GeoAgro-MiSR

A comprehensive digital solution that enables Egyptian small holder farmers achieve climate smartness, sustainable intensification and economic optimization under climate change and economic volatility

جيو أجرو برو(مصر)

يساعد هذا التطبيق مزارعي الحيازات الصغيرة في مصر من خلال التحول الرقمي على الاستخدام الأمثل للموارد وتقديم النصائح الإرشادية في ظل سيناريوهات تغير المناخ والسوق.

Egyptian agricultural system is an important breadbasket of the MENA region. The production system here is primarily irrigated with water from the Nile river. Egyptian farmers grow a wide variety of crops, including cereals, legumes, fruits, and vegetables. Wheat is one of the most important crop in Egypt and essentially the Nile basin is dominated by Wheat based cropping systems. Although Egypt has one of the highest wheat productivities (because of excessive input use) in the world, the country is struggling to meet the in-country demand amidst climate change and geopolitical complexities. One of the main reasons for the country's swinging wheat production is poor agronomic practices by farmers who don't have access to information about the best agronomic practices. The CGIAR Excellence in Agronomy Initiative (EiA) aims to increase in productivity and quality per unit of input (agronomic gain) for millions of smallholder farming households in prioritized farming systems by 2030. Under the Egypt Use Case of EiA, we hypothesize that digital augmentation may be able to solve the problem. We developed a comprehensive digital solution (GeoAgro-MiSR) that enables Egyptian small holder farmers achieve climate smartness, sustainable intensification and economic optimization. This digital augmentation initiative will serve the national extension system, farmers, youth and women to provide site-specific agronomic recommendations generated from various farm analytics. A digital transformation with the EiA solutions will enable the last mile delivery to millions of Egyptian farmers by 2030.
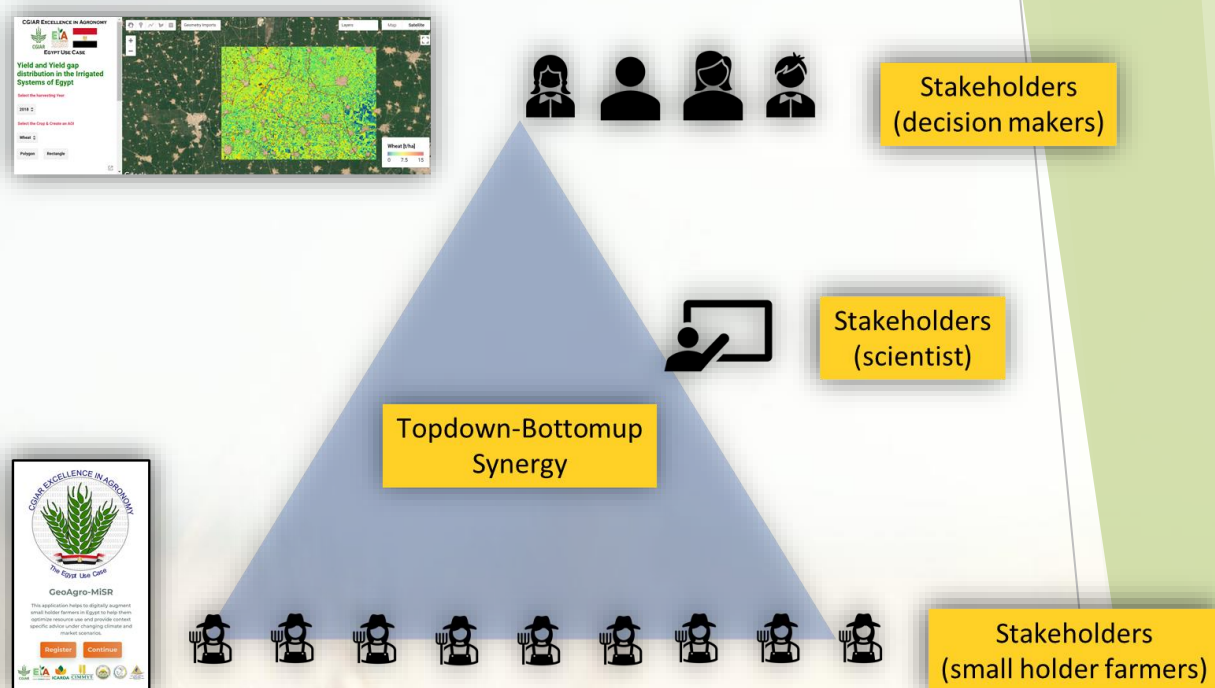
Fig. Top-down Bottom-up synergy in digitalization of Egyptian Agriculture using the GeoAgro series of tools developed under the EiA Egypt Use Case. While the phone based android app (GeoAgro-MiSR) serves the grass-root level small holder farmers, the web-based GeoAgro Yield Gap Mapper serves policy level stakeholders.

