Terms of Reference
Supply of precision agriculture Drones and related Training 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

Two of the innovative technologies that will be tested in the framework of this demonstration activity are the following:

- **Drone for Crop Monitoring**

A precision drone will be deployed to provide farmers with real-time, localized crop health monitoring insights, enabling them to take informed decisions and timely interventions to optimize their irrigation strategies and assess climate-related and other disasters. In particular, this technology-driven approach will allow farmers to better identify:

- Water stress in the parcel
- Biomass status
- Diseases
- Flash flood damages (which is a common issue in several agricultural areas in Lebanon)

- **Drone for Precise Pesticide Spraying**

A different precision drone equipped with advanced pesticide spraying capabilities will be deployed to ensure targeted and efficient application of chemicals, therefore minimizing their environmental and human health impacts.

This, along with the previously mentioned smart technologies for evaluating: 1. The overall health condition of crops to anticipate disease outbreaks and plan for proactive and reactive actions and; 2. Irrigation needs to mitigate excessive water use, which can also lead to crop diseases; establishes a comprehensive framework having the potential to decrease chemical inputs in farming practices to the minimum amounts needed, while optimizing their benefits.

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 Drone for Crop Monitoring

This state-of-the-art drone is tailored for precision agriculture, offering farmers real-time insights into crop health. By providing localized data, it empowers them to make informed decisions about irrigation, disease management, and disaster response. This technology plays a critical role in mitigating challenges like water stress, biomass variability, and damage from natural disasters, which are common in agricultural zones such as those in Lebanon.

Minimum Technical Specifications of the Drone for Crop Monitoring

Item#	Specification	Details
1	Functionality and Purpose	• Designed for real-time monitoring of crop health and conditions. It should be able to record also images for future treatments. • Provides actionable insights on water stress, disease and detection, biomass status, and damage from natural disasters. • Capable of recording and storing high-resolution images for future analysis. • The obtained images should be able to be used for flying control of the spraying drone.
2	Drone Body and Build	• Lightweight of maximum 50 kg, and durable frame made from carbon fiber or equivalent materials. • Weather-resistant design to operate in diverse environmental conditions (temperature, humidity, light rain). It is required to have a protection grade of minimum IPX4.
3	Flight Specifications	• **Flight Time:** minimum 18 minutes flight time (preferably up to 120 minutes). • **Flight Range:** Minimum 1 km operational range (longer range preferable). • **Flight Altitude:** Capable of flying up to 120 meters above ground level for optimal monitoring. • **Navigation System:** GPS/GLONASS-based navigation with autonomous flight capability and manual override. • **Obstacle Avoidance:** Basic obstacle detection is required, advanced is optional. (omnidirectional obstacle detection and having radars for obstacle detection).
4	Monitoring Equipment	• High-resolution RGB camera with multi-spectral and thermal imaging capabilities is required: The drone should be equipped with a high-resolution RGB camera for detailed imaging. Additionally, it should have multi-spectral and thermal sensors, for NDVI computation (Normalized Difference Vegetation Index) for vegetation analysis and a high-sensitivity thermal sensor for heat mapping. The multi-spectral and thermal sensors should provide accurate and reliable data across various environmental conditions. • **Thermal Imaging Camera:** For heat mapping and temperature-based analysis. Detailed info is required. • **Camera Resolution:** Minimum 12 MP for RGB and 640x512

		resolution for thermal imaging. • **Field of View (FOV):** Wide-angle coverage with adjustable focus. • **Data Storage:** Internal storage capacity is minimum 32 GB; external SD card compatibility is optional. • **Image Processing System:** Ability to store images and transmit data for manual or automated spray guidance. Able to provide images for later analysis, integration with spraying drones is preferable.
5	Power and Battery	• **Battery Type:** High-capacity lithium-polymer (LiPo) or lithium-ion (Li-ion). 12 batteries and 4 charging stations are required for continuous functioning. • **Charging Time:** ≤ 3 hours with fast charging options. • **Swappable Batteries:** Allows extended operations with quick replacement.
6	Operational Features	• **Autonomous Flight Modes:** Pre-programmed routes, area mapping, and waypoint navigation. • **Real-Time Data Transmission:** Live data feed to a control unit, tablet, or mobile device. • **Data Processing:** Able to provide images for later analysis, integration with spraying drones is optional. • **Data Accuracy:** Spatial resolution of ≤ 10 cm for detailed monitoring. • **Weather Monitoring Integration:** Measures local conditions such as temperature and humidity during flights. • **Emergency Return:** Auto-return to base on low battery or communication loss.
7	Maintenance and Support	• Easy access to spare parts and servicing. • User training and comprehensive user manuals. • Software license: free license for a minimum of 1 year (preferable to have free upgrade software, or provide two years license for free).
8	Certification and Compliance	• CE, FCC, or equivalent international certifications for safety and reliability. • Compliance with aviation regulations of Lebanon.
9	Tender Documentation Requirements	• Detailed Bill of Quantities (BoQ) including all drone components and three additional batteries + a fast charger • Delivery timeline and installation requirements. The delivery time is a maximum of 30 working days.

