

Identification of Technical Practices for Climate-Smart Agriculture (CSA) in Indonesia

Project Reference: CTCN 22-011

Stakeholder Working Group Meeting

Date: 12 July 2023 (09.00 am to 16.00 pm)

Place: Morrissey Hotel, Jakarta

Participants:

Present

Dr Ir Dudi Iskandar (Mr)	Project Proponent
Rizki Amelgia, S.Hut. M.Sc. (Ms)	National Designated Entity (NDE)
Dr M Nasir Rofiq (Mr)	National Research and Innovation Agency (BRIN)
Dr Lukita Devy (Ms)	National Research and Innovation Agency (BRIN)
Sostenes (Mr)	Regency of Sukabumi
Dr Ir Joko Pitoyo (Mr)	Ministry of Agriculture
Fathan Oktisaf (Mr)	Partnership for Indonesia's Sustainable Agriculture (PISAgro)
Rahmad Gunawan (Mr)	Ministry of Agriculture
Haryo Istianto (Mr)	Ministry of Public Works and Housing
Nurul Salimah (Ms)	Ministry of Women Empowerment and Children Protection
Asep Sukmara (Mr)	DHI Indonesia
Tyas Widisetianto Prasetyo (Ms)	DHI Indonesia
Dina Ariani (Ms)	DHI Indonesia
Dr Satyanto Krido Saptomo (Mr)	<i>IPB University</i>
Dr A. Faroby Falatehan (Mr)	<i>IPB University</i>
Sriwulan Ferindian (Ms)	<i>IPB University</i>
Dr Arien Heryansyah (Mr)	<i>UIKA Bogor</i>

Absent

Dra Eko Novi Ariyanti (Ms)	Ministry of Women Empowerment and Children Protection
Syed Mohazri Syed Hazari (Mr)	DHI Malaysia

Agenda:

1. Opening of the meeting.
2. Identify existing technologies that provide data on water content and soil chemistry on agricultural land (vidiometry/drone/CCTV, etc.).
3. Technology feasibility analysis.
4. Design the macrosystem framework for the selected technology.
5. Closing of the meeting.

Notes:

Item	Discussion Notes	Remarks
1.0	The meeting was conducted in Bahasa Indonesia. The workshop was moderated by Mr Asep Sukmara and started at 9.30 am (Jakarta time). It was officially opened by Dr Dudi Iskandar of BRIN.	-
2.0	A presentation on the identification of existing technologies that provide data on water content and soil chemistry on agricultural land was done by Dr Satyanto Krido Saptomo with the following main points:	-
	a) System Technology of Soil Sensing: <ul style="list-style-type: none"> • Soil Sensing: <ul style="list-style-type: none"> - Soil Moisture - Soil Chemical • Technology Sensing: <ul style="list-style-type: none"> - On-site Implanted Sensors - Remote Sensing Satellites - Drone (Unmanned Aerial Vehicles) - Combine Approaches • Comparative Analysis: <ul style="list-style-type: none"> - Comparison of the four categories across various parameters - Trade-offs and decision-making criteria - Suitability for different agricultural applications and environments 	-
	b) List of Technologies: <ul style="list-style-type: none"> • Site Implanted Sensors: <ul style="list-style-type: none"> - Provides high-resolution data but can be challenging to install. - The sensor is planted at the measurement site and provides real-time and accurate soil moisture level readings. • Remote Sensing: <ul style="list-style-type: none"> - Remote sensing technology collects ground data from space and can provide large-scale data. - Remote sensing technology captures and analyzes the reflection or emission of electromagnetic radiation from the ground surface to determine soil moisture levels. • UAV-based Sensors: 	-