The digital transformation philosophy of the EiA Egypt Use case employs a bottom-up town-down synergy approach. This employs two types of digital tools to enable the digital transformation in Egyptian agricultural system, engaging with stakeholders at different scales. At the grass-roots level, we have the GeoAgro-MiSR smartphone application that provides bespoke agronomic and other advisories and services to the small holder farmers. It also provides a mechanism where the grass-root level user can contribute to a centralized database by which citizen science can be fostered. At the larger scale we have the GeoAgro web-based Yield Gap Mapper which will be used by policy makers and high-level stakeholders to shape national agricultural interventions, policies and priorities. Thus, the vision is a top-down bottom-up synergy. This digital transformation approach works with a strong emphasis on stakeholder engagement. At the outset, a clear understanding of the situation of the Egyptian agriculture was obtained through a series of trans-Egypt surveys across all the governorates in Egypt covering ~3000 farmers in each of these surveys. Various thematic surveys were conducted, and this forms the basis of designing and improving and evaluating the GeoAgro-MiSR system.
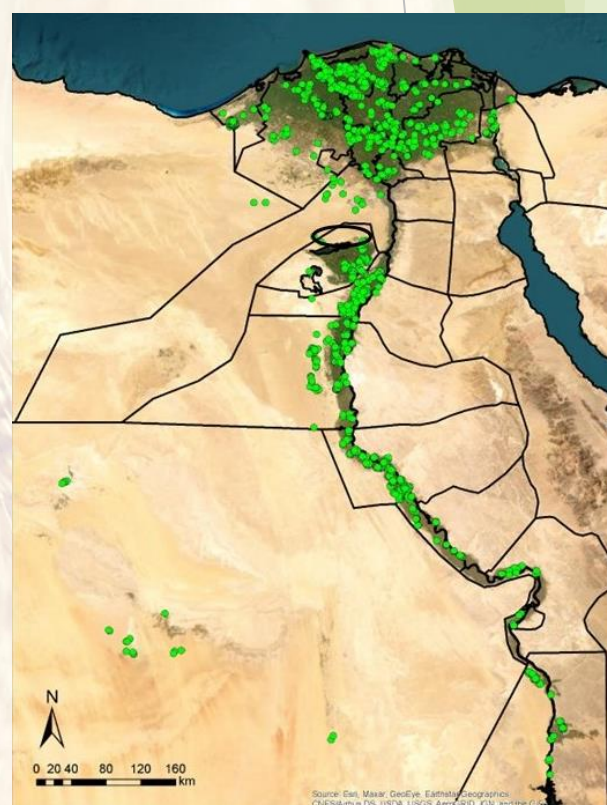

Fig. A series of comprehensive multi-thematic trans-Egyptian surveys forms the basis of our understanding of the current agronomic situation and develop strategies of digitalization needs in the Egyptian agricultural system.

The GeoAgro-MiSR system consists of a centralized server (hosted at ICARDA) along with [1] the GeoAgro-MiSR app and [2] the GeoAgro-MiSR administrative dashboard being the two interfaces where the user (small holder farmer) and the experts (scientists) interact on either side. Communications between the users and the experts happen via the server in the form of announcements, queries and responses through the "ask an expert" module, P2P chatting between the farmers etc. There are api based services that are streamed into the app and the administrative dashboard. The most important api-based service is to fetch user's location specific current and forecasted weather. Synoptic weather dynamics and the remote sensing analytics to understand biophysical variability at the plot scale are other services. Information on crop-specific agronomic package of practices are fed through the administrative dashboard, which can be changed or revised in real time by the experts as and when required. The questions posted by the farmers to the experts (categorized based on topic) are channelized to the targeted experts by the server and it reaches the email of the expert. The response (email reply) of the expert passes through the server and reaches the GeoAgro-MiSR app instantaneously.

