Terms of Reference
Supply, Installation and Training of precision agriculture systems (including 2 smart Automated Agro-Meteorological Weather Station, 24 Soil Moisture Sensors and 12 data loggers (1 data logger per each couple of soil humidity sensors)

for the Demonstration Activity related to
Testing innovative technologies and partnerships for food security in Lebanon

Contributing to the Water-Energy-Food-Ecosystems (WEFE) Nexus Policy Dialogue in Lebanon carried out by the Global Water Partnership-Mediterranean (GWP-Med) in the framework of Child Project 2.2 of the GEF/UNEP MedProgramme

1. Background and objective of the demonstration activity

The demonstration activity related to **"Testing innovative technologies and partnerships for food security in Lebanon"** is carried out in the framework of the GEF UNEP MedProgramme Child project 2.2 "Mediterranean Coastal Zones: Managing the Water-Energy-Food and Ecosystems Nexus" and particularly of its Component 3.1.3.: Testing of novel applications and assessment of their replication potential and feasibility that is executed by GWP-Med.

It has been designed following discussions with partners in the framework of the 2nd multi-stakeholder Consultation on the Water-Energy-Food-Ecosystems (WEFE) Nexus in Lebanon (27-28 February 2023), as part of the WEFE Nexus Policy Dialogue launched by GWP-Med in Lebanon since 2022.

The agricultural sector is one of the entry points for the design and implementation of WEFE Nexus solutions in Lebanon. Such solutions present opportunities for positive socio-economic results - through reduced costs and increased production/income- and food security while, in parallel, has a great potential for reducing the use of water and agrochemicals, hence for enhancing the state of the environment, ecosystems and human health.

In fact, chemical pollution from the overuse of fertilisers and pesticides has been common in Lebanon, among others due to the lack of related knowledge and capacities among farmers. The current economic and financial crisis the country is facing has resulted in limitations of imports and increase of prices of agrochemicals. This has stimulated an interest for cheaper alternatives to increase soil productivity and natural ways to manage pests.

Also, at the level of irrigation, the lack of electricity for pumping and distributing water has become a constraint of increasing intensity for farming activities, along with other challenges faced by the agro-food sector due to the scarcity and higher prices of all energy products (gas, electricity and fuel for cooking, heating, transport etc.).

This situation presents obvious and direct threats to the country's agricultural production capacity. At the same time, it presents an opportunity to build back the agricultural sector better and greener with the use of less energy, more environmentally friendly agricultural practices, with reduced costs for the farmers.

Having this in mind, the demonstration activity aims at experimenting novel technologies

for Lebanon, supporting precision agriculture and aiming to reduce the need for inputs and other resources in farming activities, therefore helping farmers in reducing their production costs and, at the same time, protecting the environment from pollution and from over-extraction of already limited water resources.

2. Innovative technology to be tested in the framework of the demonstration activity

One of the innovative technologies tested in the framework of this demonstration activity is the following:

- **Smart Automated Agro-Meteorological Weather Station**

The procurement of smart agro-meteorological weather stations is aimed to modernize and enhance agricultural practices in Lebanon. These stations will provide precise and real-time data on various environmental parameters, enabling the following benefits:

1. Optimized Irrigation Management
   - Assist farmers in planning and executing precise irrigation schedules based on localized climate conditions.
   - Reduce water consumption and promote sustainable water resource management.
2. Enhanced Crop Health Monitoring
   - Monitor factors such as soil moisture, air temperature, and humidity to predict and prevent crop diseases.
   - Support proactive interventions to mitigate risks associated with high temperatures, excess soil moisture, and other climate factors.
3. Informed Decision-Making
   - Equip farmers and relevant institutions with reliable data to make informed decisions regarding irrigation, fertilization, and pest control.
   - Enable better planning and adaptation to changed weather patterns.
4. Support of Sustainable Agricultural Practices
   - Minimize reliance on agrochemicals by providing data to tailor inputs like fertilizers and pesticides.
   - Promote environmentally friendly practices to safeguard ecosystems and human health.
5. Capacity Building and Knowledge Sharing
   - Offer training and tools to farmers, empowering them to utilize the data effectively and improve their agricultural productivity.
   - Facilitate the development of a data-driven agricultural ecosystem in Lebanon.
6. Climate Change Adaptation
   - Enhance the resilience of the agricultural sector by providing tools to adapt to climate variability.