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	<ul style="list-style-type: none"> - UAV-based sensors mounted on drones or other small aircraft to collect ground data from above. UAV-based Sensors involve the use of drones equipped with sensors to monitor ground conditions. • Combination of Technologies: <ul style="list-style-type: none"> - The combination system combines data from multiple sensors to provide a more comprehensive view of ground conditions. - This system may be the most expensive, but it can also provide the most accurate data. Combination of Technologies seeks to take advantage of the advantages of technology while reducing the limitations of each unit. 	
	<p>c) Advantages and Potential Challenges of Technologies:</p> <ul style="list-style-type: none"> • Site Implanted Sensors <ul style="list-style-type: none"> - Advantages: offers precise local data, is easy to install, durable and can function effectively for several years without requiring extensive maintenance. - Potential Challenges: data for limited areas, requires additional infrastructure, requires manual reading or data extraction. • Remote Sensing <ul style="list-style-type: none"> - Advantages: suitable for monitoring large areas of soil condition without the need for physical contact with the ground. - Potential Challenges: Requiring high technology, measurement data may be less precise than sensors implanted at the site due to factors such as crop cover, topography, and soil surface roughness. • UAV-based Sensors <ul style="list-style-type: none"> - Advantages: can cover large areas faster than embedded sensors, provide more detailed data than remote sensing technology and can be programmed to fly over a field at specified intervals. - Potential Challenges: regulations on the use of drones, the initial cost of buying and operating drones can be high, the analysis of data collected from UAVs can also be complicated. • Combination of Technologies <ul style="list-style-type: none"> - Advantages: can provide comprehensive high-resolution data over a wide area. 	-

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	<ul style="list-style-type: none"> - Potential Challenges: requires complex data integration and analysis, requires high costs and significant technical expertise. 	
	<p>d) Summary:</p> <ul style="list-style-type: none"> • The review provides a thorough analysis of various soil moisture and chemistry sensing systems, including their advantages, challenges, and applications in different agricultural settings. • In the context of Climate-Smart Agriculture (CSA) in Sukabumi region, West Java, Indonesia, these sensing systems can aid farmers in soil monitoring, optimizing irrigation and nutrient management, and improving crop yield and resilience to climate change. • Emerging trends in soil sensing include low-cost, energy-efficient sensors, advanced data fusion techniques, and the use of AI and machine learning, all enhancing the efficiency of soil monitoring systems. • For the Sukabumi region, the focus should be on creating solutions tailored to local agricultural practices and environmental conditions. Conducting local field trials and validation studies will be key to assess the performance of various sensing technologies. 	
	<p>e) Discussion (Inputs and Comments):</p> <ul style="list-style-type: none"> • Will the remote sensing be used as the main technology for soil moisture? If it uses remote sensing sensors, the implementation of CSA in Sukabumi will be difficult unless the officer in the district or province can map the technology area to be able to get closer to precision farming. • CSA must be precise and there are factors to consider for climate support through production-based environmental adaptation and mitigation. • BRIN has conducted research related to soil sensors, etc. Will it be carried out/associated with the Sukabumi location? Can be added as a recommendation in the report. There will be a macro framework, related to aspects of soil moisture, but in general it will be in the form of sensors implanted in the fields. • The reliability of the sensor will depend on how long it can be used. Calibration needs to be done if the value changes, then the sensor needs to be calibrated. • Remote sensing and drones are very prospective which can accommodate monitoring. • Need to pay attention to the morphology of the location to analyze what the water needs are like. 	-

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	<p>Agree to use of Sensors in the ground, above the ground, and in the air.</p> <ul style="list-style-type: none"> • The use of technology needs to calculate emission reductions because it is related to climate change and needs to add local technology used by farmers even though it is not directly related to CSA. • The choice of technology to use field implemented, drones or satellites depends on the type of plant. Local technology related to soil moisture and moisture content in Sukabumi is only based on experience. • The technology presented is existing technology and can be implemented in Sukabumi. • The economic value used is technology to increase margins for long-term use. 	
3.0	<p>A presentation on Feasibility Analysis on Soil Moisture and Chemical Sensing Technologies was done by Dr Satyanto Krido Saptomo with the following main points:</p>	
	<p>a) Feasibility Analysis:</p> <ul style="list-style-type: none"> • Identification of Gap and Barrier: These gaps and barriers include regulation, infrastructure, technology, finance, human resources and skills, geography, culture, and market. • Construction of Scoring Instrument: This instrument is based on a Likert Scale, an effective psychometric tool for measuring attitudes and perceptions. The question or statement were to be provided on a scale ranging from "Strongly Agree" (Score = 5 or 10) to "Strongly Disagree" (Score = 1). • Scoring of Products: Scoring process on each technology listed in the catalogue is performed by a team of experts and the resultant scores provided a quantitative reflection of the extent to which each technology could potentially overcome or be impeded by the gaps and barriers. 	
	<p>b) Summary and Recommendations:</p> <ul style="list-style-type: none"> • Using field implanted sensor as the main part, with product priority from brands that have the highest average score or highest hierarchy: 5TE sensor from Meter Group, CS655 sensor from Campbell and SENTEK Probe sensor. • Other technologies such as remote sensing, UAV can be designed as additional technologies. • The technology designed can use field implanted sensor as the main approach, then equipped with a 	