Fig. Multiscale stakeholder engagement is the basis of developing sound digitalization strategy. This includes one-to-one interaction with farmers to understand their readiness and challenges to adopt digital tools and also interactions with high level stakeholders (policy makers) to understand the national strategies on digital transformation of Egyptian agriculture.
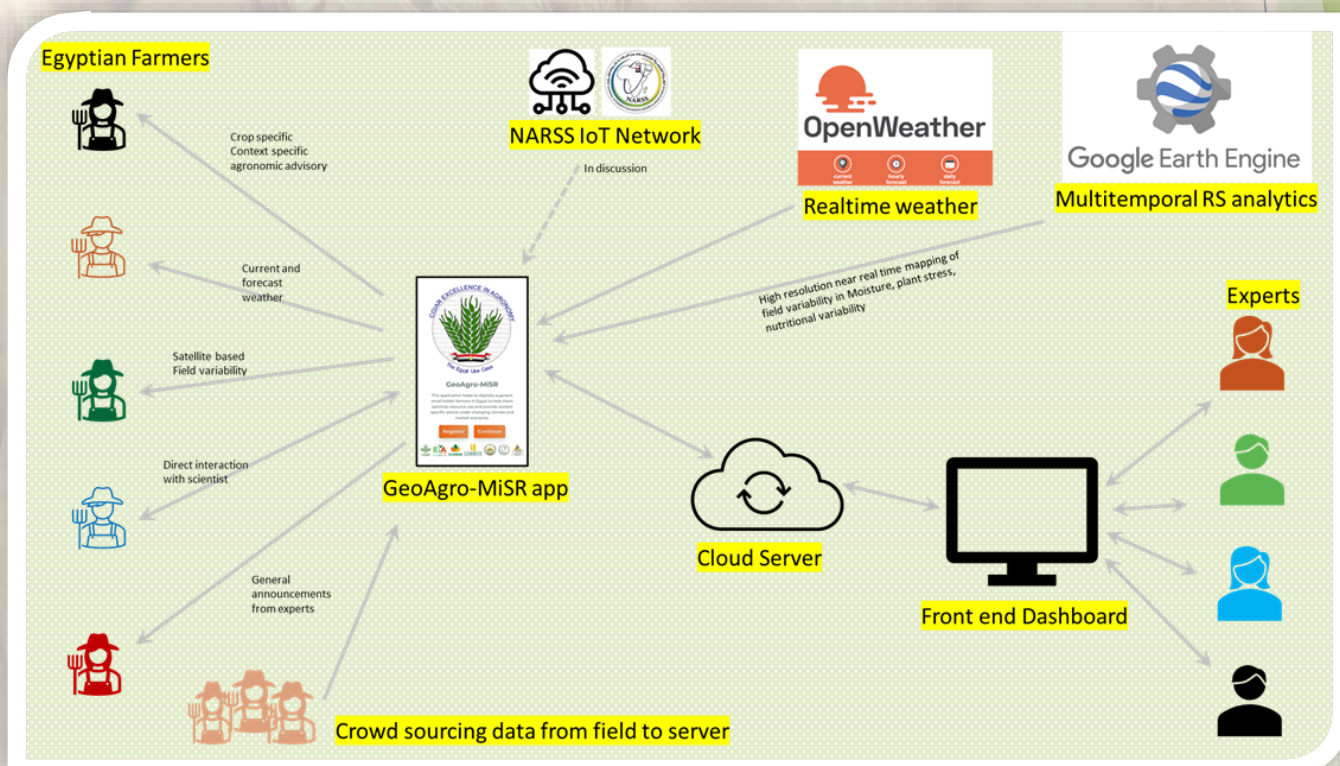

Fig. A conceptual representation of the GeoAgro-MiSR system that consists of a centralized server and two interfaces: GeoAgro-MiSR app (for the farmer) and the GeoAgro-MiSR dashboard (for the experts) to manage content. Communications happen between the two interfaces through the server. Several API based external services are also streamed into the two interfaces.

Different Modules of the GeoAgro-MiSR Application

Agronomy

Package of Practices for 21 crops with recommendations classified to 10 agronomic sub-modules

Ask an Expert

Module through which users can post questions (which pictures) to different subject matter specialists and receive response in real-time

Announcements

Module through which announcements posted by experts can be viewed by all the users. e.g. information on subsidies, early warning etc

P2P Chatting

Module through which various users can engage in chats with their peers either on a one-to-one basis or in a group

Expense Tracker

Module through which various users can track expenses on various farm operations and analyse the cost-benefit. Also analyse long term economics

Weather

Module through which current local weather can be seen. A 6-day weather forecasts can also be obtained. Visualization of synoptic weather situation.

Know Your Field

Module through which users can see the biophysical status of their plots based on real-time remote sensing analytics, without much scientific jargon.

Geotagging

Module through which users contribute data about his farm characteristics and agronomical situation, fostering citizen science

Market Place

Module through which users can post advertisements on various categories of farm inputs, farm services and selling of produce.

Livestock

Module through which users can get information on the package of practices of raising different types of livestock, poultry and aquaculture.

