

# Designing sustainable smallholder farming systems in global south: Integrating multidimensional and whole farm perspective using systems tool box

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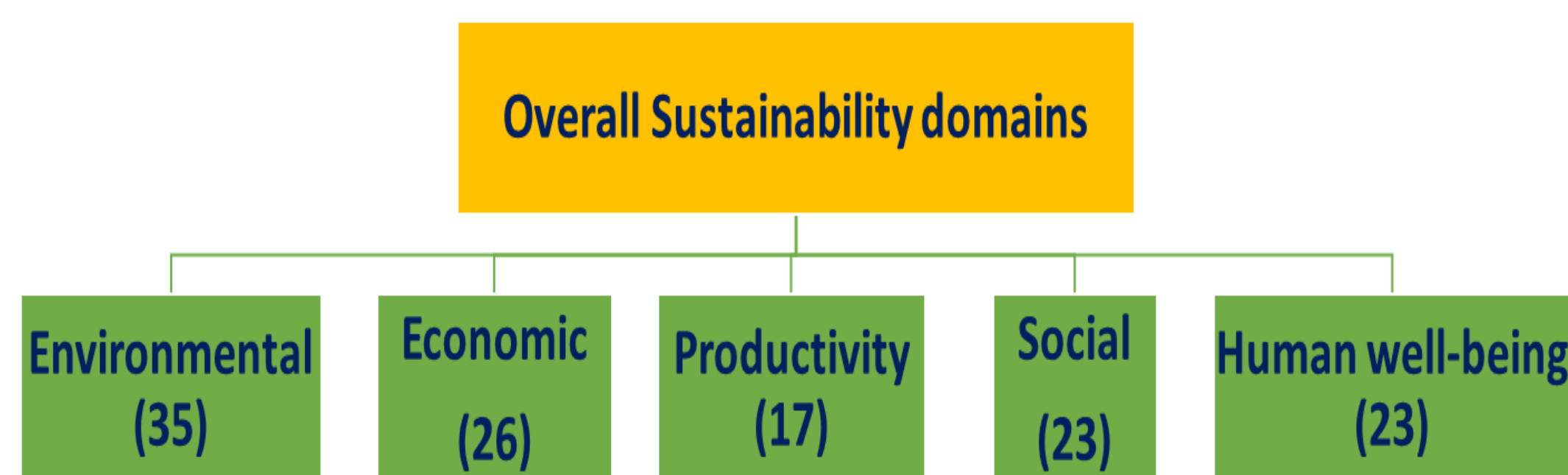
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## Introduction

- The absence of comprehensive and user friendly tools for assessing multiple dimensions of farming and livelihood systems often lead to poor targeting of development policies and interventions.
- A framework was developed and validated to assess multi-dimensional sustainability of farming system that fills a critical gap by providing a comprehensive and user-friendly tool for R&D stakeholders
- The tool has also been transformed into an automated dashboard to promote its wider use
- Considers five major sustainability domains: environmental, economic, productivity, social, and human well-being
- Each domain is divided into different themes, sub-themes, and indicators
- Enables stakeholders to design holistic solutions and track impact of potential interventions on the well-being of smallholders and the sustainability of farming systems

## Materials and Methods

- The indicators have been finalized with rounds of stakeholders' consultations from India and Sub-Saharan Africa
- Identified 124 measurable indicators for 5 domains:



- The final framework is consolidated into an index that represents sustainability and resilience levels across different scales, with a maximum value of 100

- The final index value estimated as:

