/ method as 'Sustainability Enabler', its Energy Usage has to be assessed first followed by steps to increase the Energy Productivity. An Energy Footprint Study Tool is highly relevant in both these contexts but so far there is none available simply because the Concrete Road map for Sustainable Agriculture, is absent.

UTILITY : It will be a 1st of a Kind Tool for Energy Audit of any Initiative w.r.t. Sustainable Agriculture, across agro ecosystems- which is Hugely Relevant in the Context of the SDG's.

Scientific Offshoots of the IBM-IORF Sustainability Accelerator Project – NINE SUSTAINABILITY TOOLS

4. AGRICULTURE CARBON FOOTPRINT ASSESSOR - UNDER PROCESS

NECESSITY : The highest indicator of Sustainable Agriculture is CO_2 Neutrality, for which Higher Crop Efficiency is Prerequisite. IRF Technology of IORF has enabled West Jalinga T.E. to become World's 1st & the Only Carbon Neutral T.E. Sustainable Agriculture means the Unsustainable Inputs will be Low/ No, along with Sustained/ Higher Crop. And for every kg of Extra Crop produced that much C- Sequestration or Tapping of Atmospheric- C occurs in the form of the Crop biomass that would be otherwise free in the atmosphere – indicates the Truest Form of C- Sequestration

UTILITY : This Tool will be a 1st of Kind Solution to assess the Sustainability Potential of any Agricultural Initiative – Hugely Relevant in the Context of Food Security Challenge under the existential Climate Change Impact considering that the Pathway for Sustainability Assessment is Practically Non- existent.

Scientific Offshoots of the IBM-IORF Sustainability Accelerator Project – NINE SUSTAINABILITY TOOLS

5. COMPOST CARBON FOOTPRINT ASSESSOR - UNDER PROCESS

NECESSITY : Compost is being recognized as a Tool for C- sequestration/ Sustainable Soil Management and an Expedient of Sustainable Agriculture. As per IPCC guidelines GHG emission from composting is usually derived by subtracting the emission from any biodegradable matter under an organized decomposition process, from the emission obtained from the same material left in an unorganized manner. But the estimation is not fully accurate because the emission during the entire biodegradation period is not considered; moreover there is no scientific judgment whether a Stable/ mature End Product is obtained at the end of the biodegradation period.

In the IBM- IORF Safe & Sustainable 'Clean Food' Project, IORF has taken a Step Ahead for **evaluation of the C- sequestration potential under Novcom Composting Process through Temporal Assessment of CO_2, N_2O (GHG gases) as well as NH_3,** followed by Organic- C content assessment in Final Novcom Compost with Quality Analysis to authenticate its Maturity Aspects.

UTILITY : The Data Generated from this Experiment is being utilized to Develop the required **Best Fit & A First of its Kind Sustainability Tool towards assessing the C- emission/ C- sequestration potential under any Biodegradation Process – Highly Relevant towards SDG 13- Climate Action**

Scientific Offshoots of the IBM-IORF Sustainability Accelerator Project – NINE SUSTAINABILITY TOOLS

6. CROP PESTICIDE POLLUTION ASSESSMENT TOOL - ALREADY DEVELOPED

Necessity : The major contributions to the Food Basket of India comes from the Small & Marginal farmers. But these farmers lack the knowledge regarding Good Agricultural Practices, especially in respect of pesticides. Moreover due to very high dependence on land they resort to injudicious applications due to the continual threat of crop loss from pest/disease. This leads a higher risk of pesticide residue in crops especially in the case of short duration vegetable crops.

In this background '**Pesticide Risk Indicators**' can provide a crucial support in the assessment of the potential environmental and health risks from pesticide use- but reliable **pesticide risk indicators especially in the context of field crops are extremely scarce.**

The IBM Sustainability Stimulus provided the opportunity to IORF to Standardize its Crop Pesticide Footprint Assessment Tool (*originally developed and used in Plantation crops*) in respect of the Field Crops (Vegetables); as no such evaluation Pathway is presently available.

UTILITY : This Tool can be a 1st Ever and Authentic 'Crop Pesticide Risk Indicator' especially for use in the Widely Diversified Indian Field Crop Sector, and especially to ascertain the Toxicity Load in those areas where actual residue analysis is not possible in the primary phase.

Scientific Offshoots of the IBM-IORF Sustainability Accelerator Project – NINE SUSTAINABILITY TOOLS

7. SOIL PESTICIDE POLLUTION ASSESSMENT TOOL - ALREADY DEVELOPED

NECESSITY : Pesticide residue in soil is one of the contributors towards food chain toxicity. For any Safe & Sustainable Agriculture Initiative; **assessment of the Pesticide Load in soil is crucial to adjudge the risk of pesticide contamination of crop from soil and to undertake specific soil health management in order to mitigate residual toxicity as well as to foster the proliferation of beneficial soil micro and macroflora** – towards restricting the Biotic Potential; which is immensely relevant in respect of Safe & Sustainable Crop production.

The IBM Sustainability Stimulus provided the opportunity to IORF to Develop and standardize the Soil Pesticide Footprint Assessment Tool as no such evaluation Pathway is presently available.

UTILITY : This Tool can be a 1st Ever and Authentic 'Soil Pesticide Risk Indicator' for use in Indian Agriculture, holds special relevance in respect of any Sustainable Agriculture Initiative.

Scientific Offshoots of the IBM-IORF Sustainability Accelerator Project – NINE SUSTAINABILITY TOOLS

8. CLEAN FOOD STANDARD (CFS) TOOL - UNDER PROCESS

NECESSITY : Standards exists for Organic Food but no such guidelines are available to authenticate Safe & Sustainable Agriculture (*Complete elimination of pesticides and No/ Low Nitrate Fertilizers*) leading to Clean Food Production.

The **Clean Food Standard is primarily designed to assure consumers about purity of food in terms of pesticide residue**, how food is produced on the farm by minimizing detrimental environmental impacts of farming operations, reducing dependence on chemical inputs and undertaking a responsible approach towards worker health & safety.

UTILITY : The CFS Tool will not only authenticate the safety and sustainability aspects of the cultivation practice and the end product but also guide the producer towards the objective through adoption of a Validated Sustainable Practice.

Scientific Offshoots of the IBM-IORF Sustainability Accelerator Project – NINE SUSTAINABILITY TOOLS

9. AGRICULTURE SYSTEM SUSTAINABILITY ASSESSOR - UNDER PROCESS

NECESSITY : Agriculture system sustainability assessor is required to evaluate overall sustainability quotient of any agricultural management system in terms of crop sustenance, environmental preservation, economic viability and adoptability potential by small and marginal farmers. So the tool will indicate usability of any agricultural practice towards safe and sustainable crop production in varied agro-ecologies as well as socio-economic settings.

UTILITY : The AGRICULTURE SYSTEM SUSTAINABILITY ASSESSOR will not only measure the impact of any agriculture management system, but also assess its Strength and Weakness. This will help in making further developments or alterations necessary to ensure a systems' compliance towards Safe and Sustainable Agriculture.

Conclusion

- Each of the Nine Sustainability Tools have specific role and relevance in different aspects of Safe & Sustainable Agriculture Initiatives.
- The tools will facilitate effective dissemination and reachness of sustainability at various levels of the farming system.

Now the need is to Apply the Sustainability Tools in different agro-ecological settings for better and more precision output towards Development of 'Climate Resilient, Safe & Sustainable Agricultural Models' for Small and Marginal farmers.