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The Agronomy Module

This module is the most classic form of ICT services where we provide agronomic package of practices for 21 crops. Agronomic recommendations are classified into sub-modules for each crop.
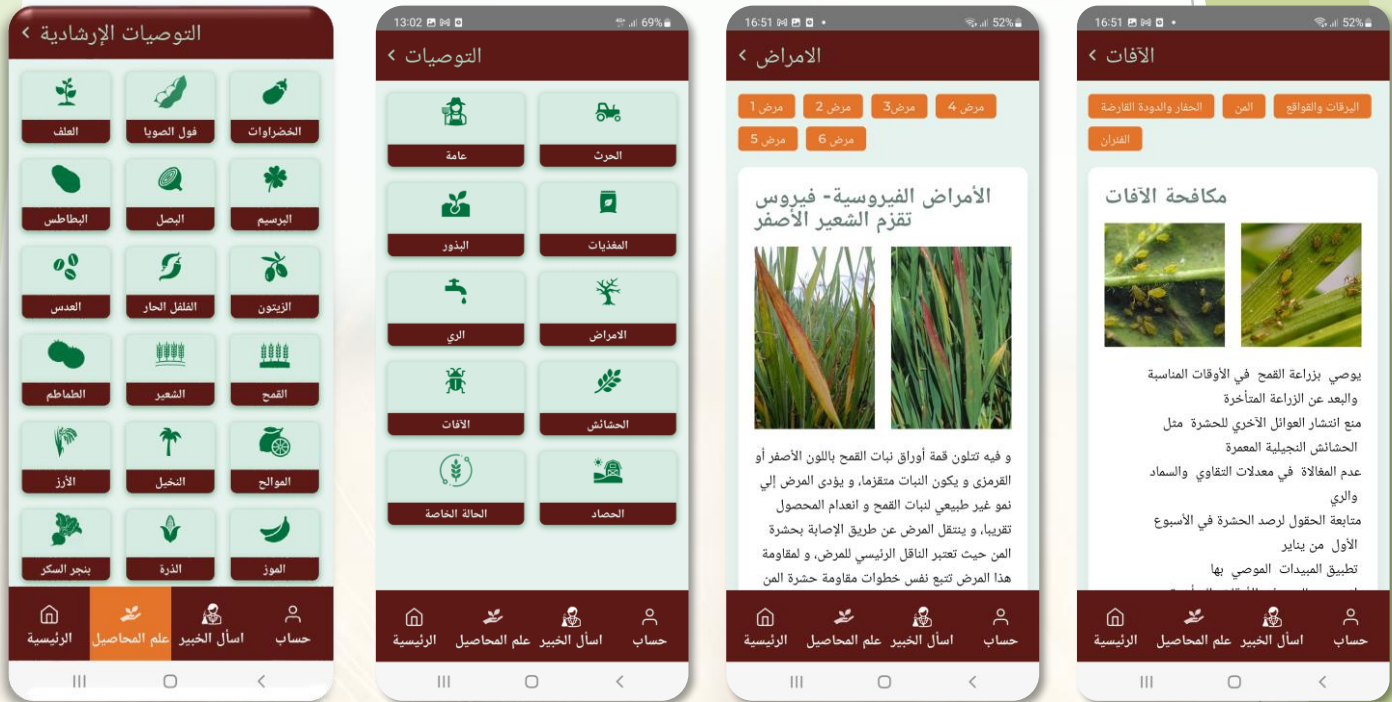
The ten sub-modules include (General description, Field Preparation, Seeds and Varieties, Water Management, Nutrient Management, Pest Management, Weed Management, Disease Management, Special Cases (e.g., Saline Soil Management) and Harvesting. There maybe several cases in each sub-module (e.g. IPM for different types of pests in a crop). The app contents can be managed (deleted, updated, or added) through the administrative dashboard.
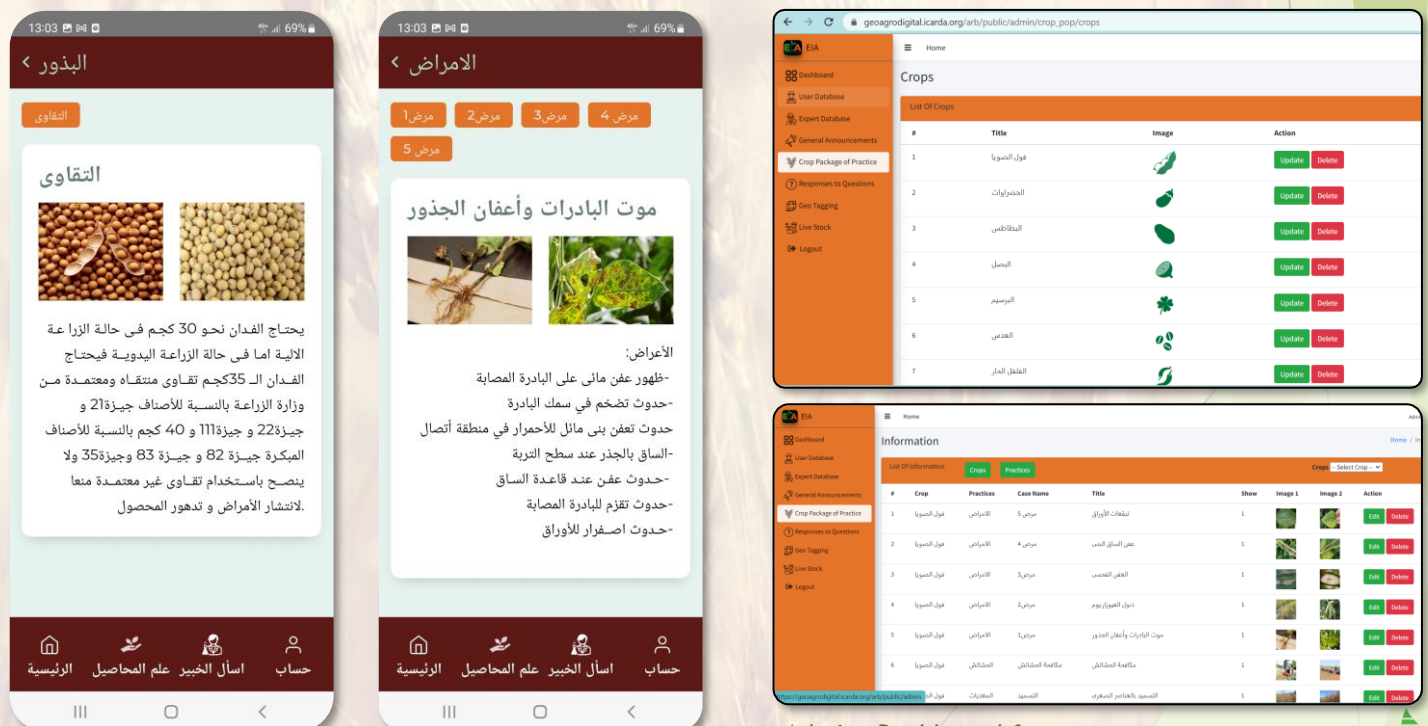