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	<p>UAV system and a Remote Sensing system in a decision support system.</p> <ul style="list-style-type: none"> • The technology product that will be used can be from outside the brand that has been presented, by paying attention to the technical specifications and other factors that are used in this analysis. 	
	<p>c) Discussion (Inputs and Comments):</p> <ul style="list-style-type: none"> • Has the location been determined? If the location has not been determined, then it is necessary to be informed about the condition of land cover, topography, and weather as parameters that we consider. • In order to determine gaps and barriers, the needs are determined first, soil moisturizer or productivity? • Will the technology be geared toward increasing income, productivity, or reducing emissions after using the criteria? • Related to emission reduction will be seen in Output 3. • In order the technology can be applied by users. Perception becomes important. • Binawi has been used by farmers in Sukabumi. Binawi started with the Coordinating Ministry for cooperation in production and marketing. • Technology will adapt to the land that will be used as contextualization. • Need site visits. 	
4.0	<p>A presentation on Macro-system Framework was done by Dr Satyanto Krido Saptomo with the following main points:</p>	
	<p>a) Framework:</p> <ul style="list-style-type: none"> • The framework to monitor and manage soil conditions, contributing to the goals of smart and sustainable agriculture effectively and efficiently. • The design approach to the macrosystem framework being explored: Supervisory Control and Data Acquisition (SCADA). • SCADA, is a computer-based system for gathering and analyzing real-time data, enables monitoring, control, and alarm of plants or regional operating systems from a central location. • SCADA can play a vital role in understanding the status of a system, making necessary adjustments in real-time, enhancing productivity, saving time, and reducing costs. 	

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	<ul style="list-style-type: none"> The document outlines a framework for soil moisture and chemical data acquisition based on Supervisory Control and Data Acquisition (SCADA), which enables real-time data collection and analysis. The framework includes components like soil moisture sensors, Remote Terminal Units (RTUs), a communication system, a central SCADA system, a user interface, a system data historian, an alarm management system, actuators and control devices, and options for integration with other systems. The case study concentrates on the use of field-implanted sensors, with the possibility of adding Unmanned Aerial Vehicles (UAVs) for routine monitoring and remote sensing for broader, less regular data collection. The framework design is flexible and scalable, facilitating the easy incorporation of additional sensors and technologies as per changing needs and objectives. 	
	<p>b) Discussion (Inputs and Comments):</p> <ul style="list-style-type: none"> When combining automation with sensing requires other equipment to support the nutritional needs of plants, for example remote sensing with vegetation index related to precision farming such as spraying fertilizers. The result of the framework is not only automation but also with specific workforce executors in certain areas. We don't strictly refer to this as SCADA because it's risky in terms of cost. View goals for productivity and time. Apart from hardware and software factors, there is also an influence on how long it lasts. It must enter into the system. The framework requires data, calculations, hardware software tools, so that it will include Human Resources and policies. Software and hardware should be accepted in the regions. The choice of technology design needs to wait for the location selection to be contextual, where the macro framework has been made. The location is expected to be an area with drought or excess water, which does not have productive land. 	-
5.0	The meeting ended at 16.00 pm (Jakarta time).	