- Contribute to national efforts in sustainable resource management and environmental conservation.

Selection of farmers, plots

The selection of farmers/plots that will benefit from the installation and demonstration of the precision agriculture solutions will be ensured by the project team (GWP-Med and LRA) in collaboration with the local, regional and national authorities and relevant administrations.

3. Description of the Assignment

Objective

In this context, the Global Water Partnership - Mediterranean (GWP-Med) seeks the service of a service provider for commissioning and installation of the precision agriculture system and in particular of:

3.1 Two (2) smart Automated Agro-Meteorological Weather Station, twenty-four (24) Soil Moisture Sensors and twelve (12) data loggers (1 data logger per each couple of soil humidity sensors). The Soil moisture sensors and data loggers are separate from the smart automated agro-meteorological weather stations.

This solution is crucial for precise irrigation planning and can allow farmers to optimize water use based on current climate conditions, which is a key factor to ensure the health of crops and limit of diseases outbreaks. In this regard, the latest advancements in meteorological technology will be used to provide accurate and localized climate data.

The solution will incorporate various features, including:

- acquire data via a set of sensors for (the list is not exhaustive): air temperature, atmospheric humidity, solar radiation, soil temperature and humidity, etc.

- calculate significant parameters (e.g. ET, irrigation dosing, fertilization, etc.).

- process data for the most significant food security related parameters to be calculated, including but not limited to: Irrigation dosing, irrigation schedule, risk of diseases outbreak, e.g. due to high soil humidity and temperature, plant damage risk due to high air temperature, etc.

- make available to the relevant institutions and administrations the raw data collected by the agro-meteorological stations and stored on the “cloud” in an automated manner, to support their planning and decision-making processes.

- make available to farmers key information to assist them in their work

The minimum technical specifications related to the smart agro-meteorological weather station procured through this Call for Offers are described in the below Table:

Minimum Technical Specifications of the Smart Automated Agro-Meteorological Weather Station

Item#	Specification	Details
1	Type	Fully automated weather station for agricultural

		and environmental applications
2	Power Supply	Solar-powered with rechargeable battery backup
3	Communication	GSM/4G/LTE, Wi-Fi, or LoRaWAN, with the ability to transmit data to cloud-based platforms (plus data Sim Card charged and communicating)
4	Data Logging Interval	Configurable, typically 10–60 minutes
5	Air Temperature Sensor • Range • Accuracy • Resolution	 -40°C to +60°C ±0.5°C or better 0.1°C
6	Relative Humidity Sensor • Range • Accuracy • Resolution	 0–100% ±2% to ±5% RH (depending on humidity level) 1%
7	Wind Speed Sensor • Range • Accuracy • Resolution	 0–40 m/s (144 km/h) or higher ±0.5 m/s or 5% (whichever is greater) 0.1 m/s
8	Wind Direction Sensor • Range • Accuracy • Resolution	 0–360° ±5° 1°
9	Solar Radiation Sensor (Pyranometer) • Range • Accuracy • Response time	 0–1500 W/m² ±5% or better ≤10 seconds
10	Rainfall Sensor • Type • Range • Accuracy	 Tipping bucket or optical 0–400 mm/hour ±0.2 mm
11	Barometric Pressure Sensor • Range • Accuracy • Operating Temperature	 300–1100 hPa ±1 hPa -40°C to +60°C.
12	Software and ETo Calculation	• Integrated software capable of calculating ETo using FAO Penman-Monteith equation. • Cloud-based data access with API for integration into third-party systems. • Historical data storage and export in CSV or other standard formats.
13	Durability and Environmental Conditions	• Operating Temperature: -40°C to +60°C. • Ingress Protection: Minimum IP65 (weatherproof and dustproof). • Material: Corrosion-resistant and UV-resistant.
14	Installation and Maintenance	• Easy to install