Admin. Dashboard for content management

The Weather Module

Module through which current local weather can be seen via 10 weather variables. A 6-day weather forecasts can also be obtained for the 10 weather variables. This is an API based service that uses user location to provide local weather. A visualization of synoptic weather situation is also provided.

The Expense Tracker Module

Module through which various users can track expenses on various farm operations and analyze the cost-benefit. A farmer can configure upto 4 plots in a farm (with different crops) and track expenses on each plot separately and do the cost-benefit analysis. It also provides analysis on long term economics for each plot. It also has possibilities to link with micro finance schemes.
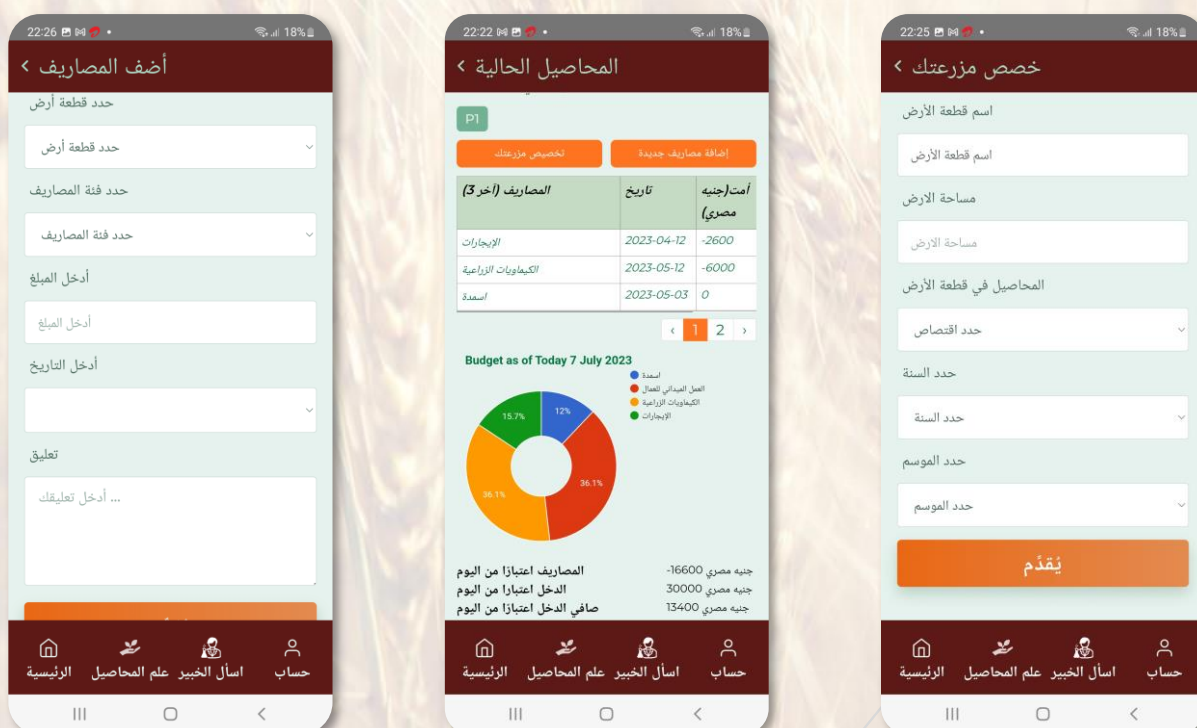
The Announcements Module

Through this module, the experts can provide announcements to all the farmers (e.g. availability of subsidies for a given crop, upcoming drought, upcoming pest etc) through the administrative dashboard and that message reaches this module in real-time with a "new message" flag.


