Summary of the context and overall objectives of the project

FATIMA addresses effective and efficient monitoring and management of agricultural resources to achieve optimum crop yield and quality in a sustainable environment. It covers both ends of the scale relevant for food production, viz., precision farming and the perspective of a sustainable agriculture in the context of integrated agri-environment management. It aims at developing innovative and new farm capacities that help the intensive farm sector optimize their external input (nutrients, water) management and use, with the vision of bridging sustainable crop production with fair economic competitiveness.

Our comprehensive strategy covers 5 interconnected levels: a modular technology package (based on the integration of Earth observation and wireless sensor networks into a webGIS), a field work package (exploring options of improving soil and input management), a toolset for multi-actor participatory processes, an integrated multi-scale economic analysis framework, and an umbrella policy analysis set.

FATIMA works with user communities (farmers, managers, decision makers in the farm and agribusiness sector) at scales ranging from farm, over irrigation scheme or aquifer, to river-basins. It provides them with maps of fertilizer and water requirements (to feed into precision farming machinery), crop water consumption and a range of further products for sustainable farm management. All information is integrated in leading-edge participatory spatial online decision-support systems. The innovative FATIMA service concept considers the economic, environmental, technical, social, and political dimensions in an integrated way.

FATIMA is implemented in 7 pilot areas representative of key European intensive crop production systems in Spain, Italy, Greece, Czech Republic, Austria, France, Turkey.

Work performed from the beginning of the project to the end of the period covered by the report and main results achieved so far

The first 18 months were dedicated to laying the foundations for the multi-actor community and active collaboration with stakeholders in all pilot areas, as well as to co-developing and consolidating the required technical and social tools, data, and frameworks.

The Core Users and stakeholder groups have been identified in each pilot area. A framework has been developed for the purpose of strengthening the participatory process and to lay the community foundations for the participatory evaluation of
the FATIMA Services and their sustainable implementation beyond the project lifetime. This framework integrates a wide range of technological modules with environmental, socio-economic, and political aspects within the multi-actor community platform. In the same context, the stakeholder analysis and a baseline description of all 7 pilot areas have been completed. Several regional meetings of the local FATIMA teams with stakeholders were held in each pilot area.

The portfolio of Earth observation (EO) products and methodology has been extended (to include nutrient use efficiency and yields) and consolidated. Accordingly, the basic operational image processing and product generation chain has been defined and automated.

The implementation of the System of Participatory Information, Decision support, and Expert knowledge for irrigation and River basin water management (SPIDER webGIS, spiderwebGIS.org) and the Irrisat webGIS (irrisat.it in the Italian pilot area), as well as a combination of FOODIE with SPIDER (Czech pilot) were adapted towards the needs of regional teams and stakeholders in each pilot area. These systems were developed in the context of precursor projects and have been operationally used for several years in irrigation management applications.

The major step achieved in FATIMA webGIS is threefold:
1- the general EO-assisted methodology has been extended to cover nutrient management on one hand (a step that is based on significant methodological innovation and that brings key operational innovation);
2- in parallel, the new methodology for variable rate diagnosis and recommendation for both nutrients and water allows for within-parcel spatial fine-tuning of application; and
3- new methodology has been developed for providing a forecast/nowcast mode in irrigation scheduling (one week ahead, with continuous adjustment) and fertilization scheduling (prediction before planting and updates during crop growth cycle).

In-field and EO-assisted variable rate fertilization has been shown to reduce significantly the required doses.

A quantum leap in user-friendly webGIS-based tools has been achieved by creating Apps for mobile phone (iPhone and Android).

A set of frameworks for socio-economic analysis, including a holistic cost-benefit analysis, water-energy-food nexus, and policy analysis has been developed and populated with first datasets from several pilot areas.

This period also saw the creation of the project brochure and the project webpage (including summaries in Spanish, Italian, French, German, Greek, Czech, and Turkish). The project coordinators and members of some partner teams have presented the project at several international and national meetings.

**Progress beyond the state of the art and expected potential impact (including the socio-economic impact and the wider societal implications of the project so far)**

FATIMA introduces new technologies as tools and services to assist in farm nutrient and irrigation water management, offering the information to a wide range of stakeholders at their required space-time resolution in non-academic, non-technical, easy-to-use and intuitive form that encourages participation.

FATIMA provides a synergy of mutually supportive innovative farm management solutions (based on new technology and/or crop management and/or cropping systems) and innovative policy frameworks, which are expected to help farmers increase nutrient and water efficiency and improve soil quality while increasing farm profitability and reducing environmental impact. Applied on a large scale (for which our broad representative sample of demonstration cases in 7 countries, with all main EU crops, will be the basis), they will help the intensive farm sector reorient itself and achieve the necessary paradigm shift towards a truly sustainable agriculture.

Working directly with key users and the relevant government organizations, including active stakeholder participation and
gender mainstreaming, increases the chances for successful implementation in policy and practice.

Use of the information and knowledge generated by the project is to some extent for further research, but mainly for exploitation. The core exploitable project result is the FATIMA webGIS and the FATIMA services provided around it. These are essentially irrigation and fertilization scheduling services, providing weekly maps of predicted crop water requirements and maps of nutrient requirements over the growing season (in forecasting and nowcasting mode).

The development of SPIDER webGIS and the FATIMA Services in each pilot area is being driven by the needs and perceptions of the users. At all project stages, it has been and will be a joint venture of the project team composed of selected key stakeholders, information service providers, and research groups. The clear intention is to implement an operational version in some pilot areas well before the end of the project time and to have a clear roadmap for all other pilot areas. The details of this implementation depend on the local situation.

Some of the tools and services developed in FATIMA have already been put on the market successfully (essentially by UCLM-spinoff AgriSat Iberia and partner Ariespace).

**Related information**

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