

ICT-AGRI: EFFORTS AND PROGRESS ON HARMONIZING EUROPEAN AGRICULTURAL RESEARCH IN ICT AND ROBOTICS AND RELATED ENVIRONMENTAL ISSUES

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Abstract

The ICT-AGRI ERA-NET is a consortium of organizations and people from several European countries with the aim to provide a central structured framework to strengthen and coordinate European research regarding ICT and robotics in agriculture. An inventory of the existing research in the research area led to the creation of the Meta Knowledge Base (MKB). This online web application (<http://db-ictagri.eu>) hosts information regarding researchers and research topics in ICT and robotics in agriculture. The MKB was extended with extra features to support the development of a common European research agenda (SRA) based on online consultation of experts in the field. The ICT-AGRI SRA is based on shared priorities and supports the coordination of European research and innovation efforts. The results of the SRA are guiding the topics for the second jointly organized research call that is launched in 2012. Using a virtual common pot funding scenario, national research funding resources are coordinated on a European level in order to associate researchers and companies from different European countries. The Public-Private-Partnership initiative (PPP) puts efforts in the cooperation between public and private players in the field.

Key words: ICT, automation, robotics, agriculture, environment.

1. Introduction

Agriculture nowadays is confronted with a diverse set of challenges. Agricultural productivity is continuously increasing, trying to keep up a breath-taking pace in order to keep up with the worldwide food demand. At the same time modern agriculture and pest control poses a serious threat to the environment. Society and politics try to interfere by imposing control measures on the use of chemicals. Soil, air, water and energy resources can only be protected when assuring food security and safety. These rules resulted in burdening the farmers with a heap of extra administrative work. Moreover, the indigenous knowledge of farmers and farm workers about animals, crops and fields has diminished significantly. Meanwhile new future challenges such as climate change and biodiversity protection are rising (Le Foll, 2009) while farmers' income fell by 17% between 2007 and 2009 in EU-15 (EC 2010).

Rules and laws are designed implying regulations for farmers that mainly act on an administrative farm level. However, neither agricultural management nor environmental regulations are particularly intelligent, possibly preventing an optimal application of control

measures (e.g. fertilizer and pesticide application), affecting agricultural productivity in a negative manner.

Research and development should find solutions to these challenges. Precision farming and precision livestock techniques attempt to determine and control all measures applied to the farm land and the individual animals. These controlled farming techniques require advanced sensors to measure the current state of animals and land. Digital data and informatisation measures can facilitate alleviating the administrative burden imposed on farmers. Modern communication techniques allow for an easy data transfer between (inter)national governments, regional authorities, farmers, tractors and robots. By putting all these technologies together, agriculture can take a leap forward in the agriculture management coping with the new challenges farmers are facing, yet taking the environment into consideration. A serious problem however remains the limited ICT adoption in agriculture.

Therefore, extensive research on ICT and Robotics in agriculture and related environmental (ICT-AGRI) issues is conducted. New ICT and Robotics technologies are rapidly emerging and can revolutionize future farming through their major impacts that relate with productivity and profitability. Unfortunately human and financial resources remain fragmented and ICT and precision farming is only slowly becoming an integrated part of farming and farm management (Le Foll, 2009). There is little tradition for networking and collaboration within ICT and robotics in agriculture. Awareness of existing knowledge is an absolute prerequisite for faster progress in research and development. The relevant knowledge within the ICT-AGRI research area is quite diffuse. It is also often time-consuming to search for knowledge and difficult to assess the completeness of the relevant knowledge that was found.

The overall aim of this project, integrated in the European Research Area-network ICT-AGRI, is to strengthen and coordinate the European research, to develop a common European research agenda, to launch common calls and create affinity between research and industry within the areas of ICT and robotics in the agricultural and environmental sector.

2. Meta Knowledge Base

Initially the Meta Knowledge Base (MKB) was designed to centralize information about research and researchers in the designated field. But soon it became ICT-AGRI Meta Knowledge Base's ambition to become the central internet-based resource for researchers, developers and users within ICT and robotics in agriculture. The MKB attempts to stimulate coordination of research and development in this area through user-driven initiatives and activities. Today, it has become an online web tool, not only designed for the mapping of research and actors, but also for the support of the daily work of the ERA net, providing a substantial added value to the project. It is a unique online tool that forms the information management core of the ICT-AGRI ERA-NET. In this manner, it helps to facilitate the main objectives of the ERA-NET.