Admininstrative dashboard to send announcements

The P2P Chat Module

This module provides opportunity for the users of this app to chat among themselves and also form various groups and chat, similar to WhatsApp. This option enhances communication between the peers to discuss farm issues either on a one-to-one basis or as groups.
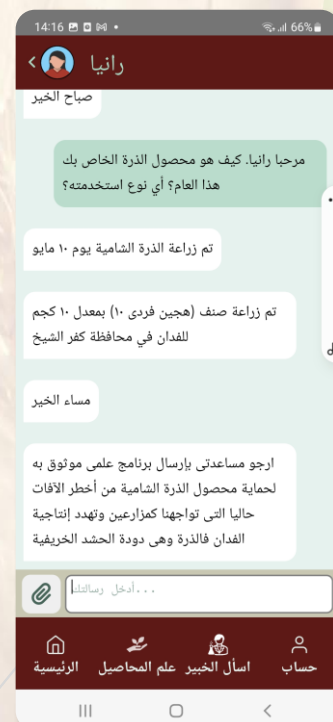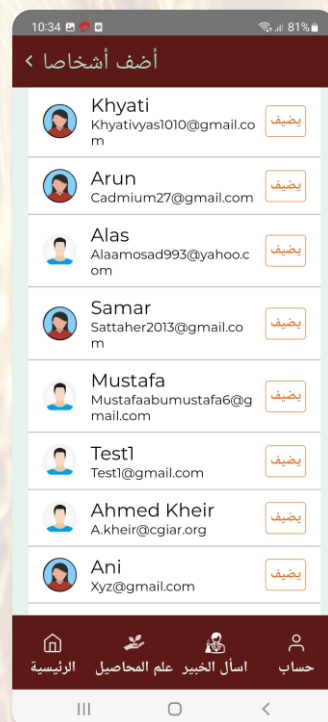
The Ask an Expert Module

Through this module , farmers can ask a question (also attach a picture) to an expert. The message goes to email of the experts sitting on the other side and he gets an expert response in real time (see the red flag). Note that this is a one-to-one interaction.
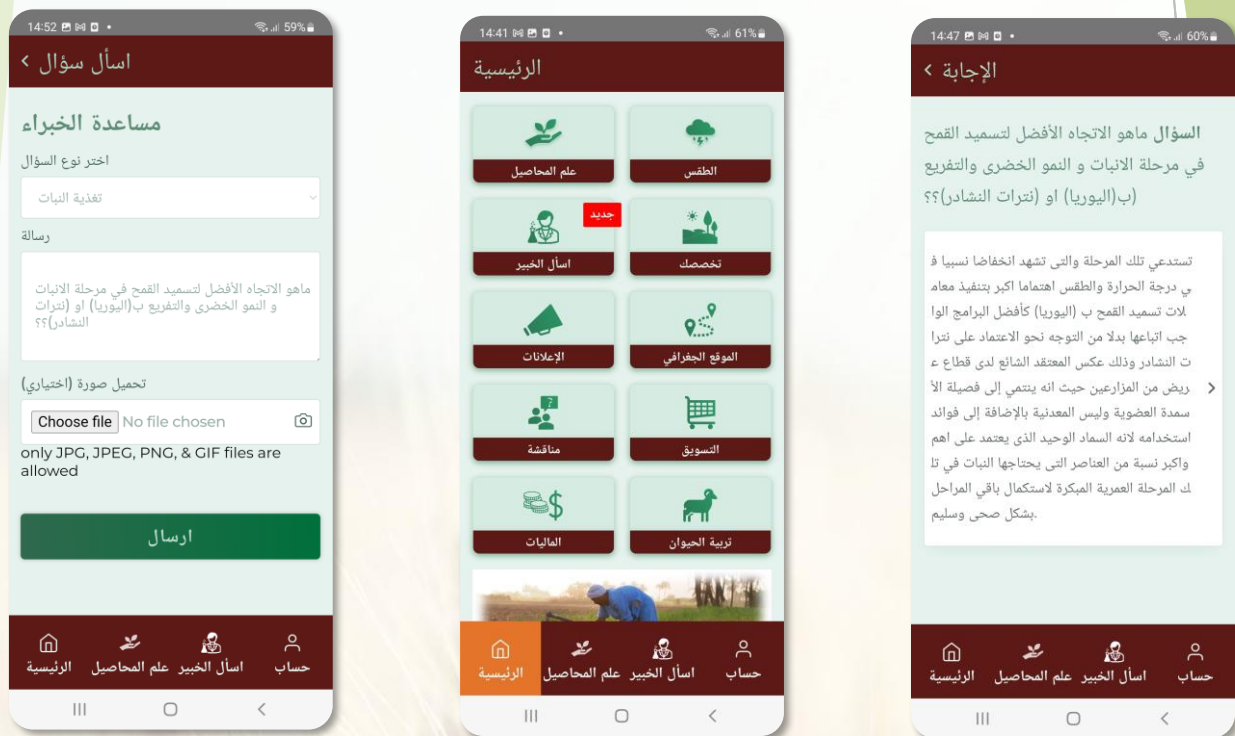

The Market Place Module

This module provides a platform for buying and selling of agricultural inputs (e.g. seeds, fertilizer, tillage implements) by various sellers. Farmers also can sell their farm produce here. This is still in development.

