ICT support for agroecology

*From field to marketplace, the **CAPSELLA** project is embracing cloud-based data to promote the transition of European agriculture to a more biodiverse and sustainable food systems*

In response to concerns over the lack of sustainability of conventional food production systems, an EU-funded CAPSELLA (Collective Awareness PlatformS for Environmentally-sound Land management based on data technoLogies and Agrobiodiversity) project coordinated by Professor Yannis Ioannidis from the ATHENA Research Centre was conceived. This is a 2½ year project that kicked off in early 2016. The overarching aims of CAPSELLA are: firstly, to raise awareness of the issues currently confronting agriculture and food systems; and, secondly, to develop ICT solutions based on bottom up data collection and top down data integration. Other objectives, outlines Ioannidis, include 'strengthening and facilitating networking, collaboration and cooperation between communities; providing information and support to policymakers; and promoting the collection and integration of open data related to agriculture and food.'

INNOVATIVE APPLICATIONS

The project is using a number of methods to achieve its aims. These include having created an interactive map to act as a hub for networks and communities to increase their visibility and seek collaboration with other complementary initiatives, and a major cloud-based platform to host bottom up open access data and analytical tools. 'Innovation is supported by targeted interdisciplinary hackathons, piloting of early demonstrator ICT tools and a competition between teams to produce tools aimed at addressing challenges identified by the project,' Ioannidis says.

BUILDING TRUST

CAPSELLA is grounded in the notion that by combining farmers' and other stakeholders'

own local knowledge, with big data and ICT, novel solutions can be found to assist small scale farmers to extend agroecology practices and also to promote diversity at all stages from farm to fork. The project collaborators, comprising institutions from several different European countries, are passionate about involving grassroots organisations and farming communities in all aspects of the project. 'The first phase comprised an intensive networking and consultation exercise undertaken through workshops and other outreach activities, to gather information on peoples' real world needs and concerns,' Ioannidis explains. Then, in a multidisciplinary and multi-domain environment, the collated problems were developed into community user cases centred on the three domains of seed, field and food. All stakeholders contributed to developing the CAPSELLA methodology and committed to promoting the project objectives.

By involving grassroots communities at all stages of the project, CAPSELLA has gained trust and buy-in, therefore alleviating small farmers' concerns that only large scale conventional agriculture has anything to gain from big data and ICT decision-support tools. CAPSELLA team member Professor Paolo Bàrberi, from the Institute of Life Sciences at the Scuola Superiore Sant'Anna in Pisa, one of the leading universities in Italy, hopes that this approach will 'help to balance power relations between large agribusiness companies and farmers and provide the latter with more power in the information management sector'. He says it is these small scale farmers and other community-based stakeholders within the food chain who will be 'actively piloting the alpha and

beta versions of mobile and web-based apps produced by the project.' Their feedback will be essential to improving and upgrading these tools to make them directly useful and accessible for as many as possible farmers' communities in Europe and beyond.

ICT communications specialist Giovanna Calabrò, who is a key part of the CAPSELLA team, believes that 'only by saving biodiversity in all its aspects, we can improve food quality and living conditions'. She is confident that CAPSELLA's novel and integrative approach promises to keep delivering and strengthening agrobiodiversity and healthy food options, long after the project has ended through the networks and tools it has facilitated and by strengthening community cooperation.

In this light, Peter Paree, employee of a Dutch farmers organisation who represents practical farmers, points out that the communities that are linked will continue to use the tools developed. For example, ZLTO and others will keep on distributing the compost /soil tool and virtual exhibition tool after the project. 'Moreover, we build bridges: between food communities and farmers communities; between farmers groups with specific needs but no sight on clear functional and technical specifications and ICT professionals who want to realise clear specs; and between high tech farmers from the Netherlands and highly skilled farmers from Greece, Spain and Italy.'

Promoting deep-rooted sustainable agriculture

*CAPSELLA researchers **Yannis Ioannidis, Paolo Bàrberi, Jorge-A Sanchez-P, Peter Paree** and **Giovanna Calabrò** describe the innovative approach of their work which brings together agriculturalists, food and ICT and open data experts*

Clockwise from left: Yannis Ioannidis, Paolo Bàrberi, Jorge-A Sanchez-P, Giovanna Calabrò and Peter Paree

In what ways is CAPSELLA working to raise awareness about the need to manage agricultural land and agrobiodiversity in Europe to address major sustainability threats?

YI: We are working on multiple levels at once, including undertaking field-work, building an online presence and holding face-to-face meetings and workshops. We are committed to engaging all the different stakeholders in agrobiodiversity and the agri-food sector, including farmers, grassroot activists, networks, related projects, food innovators, policymakers and citizens. We advocate for the collation of open data and leverage existing collective knowledge from within communities.

JS: CAPSELLA is aligned with open innovation principles, meaning that pre-existing boundaries in the innovation funnel - from ideation to commercialisation- have been removed in our project. This enables all interested parties to join a co-creation process that allows innovation to flourish.

How are you working to strengthen collaboration within and between communities and support their interactions with ICT experts and businesses?

YI: CAPSELLA enables any agro-biodiversity and agri-food community or network to add themselves to our collaborative interactive map and to share their objectives and the challenges they are addressing. This provides great visibility and opens up networking and collaboration opportunities both within and outside of CAPSELLA. The interactive map link is on the CAPSELLA website, communities and networks are most welcome to register and join the community already in place. To ensure we address the real needs of communities, we spent the first months of the project intensively questioning stakeholders on their ICT challenges in a bottom-up and participatory way. These requirements have since been transformed into challenges and are being addressed in CAPSELLA hackathons and within the CAPSELLA Acceleration Programme.