From the start, a structured framework for mapping and analysis of all relevant knowledge within the described research area was needed. Based on theory by De Leeuw (2000) and Wolfert (2002) an improved three-dimensional task-technology oriented framework was developed approaching the farm as a management system, in order to categorize the postings authored by the users. Search functionality was provided to allow visitors to find relevant information on topics and people (called postings and profiles in the application) in the research area through the selection of one or more keywords. The MKB also aims at bringing researchers together through mapping of research facilities and by launching a forum. Successful network activity on the forum was only noticeable during the opening of the first transnational call. The MKB's functionality has recently been improved to better facilitate this networking for the second call. It provides functionality for people to join together to form a project consortium for the 2nd research call.

Recent efforts aim at making the Meta Knowledge Base reusable for other ERA-NETs. Many ERA-NETs show the same requirements regarding information acquisition and

dissemination. The financial and time investment into this tool should not be repeated by every other ERA-NET. In this way, ERA-NETs can more efficiently reach their specific goals by concentrating on the content rather than the means. The original website, authored in the PHP programming language was considered less suitable to share with other users in its current form due to high programming complexity. Therefore a framework was sought to make the website's structure more transparent and comprehensible, also for non-IT experts. A commonly used CMS called Drupal also written in PHP code is currently being explored with the intention to construct a new MKB tool that can be adopted by other ERA-NETs.

3. Strategic Research Agenda

The MKB was extended with extra features to support the development of a common European research agenda (SRA). The ICT-AGRI SRA is based on shared priorities and supports the coordination of European research and innovation efforts. Literature review identified challenges and needs that were formalized into goals and the related appropriate solutions. In an online consultation organized as a real time Delphi survey, all interested stakeholders were invited to identify the key solutions that are most capable of meeting the challenges of European agriculture regarding ICT and robotics. The strategic research agenda is discussed extensively in another article of this conference.

4. Research Call

The results of the SRA are guiding the topics for the second jointly organized research call that is launched in 2012. Using a virtual common pot funding scenario, national research funding resources are coordinated on a European level in order to associate researchers and companies from different European countries. During the first call procedure, of the 44 projects that were submitted, 7 were financed for a total budget of over 3 million Euros. For the 2nd call, focus was put on transnational research and technological development and demonstration projects. It aims at utilizing ICT and automation in primary agriculture for sustainable use of natural resources, reduction of agriculture's environmental footprint, mitigation of climate change while securing farm economy and good working conditions, food supply, quality and security, and animal welfare. Projects are expected to develop and demonstrate feasible solutions with proven effects towards a greener European agriculture. Projects can include a combination of Research and Technological Development (RTD) and Demonstration. Project consortia are expected to be formed by public research organisations, public services as well as commercial enterprises across Europe. It is expected that 5-10 projects will be funded by this call with subsidies per project between 0.6 and 1 million euro. Funding is subject to national regulations. Five main topics were suggested based on the conclusions from the SRA:

1. Open Farm Management Systems
2. Enabling farming based on ICT and robotic machines
3. Transfer of Knowledge and Solutions
4. Interactions between farmers and public services based on ICT and automation
5. Retrieval of knowledge from agriculture based on empirical data in farm management systems

To help researchers in their quest for suitable partners, a new tool was developed as part of the MKB. iProjects, a matchmaking and consortium building tool allows users to create an iProject, a closed room where a group of users can share messages and documents. It is intended for matchmaking and for discussions among the potential partners. Based on login identification, elevated rights are accorded to the iProject leader. An iProject can be promoted to an application workspace that can be used for online input of project data, consortium and budget for the research call. Projects can start from December 2012 onwards.

5. Public Private Partnership

Another initiative that is organised focusses on the gap between research and its implementation in the real world or industry. The Public-Private-Partnership initiative (PPP) puts efforts in the cooperation between public and private players in the field. To reach this goal, a subject was chosen: the 2009 EU Directive for establishment of a framework for community action to achieve the sustainable use of pesticides and the associated reduction on the use of pesticides with 50% by 2018. A PPP event is incorporated into the Smart Agrimatics conference that is organized in June 2012 together with two other ERA-NETs: AgriXChange and SmartAgriFood, both active in the same sector of ICT and robotics in the agri-food sector, yet each with their own perspective on the matter.

6. Conclusions and future work

ICT-AGRI is a consortium of several European partners working together on stimulating the efforts in the research area of ICT and robotics in agriculture. Partners are currently looking at structures facilitating the continuation of this successful cooperation beyond the initial ERA period.

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References:

De Leeuw, A.C.J., (2000). Bedrijfskundig management: primair proces, strategie en organisatie. Van Gorcum, Assen, 555p.

EC (2010). Developments in the income situation of the EU agricultural sector. http://ec.europa.eu/agriculture/rca/pdf/hc0301_income.pdf.

Le Foll, S., (2009). Draft report on on EU agriculture and climate change. 11p.

Wolfert, J., (2002). Sustainable Agriculture: How to make it work? A modeling approach to support management of a mixed ecological farm. Phd Thesis, Wageningen University, Wageningen.