		• pole or tripod mounting • Modular design for easy sensor replacement or calibration.
15	Leaf wetness sensor	• For plant disease monitoring. Conductivity-based sensor measuring leaf surface wetness by detecting moisture presence through filter paper between two stainless steel electrodes. • It can accurately detect leaf wetness from 0 to 100% wetness, within 2% accuracy. • Low power consumption. Compatible with the weather station data logger. Powered by the station itself. • Housing should be transparent, durable Lucite plastic housing to minimize direct sunlight heating and ensure long-term outdoor exposure. Housing: • Weather-resistant and designed for harsh environmental conditions. • Can be mounted easily, ensuring proper exposure to the environment.
16	Technical Support	• Must be provided and training

The **minimum technical specifications related to the soil humidity sensors** to be procured through this Call for Offers are described in the below Table:

Item#	**Specification**	**Details**
1	Measurement Principle	Capacitive sensing technology
2	Probe Length	50 to 70 cm
3	Measurement Parameters	Volumetric Water Content (VWC) in percentage
4	Accuracy	±5% or better
5	Resolution	0.1% VWC or better
6	Operating Temperature Range	-10°C to +60°C
7	Soil Compatibility	Suitable for clayey soils with alkaline nature
8	Response Time	Less than 10 seconds
9	Power Consumption	low power consumption preferred
10	Communication Interface	Wireless (GPRS, LoRa, Bluetooth, or other compatible technology); needs to be remotely read through the clouds
11	Data Logging Capability	• Able to communicate remotely and able to record data for at least 3 months for local download; • two soil moisture sensors per one datalogger. • Extension cable from sensors to dataloggers of minimum 5 meters
12	Ingress Protection	IP67 or better for outdoor use

13	Calibration	Factory-calibrated with the option for field calibration
14	Mounting and soil installation	Easy installation with minimal soil disturbance
15	Certification	International certification
16	Warranty	Minimum 1-year manufacturer warranty
17	Technical Support	Must be provided and training
18	Installation Support	Provider has to support field installation for all farmers' fields and supplies guidelines and manuals
19	Access tubes	Will be preferred

Additional Specifications:

1. All equipment delivered must be original industrial products and ready to install.
2. The supplier should provide a guarantee for the equipment for a minimum of one year.
3. The sensors / devices must be equipped with all necessary accessories for installation and operation: protective case, mat(s), support(s), an anchoring system, etc.
4. All sensor/device enclosures and accessories must be resistant to water, dust, and radiations.
5. Alert system regarding sensor/devices malfunction is required.
6. Access to raw sensor data (in direct or indirect form) is required for validation of field data.
7. All sensors that will be installed by the project and which are linked to climate, soil and water have to be accessible to different users (administrative teams, project partners, farmers) via a web console with different levels of accessibility (access to all or part of the data collected). It must also be able to integrate Application Programming Interfaces (APIs) that allow it to connect to third-party applications. To this end, the company is requested to provide technical support to facilitate the transfer. API service is required for a 10 years duration.
8. Documentation, manual and datasheet of the technical specifications of all the proposed material is required.
9. If the addition of an equipment or an accessory is deemed necessary for the correct functioning of the system, the price must be indicated with the mention EXTRA.
10 Minimum of two days training session on equipment/sensor installation, configuration, and maintenance and data configurating reading, viewing and downloading.

4. Reporting, deliverables and milestones

Deliverable	**Deadline expressed in days after contract signature**
Supply and installation of two (2) fully equipped smart Automated Agro-Meteorological Weather Station in 2 areas of the Bekaa Valley.	**30 days**
Supply and installation of 24 Soil Moisture Sensors in 12 farms located in the Bekaa Valley	**30 days**
Supply and installation of 12 data loggers (1 data logger per each couple of soil humidity sensors) in the same 12 farms mentioned above	**30 days**
Training of farmers on the use and maintenance of the equipment in 12 farms in the Bekaa Valley	**45 days**

5. Duration of the Contract

Delivery of the requested services (supply and installation) should be completed 45 days after the contract signature. The date of the commencement of the contract execution shall be the last signing of the contract. The location of the equipment delivery and installation is the Bekaa Valley (2 areas for the smart automated agro-meteorological stations and 12 farms for the soil moisture sensors and data loggers). The exact locations will be defined at the contract signature.