PP: We have put in place several successful collaborations with related projects and believe that this is important. I personally have made connections to IoF 2020: Make a bridge between Internet of Things: sensing, prediction, actuation with sensors, and Internet of Open Data.

Can you explain how the cloud platform to support ICT solutions related to biodiversity in agri-food systems and food quality works?

YI: The CAPSELLA platform hosts many open datasets provided by the agrobiodiversity sector. From the beginning we have based the design of the platform on the communities' requirements and on being FAIR - Findable, Accessible, Interoperable and Re-usable - with respect to the data. To this end, we are implementing a pluggable and extensible platform that consists of a number of independent, but interconnected services, capable of supporting different data types of any schema. The platform also offers data analytics and processing tools. Therefore, all our pilot applications can use the platform and its services despite targeting different domains and having different technical requirements.

What is the pilot initiative and how is this supporting new approaches to sustainable land management?

PB: We strongly support the idea that engaging end-users through a participatory approach enhances the successful uptake of ICT tools. We believe that the development of ICT tools needs to be user-centred, allowing the target end-users to co-design the application and to be directly involved throughout the whole process.

GC: Besides increasing the adoption of innovations, a participatory process promotes a co-learning process among the stakeholders involved. This methodology is applied in CAPSELLA in each pilot case and so far we have received positive feedback from the communities. Currently we are running two pilots on soil health, one in Italy and the second one in the Netherlands.

PP: Already it is shown, that application based on a soil map is possible, a proof of principle is shown and measurements of soil quality, growth, quality and harvest are

> *CAPSELLA pilots cover the whole spectrum of the agrobiodiversity and agri-food chain and try to address critical community challenges*

available electronically and in the CAPSELLA platform. From this experience a realisable design of a spreading tool has been developed. This is now 80 per cent ready and will soon be available on the CAPSELLA platform as well. This tool will be tested in practice and made available for any farmer who would like to test it.

YI: The CAPSELLA pilot schemes follow a methodology developed earlier in the project, when we defined our three community case scenarios for seed, field and food. The methodology was crafted through direct engagement and consultation with stakeholders. Technical development of each pilot project is taking place in phases, with early versions being tested by communities and their feedback incorporated into the next version. Performance indicators and evaluation criteria have also been defined for each pilot.

Can you tell us about the seven pilot applications being developed within the CAPSELLA project?

YI: CAPSELLA pilots cover the whole spectrum of the agrobiodiversity and agri-food chain and try to address critical community challenges. In the seed pilot we are developing a data entry tool for European seed communities to replace a manual process that is time-consuming and error-prone. The field pilots are developing an application to support soil health self-assessment and evaluation of soil organic matter dynamics, and another that assists farmers to precisely manage organic fertilisation. Both are linking farmers, local knowledge and open data. The food pilot application integrates open data related to health and nutrition with user generated data, and applies this to meals served in school canteens. The application will provide useful personalised recommendations and information to encourage healthy and sustainable consumption. In the Netherlands the proposed pilot will focus on the reduction of CO_2 emissions and will provide support to maximise farming efficiency by improving the sector's accountability to market and society. Through the aforementioned processes, farmers can prove with facts and figures that they improve soil quality, to their peers, politicians, market partners and consumers.

The precision farming compost pilot will be run at the innovative potato producer Jacob van den Borne who has experience in measuring potato growth, etc.

What ways do you plan to roll out the successful pilots for wider use?

YI: The participation rate will firstly broaden at a community level. The CAPSELLA platform is extensible and agile enabling the engagement of more users and communities over time. Communities involved in the demonstrator phase of the pilots have a vested interest in the success of each activity. Therefore, we are confident they will embrace the developed applications and will want to use successive updated versions, long after the project itself has ended. Secondly, the CAPSELLA applications may well be taken up at regional and national levels, thus providing much greater momentum.

Do you have any dissemination activities coming up?

GC: We are currently calling for participants to take part in the CAPSELLA Acceleration Programme warm-up event in September 2017. Also, over the coming months, we will be organising key workshops within major events such as the CAPSELLA workshop *The roadmap to better food: Using ICT and Open Data to Overcome Barriers in the Agriculture Value Chain* within the Open Science Fair that will take place in Athens, Greece on September 6th- 8th 2017. Moreover, CAPSELLA will be organising a Field-Day dedicated to its field pilot at the first Agroecology Europe Conference in Lyon, France on October the 25th-27th 2017 http://www.agroecology-europe.org/agroecology-forum-2017/.

Finally, we will be at the prestigious 8th International Conference on Information and Communication Technologies in Agriculture, Food and Environment to be held in Crete and we are already beginning preparation of our major final workshop during which we present the CAPSELLA results. We invite and encourage anyone interested in sustainable agriculture to visit the CAPSELLA website that is continuously updated with relevant news and events.

Project Insights

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BIOS
Professor Yannis Ioannidis is the President and General Director of the Athena Research and Innovation Center as well as a Professor at the Department of Informatics and Telecommunications of the University of Athens.

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Dr Jorge-A Sanchez-P joined GRNET in 2002 contributing to the development of European and Regional Networks and European Policies on electronic infrastructures. Since 2006 he has been the co-founder and Chief Strategy and Financial Officer at Corallia (www.corallia.org).

Peter Paree is senior programme leader and project developer in agriculture, rural development and crossovers agri-hitech. He has worked for 31 years in strategic advice, project- and programme management.

Giovanna Calabrò has significant experience in dissemination, communication and project management in the sectors of ICT, cloud computing, and research infrastructures. Since 2005, she has worked with developing ICT communication platforms to supporting collaborations between Europe and developing countries.

CAPSELLA
COLLECTIVE AWARENESS PLATFORMS FOR ENVIRONMENTALLY-SOUND LAND MANAGEMENT BASED ON DATA TECHNOLOGIES AND AGROBIODIVERSITY

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