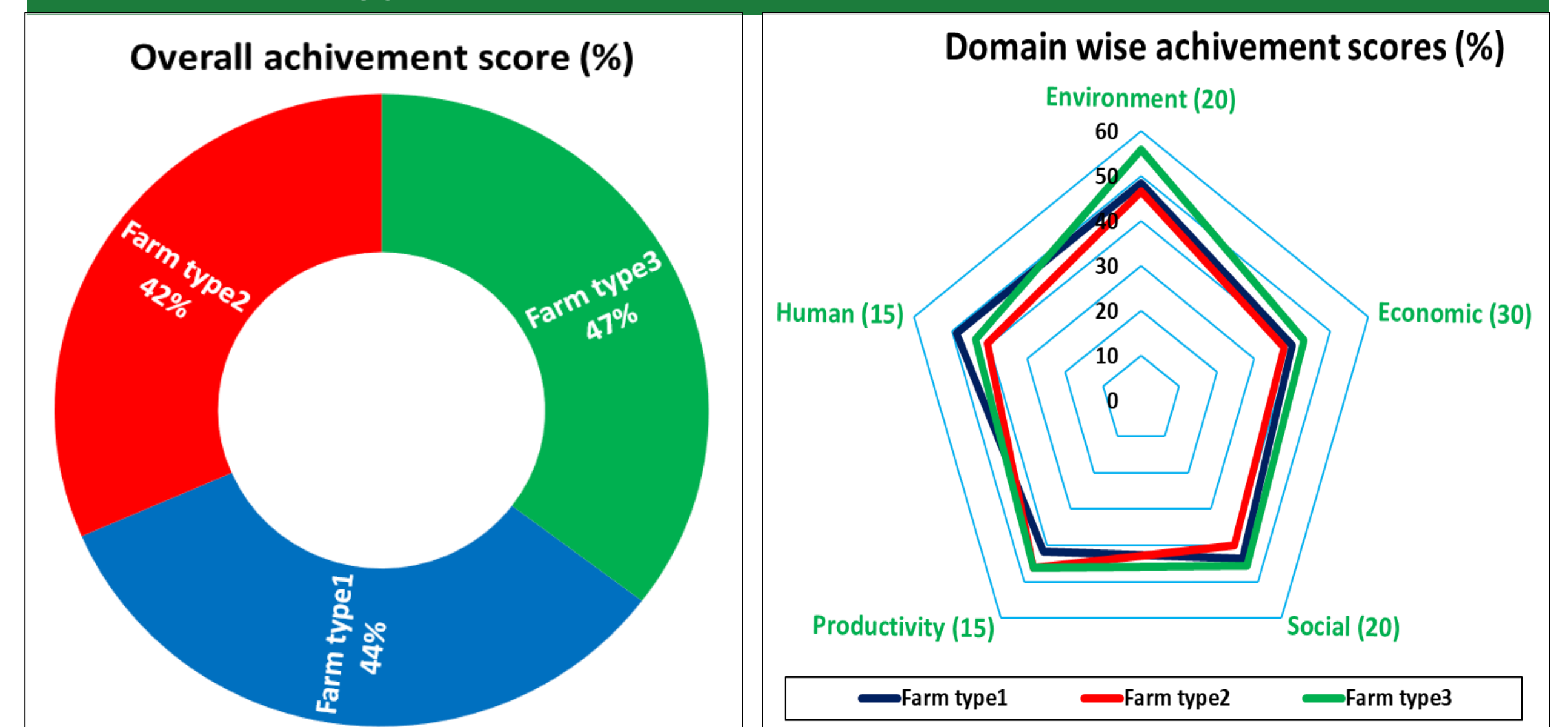
$$\text{Overall Sustainability Index (OSI)} = \sum_{i=1}^5 \text{Domain index value}$$

- A case study was carried out to validate the tool by utilizing household-level data collected from two villages of Suryapet district of Telangana State, India and the households were clustered into three distinct farming systems

## Results and Discussion

- Measuring sustainability in farming is challenging, but a framework with defined indicators and weights for five domains (environment, economy, social, productivity, and well-being) simplifies the process
- Indicators were weighted as follows: environment (20), economy (30), social (20), productivity and well-being (15), totaling 100 in the present case study
- Index values were estimated for each domain and overall sustainability index value was calculated for different farm types.
- A multidimensional framework was used to develop and discuss this approach in the preceding section