3.2 Drone for Precise Pesticides Spraying

This drone represents an innovation in agricultural technology, designed to optimize pesticide application. By targeting specific areas with precision, it minimizes environmental harm and reduces the health risks associated with traditional spraying methods. This innovation supports farmers in achieving higher efficiency while safeguarding natural resources and human health.

The deployment of this technology is particularly vital in regions like Lebanon, where the overuse of chemicals has historically contributed to environmental degradation and increased costs for farmers.

Minimum Technical Specifications of the Drone for Precise Pesticides Spraying

Item#	Specification	Details
1	Functionality and Purpose	• Designed for precision pesticide application to minimize chemical usage and environmental impact. • Suitable for agricultural fields of varying sizes and crop types. • Able to be programmed for precise chemical spraying
2	Drone Body and Build	• Lightweight (Maximum 80 kg of an empty drone is accepted) and durable frame constructed from carbon fiber or equivalent materials. • Weather-resistant design to operate in diverse environmental conditions (temperature, humidity, light rain). It is required to have a protection grade of minimum IPX4.
3	Flight Specifications	• **Flight Time:** up to 30 minutes per charge, depending on payload. (longer period preferable) • **Flight Range:** Minimum 1 km operational range (longer range is preferable). • **Flight Altitude:** Capable of flying at least up to 20 meters above ground level. • **Navigation System:** GPS/GLONASS-based navigation with autonomous flight capability and manual override. • **Obstacle Detection and Avoidance:** Basic obstacle detection is required (omnidirectional obstacle detection and having radars for obstacle detection).
4	Spraying system	• **Tank Capacity:** minimum tank capacity of 30 (with adjustable spraying width). • **Spray Nozzles:** Replaceable nozzles with variable spray widths (6 to 10 m depending on nozzle type). • **Spray Rate:** Adjustable flow rates to accommodate different pesticides and crop needs (up to 8 l/min). • **Droplet Size Control:** Ensures uniform droplet size (20–200 microns) for effective coverage. • **Spray Pump:** High-efficiency pump for consistent spraying pressure.
5	Power and Battery	• **Battery Type:** High-capacity lithium-polymer (LiPo) or lithium-ion (Li-ion). 9 batteries and 3 chargers are required for continuous functioning. • **Charging Time:** ≤ 3 hours with fast charging

		options. • **Swappable Batteries:** Enables extended operations with quick battery replacement.
6	Operational Features	• **Autonomous Flight Modes:** Pre-programmed flight paths, area mapping, and waypoint navigation. • **Real-Time Monitoring:** Live data transmission to a remote-control unit and mobile device. • **Payload Monitoring:** Real-time tracking of tank levels and spray coverage. • **Emergency Return:** Auto-return to base on low battery or communication loss.
7	Maintenance and Support	• Easy access to spare parts and servicing. • User training and comprehensive user manuals. • Software license: free license for a minimum of 1 year. Detailed info is required.
8	Certification and Compliance	• CE, FCC, or equivalent international certifications for safety and operation. • Compliance with aviation regulations in Lebanon.
9	Tender Documentation Requirements	• Detailed Bill of Quantities (BoQ) including all drone components. • Delivery timeline and installation requirements. It is mandatory to mention the exact delivery timeline and installation requirements. The delivery time is a maximum of 30 working days.

3.3 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. Access to raw data (in direct or indirect form) is required for validation of field data.
6. Documentation, manual and datasheet of the technical specifications of all the proposed material is required.
7. Documentation / Material on how the data of the monitoring drone can be used for the management of spraying drone.
8. If the addition of any 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 six days training sessions: three days training at each of the two locations (including all coasts for the trainers) on the use and management of the drones, emergency procedures, mission planning and data management. The course will be held in the local language.

NOTE: The spraying drone and the crop monitoring drone must be supplied by a single bidder and must be fully compatible to ensure seamless integration and optimal workflow efficiency.

4. Reporting, deliverables and milestones

	Deliverables	Deadline expressed in days after contract signature
1	**Supply of one (1) Drone for Crop Monitoring in the Bekaa Valley as per specifications as per sections 3.1 and 3.3 of the ToR**	**30 days**
2	**Supply of one (1 Drone for Precise Pesticides Spraying in the Bakaa Valley as per specifications as per sections 3.1 and 3.3 of the ToR**	**30 days**
3	**Training of targeted farmers and local stakeholders about the use of the drones in two locations in the Bekaa Valley as per section 3.3 of the ToR**	**45 days**

5. Duration of the Contract

Delivery of the requested services (supply and training) **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 trainings will take place in two farms located in the Bekaa area in Lebanon. The exact locations will be provided 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 90,000 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 guarantee (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

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

- A Guarantee accounting to 20% of the contract value – Optional in case the contractor needs downpayment

The successful supplier shall, within 10 calendar days of 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 are to be endorsed by the Contracting Authority prior to submission. The successful participant is therefore obliged to forward the original Performance Guarantee to the Contracting Authority. Any Performance Guarantee issuance expenses bear's the successful participant. The Guarantee shall be released within 30 days of the completion of works to the satisfaction of the Contracting Authority. 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:

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).
• 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 list of projects proving at least five (5) years of experience in the provision of diagnostic equipment and instruments for monitoring and precision surveying, including through unmanned aerial vehicles (UAV) and other smart irrigation equipment, and the related training.
• 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. The certified English version will be requested by the successful participant before contract signature).

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.