The Know Your Field and Geotagging Modules

This module provides information on near-real time field situation as sensed by near-real time satellite data at very high resolution. Effort has been made to reduce the scientific jargon as much as possible to make it really useful to the farmers. The geotagging module allows user to contribute information regarding his plot to a centralized database using a simple questionnaire.
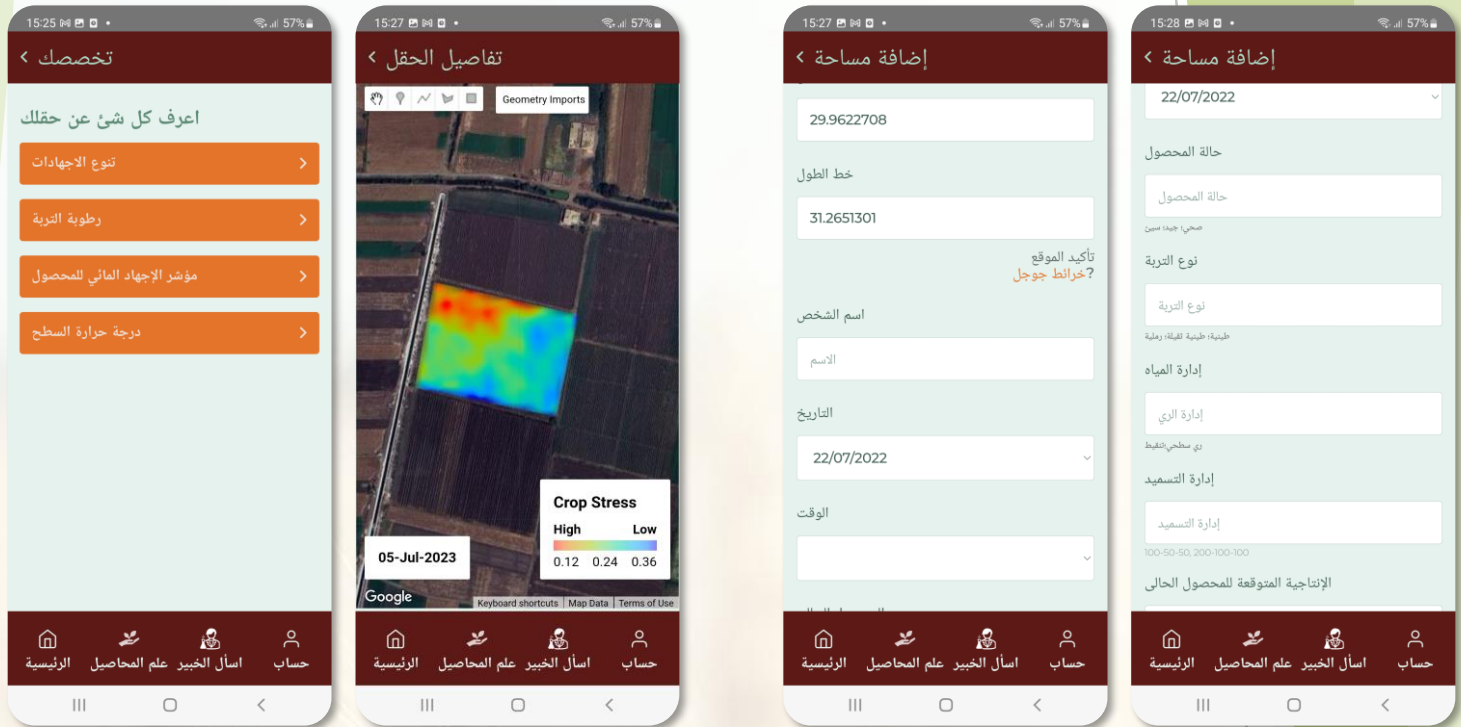
The Animal Husbandry Module

This module provides package of practices for raising several animals that are economically viable. This includes livestock, poultry and fishes. The animal-specific package of practices are categorized into several submodules such as General description, Breeds, Feed, Housing, Reproduction, Zoonotic Diseases and Harvesting (with cases if needed). Its under development.
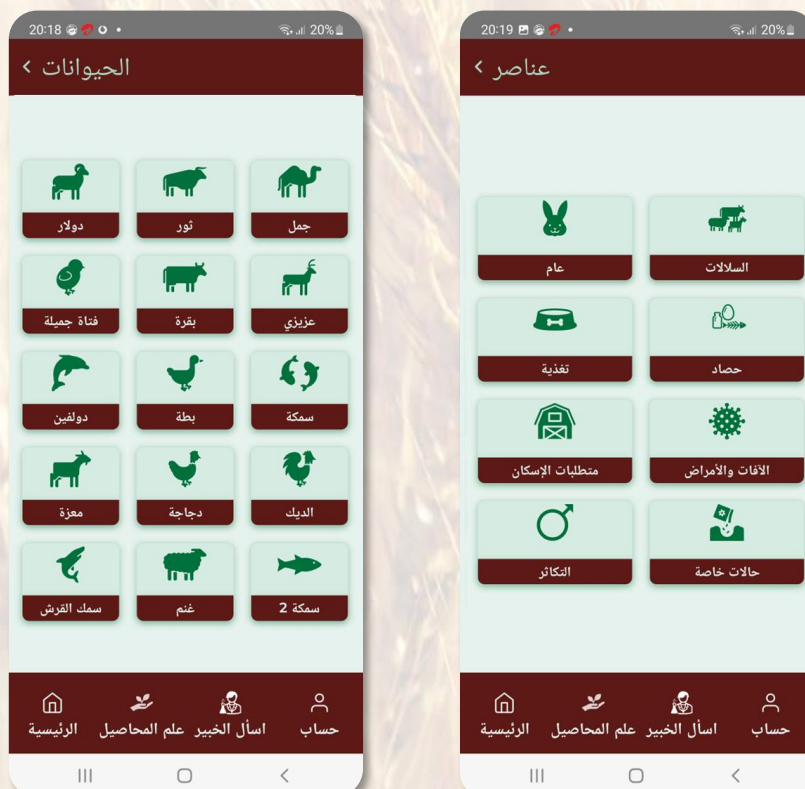
Availability of the Application