6. Contract Price, Schedule of Payments and Performance Guarantee

6.1. Contract Price and Schedule of Payments

The maximum fee for this assignment is 45,000 USD (including VAT). This amount includes all other costs, income taxes and any other amount payable or cost that may be required for the completion of the service.

6.2. Schedule of payments:

There are two payments options out of which the contractor may choose from:

Option 1:

-20% payment in advance upon Contract Signature and submission of both guarantees (see below) accounting to 20% of the contract value.

-80% payment upon satisfactory completion of the work.

Option 2:

-100% payment upon satisfactory completion of the work and submission of performance guarantee (see below) accounting to 2% of the contract value.

The final payment will be issued after the quality assessment and approval of each deliverable by the Contracting Authority. Then, the awarded service provider will issue the respective invoices. The method for measuring completed service for payment must be in accordance with the Contract. In the event that there are delays in the execution of the contract, the contractor shall be liable to pay compensation in the form of a penalty. The amount of the flat rate compensation per day of delay (penalty) shall be of 1% of the net contract value per week up to a limit of 10% of the total contract value. For the calculation of penalties, the number of days of delays shall be converted into weeks by rounding down to the nearest week.

6.3. Guarantees:

The successful supplier agrees to submit to the Contracting Authority

- 1st Performance Guarantee accounting to 2% of the contract value.
- 2nd Guarantee accounting to 18% of the contract value – Optional in case the contractor needs downpayment

The successful supplier shall, within 10 calendar days of the receipt of the contract, sign and date the contract and return it together with a copy of the Performance Guarantees. The copies of the Performance Guarantee(s) are to be endorsed by the Contracting Authority prior to submission. The successful participant is therefore obliged to forward the original Performance Guarantees to the Contracting Authority. Any Performance Guarantee(s) issuance expenses bear's the successful

participant. The 2nd Guarantee shall be released within 30 days of the completion of works to the satisfaction of the Contracting Authority and the 1st performance Guarantee shall be released on the completion of the 12-months warranty period. The Contracting Authority will not affect any payment to the Contractor until the Performance Guarantee has been submitted.

7. Selection criteria (Pass/Fail)

Successful participants must provide the following:

A. Technical Offer (Annex 2):

• Be enrolled in one of the official professional or trade registries at the country of registration. The submitted document preferably, should be submitted in English. However, for the evaluation process those can also be submitted in Arabic. The certified English version will be requested by the successful participant before contract signature.
• Be licensed to perform works in Lebanon. The submitted document preferably, should be submitted in English. However, for the evaluation process those can also be submitted in Arabic.
• Provide a signed statement certifying that the equipment is new and unused.
• Provide a warranty for good operation for at least 1 year for the equipment which is to be supplied and installed.
• Provide proof of their average annual turnover for the last three (3) fiscal years being at least equivalent to the maximum amount of this Call. As supporting documentation, the applicant must provide their official Financial Statements, stamped, and signed by the legal representative of the company. The submitted document preferably, should be submitted in English. However, for the evaluation process those can also be submitted in Arabic.
• Provide a statement that at least one certified installer will perform the requested work.
• A list of projects proving at least five (5) years in the field of smart irrigation systems and support for farmers with a proven experience in the installation of smart irrigation systems.
• Technical specification leaflets and brochures for the Compliance of the equipment should be provided.
• Have minimum duration of operation of five (5) years. Proof to be provided by the related chamber (date of registration). The submitted document preferably, should be submitted in English. However, for the evaluation process those can also be submitted in Arabic.

B. Financial Offer (Annex 3)

8. Awarding Criterion and Evaluation Process

Award criterion is the Most Economically Advantageous offer with criterion the lowest price for the offers satisfying the selection criteria.

9. Submission of Offers

Please refer to the Call for Offers Document for the proper submission of the Technical and Financial Offer.

10. Monitoring and progress control

Ms. Barbara Tomassini, Senior Programme Officer at GWP-Med, will be providing oversight and guidance from the side of the Project Team. Services will be rendered and will be considered completed upon approval of the deliverables by the Project Manager, Mr. Dimitris Faloutsos.