CGIAR Platform for Big Data in Agriculture, Inspire Challenge Proposal

Theme: Disrupting Impact Assessment
Title: **R**emote Sensing-based **I**nformation for **M**onitoring **A**gricultural **T**echnologies **A**doption (RIMATA)
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What is your idea?

The proposed project will use satellite and UAVs derived remote sensing data, processed weather data, and crop modeling outputs together with GPS-tracked and ICT-assisted household survey data and DNA finger printing technique to monitor agricultural technologies adoption in rice-based system, namely rice varieties tolerant to abiotic stresses (flood and drought), diversified cropping systems (rice-rice and rice-nonrice), and water saving alternate wet and drying (AWD) practice. Integration of spatial analysis of rainfall data, evapotranspiration, irrigation water release frequency and depth, irrigation infrastructure, flood maps derived from Synthetic Aperture Radar (SAR) imagery, and real-time biophysical monitoring using UAVs, yield simulation using ORYZA crop growth model, and rice variety verification system using DNA finger printing allows effective assessment of adoption of abiotic stress tolerant rice varieties, diversified cropping systems and AWD at landscape level. This revolutionary approach will generate substantial evidence of impact in agricultural research.

Rationale
Satellite-based Rice Monitoring (SRM) activities are on active trajectories in Odisha and Andhra Pradesh, India and by early 2018, the entire rice growing area in these states will be regularly monitored and mapped at high resolution. By then protocol for landscape level and field level rice monitoring using UAVs will reach maturity and ready for deployment. Likewise, IRRI team has developed geo-climate database and weather monitoring system that was used to tracked early rainfall deficit during 2016 wet season in Thailand under the Remote Sensing-based Information and Insurance for Crops in Emerging Economies (RIICE) project. Under the RIICE project, ICT -based data capture technology was implemented to record farmers' agronomic management operations. At one hand large datasets (remote-sensing and climate) will be made available capturing key information for tracking adoption of technologies and on the other hands solid experiences have been obtained by utilizing UAVs to capture field and landscape level biophysical information and ICT and DNA finger printing implementation for capturing ground information. The proposed project will take advantage of these strengths and opportunities to use them to pilot a tracking system of adoption of climate-resilient and other varieties including cropping systems and AWD technologies in Odisha and Andhra Pradesh, India. The generated data, evidences, and knowledge will be useful to craft strategies for faster dissemination of new technologies at scale in the future with well-balanced socio-economic and environmental benefits and as well as contributing to reduction in greenhouse gas emission from rice farming.

Hypothesis
Adoption of the rice varieties tolerant to abiotic stresses, diversified cropping systems, and water saving technologies can be tracked effectively by harnessing integrated big data from Satellite-based Rice Monitoring System (SRM); new initiative of capturing information using UAVs as well as GPS-tagged ICT-based household survey. A seamless integration of these dataset is the key in obtaining the goal of assessing impact of agricultural technologies adoption on the ground. The proposed idea is expected to be successful given the experience of RIICE project in detecting flood and drought affecting rice field in the past and as well as well as critical experience of the project in UAVs operation for rice monitoring. The proposed project is expected to generate a big volume of high quality data covering a wider geographical scale in a time- and cost-efficient manner.

How will you pilot it?

Project funding will be used to (1) Develop new analytical tool with machine learning to analyze data derived from UAVs, SAR, Weather Monitoring System (WMS), ICT-based ground survey in flood, drought, and salinity prone areas in Odisha and Andhra Pradesh, India; (2) Develop and pilot a system to track technology adoption using Satellite, UAVs, WMS, and ICT-based survey information and demonstrate its ability to track technology adoption dealing with flood and drought. Data fusion technique will be used to effectively integrate the collected information including secondary data from external sources. The funding will cover staff time of IRRI and NARES partners, procurement of UAVs and sensors, cloud computing and storage, GPS-cameras, mobile phones and other equipments and supplies, travels for IRRI staffs to study locations. This will be accomplished within 12 months' time. Timeliness completion of the work is promising given SRMs and UAVs operation will be on going by the time the proposed project is expected to start. Adequate degree of flexibility will be planned for the project activities to account for uncertainty of information and the expected weather at the study areas.

Next step
The project will start with small scale pilot focusing on methodology development for this technology tracking tool using combination of Satellite and UAVs-based Remote Sensing and ICT with geographical focus in Odisha and Andhra Pradesh, India. If successful, the next step is to track salinity tolerant varieties as well as demonstrate implementation in other geography of interest including Bangladesh where production environments are similar to Odisha, India and as well as to mainstream the approach to cover regional and as well as global interest.