The GeoAgro-MiSR app is available to download from the Google Play store. Currently it is available only as an android version. In the future if there is a pressing need, we will develop the iOS version.
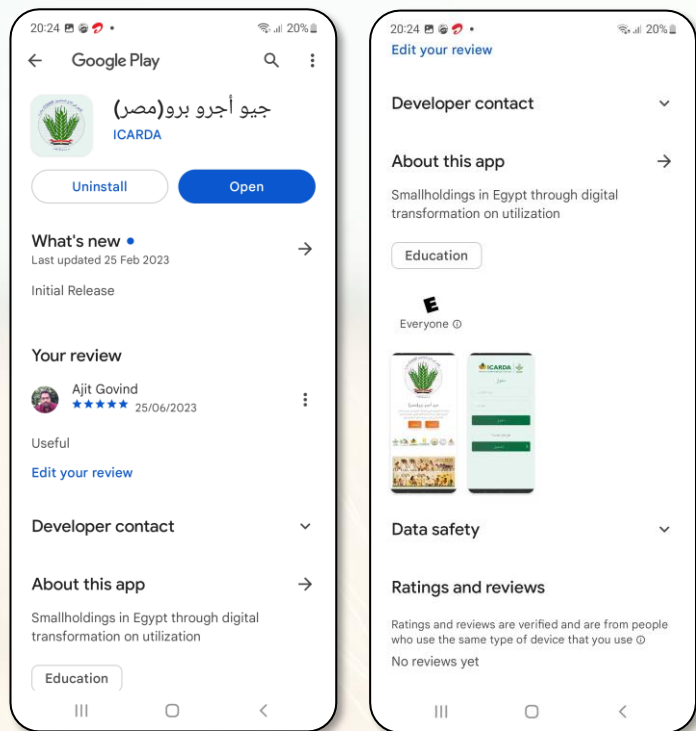

Fig. Google Play store page where GeoAgro-MiSR app can be downloaded. Active high level stakeholder engagement with various ministries of the Government of Egypt ensures strong endorsement from State.

The CGIAR Excellence in Agronomy

Smallholder farmers seasonally make critical agronomic decisions regarding crop choice, planting dates and pest, disease, weed, soil fertility and water management, often based on suboptimal practices and information. Traditional agronomic research enhances our understanding of basic processes, but with limited connection to stakeholder demand and often based on outdated approaches. The development, deployment and uptake of interventions is hampered by social, economic and institutional constraints, further confounded by adherence to conventional supply-driven innovation strategies. The CGIAR Excellence in Agronomy (EiA) Initiative aims to deliver an increase in productivity and quality per unit of input (agronomic gain) for millions of smallholder farming households in prioritized farming systems by 2030, with an emphasis on women and young farmers, showing a measurable impact on food and nutrition security, income, resource use, soil health, climate resilience and climate change mitigation. The GeoAgro-MiSR system development was supported by EiA under its Egypt Use Case.

The GeoAgro-MiSR Development Team

The GeoAgro-MiSR app was developed based on a team effort under the Egypt Use Case of the CGIAR EiA. The key team members are

Ajit Govind
Egypt Use Case Lead

Vinay Nangia
EiA CWANA Regional Lead

Mohie Omar
Hydrologist

Mina Devkota
Chief Agronomist

Ahmed Kheir
ML Expert & Modeller

Samar Attaher
Agronomist

Layal Atassi
Geospatial Expert

Bezaiet Dessalegn
Social Scientist

Rania Gamal
Biometeorologist

Alaa Mosad
Soil Scientist

Brijesh Mishra
Developer

Apoorva Singh
GEE Expert

For more details:

Ajit Govind, PhD

Senior Climatologist and Systems Modeler

Egypt Use Case Lead-CGIAR Excellence in Agronomy

International Center for Agricultural Research in the Dry Areas (ICARDA)

Email: a.govind@cgiar.org