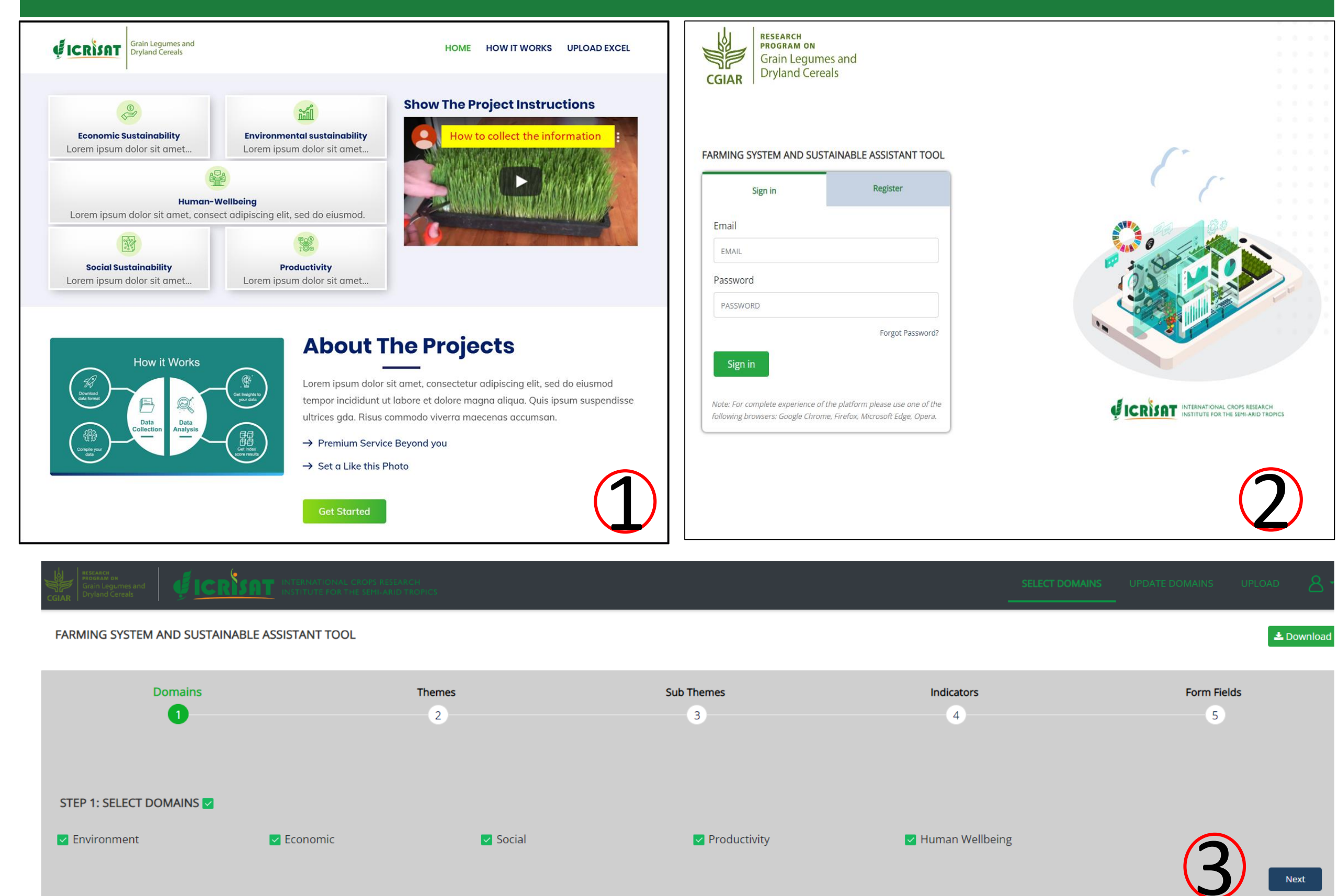
**Figure 1. Overall and domain wise sustainability scores (%) across farm types**



Note: values in the parentheses indicates assign weights

- Overall sustainability achievement score is the sum of scores in 5 domains.
- In the case study, the farm type 3 has the highest overall score with 47% followed by Farm type 1 (44%) and Farm type 2 (42%)
- Farm type 3 has the highest score in the environment domain (56%), economic domain (43%), social domain (46%) and jointly with Farm type 2 in productivity domain (46%)
- Overall, the insufficient performance of all farm types, as reflected from the sustainability scores, underscores the urgent need to explore solutions for improving the sustainability and resilience of agricultural systems in the study region.

**Figure 2. Farming system sustainability assessment tool- Automated dashboard**



## Conclusions

- This framework and tool fills a critical gap and provides a comprehensive and user-friendly tool for R&D stakeholders to assess multi-dimensional sustainability of farming systems.
- It allows to assess sustainability at different scales: farming systems, each domain, theme and sub-theme level to design effective interventions and policies
- It has also been integrated with farm household modelling to evaluate the impact of farming system interventions on its multi-dimensional sustainability.