Book of abstract RUC-APS international conference 2021

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University of Liverpool, United Kingdom

RUC-APS International conference in Technology Innovation and Uncertainty Management in Agri-Food systems

November 29th – December 2nd, 2021

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Participant institutions

How to reference this book

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Book of abstracts Contents

Organising committee

General Chair and local organisation

Jorge Hernandez. I work at University of Liverpool Management School as Associate Professor in Operations & Supply Chain Management. Currently I am the H2020 RUC-APS project Coordinator - principal investigator and the N8 agri-food project academic lead for the University of Liverpool. Also I am the Director of Studies for the Msc in Business Analytics and Big Data. With +20 years of experience, my main research is oriented to support resilience and decision-making processes in agri-food supply chains connecting with real-industry life challenges and requirements under high risk and uncertainty.

Rachel Brockley. I work in the Management School at The University of Liverpool. I provide project management and research administration support for multi-partner projects. I am currently working on two international H2020 RISE projects and an ERDF project.

Program Chairs

Leandro Antonelli. I work in the Lifia Research Centre of the Facultad de Informatica at the Universidad de La Plata in Argentina. I am a computer scientist and my research line is software engineering. In particular, I work in requirements engineering and project management.

Ana Esteso is Assistant professor at the School of Industrial Engineering of the Universitat Politècnica de València and member of the Research Centre in Management and Production Engineering of the same university. Her research is mainly focused on the design and management of agri-food supply chains through simulation and optimisation models.

Shaofeng Liu is Associate Head of School for Research and Innovation at Plymouth Business School in University of Plymouth, UK. Her research interests are agri-food value chain innovation, knowledge mobilisation across boundaries, supply chain resilience, and agri-food safety, quality and security.

Industry Panels chairs

Rina Iannacone. I work for the Research Center Metapontum Agrobios of ALSIA (Matera - Italy). I am a Plant biotechnologist, and my main interests are on plant biotic and abiotic stress and the production of valuable compounds from plants for pharmaceutical and nutraceutical applications.

Horacio Arias. I am the founder of Bbloock Smarthinking, a startup that promotes the use of sophisticated technology, such as blockchain, to develop business solutions for different industries, such as: agri-food and energy. I am a Chilean electrical engineer, MBA and master in sales with more than 20 years of professional experience. I have worked in different industries such as mass consumption (Unilever) and banking.

ICT Panel chair

Pascale Zarate. I work at University Toulouse 1 Capitole (Toulouse, France) and conduct my research at IRIT in the Artificial Intelligence Department for which I am chairwoman. I am Computer Scientist and more particularly I develop software called Decision Support Systems for single Decision Maker or for a Group of Decision Makers. These systems are also called Recommender Systems and all my researches are based on a multi-criteria approach.

Publication Chair

Janusz Kacprzyk, FIEEE, FIET, FEurAI, FAAIA, is Full Professor of computer science at the Systems Research Institute, Polish Academy of Sciences in Warsaw, Poland, and at the Three Gorges University in Wanxi, China, and FUll Professor of Automatic Control and RObotics at the Lukasiewicz Network PIAP - Industrial Institute of Automation and MEasurements, His main research interests are decision making and support, in particular under uncertain, imprecise (fuzzy) and incomplete information, computational and artificial intelligence, with applications in systems modelling and control.

Dissemination and social media

Alejandro Fernandez. I am the director of the LIFIA Research Center of the Faculty of Informatics, at the National University of La Plata. My research interests lie in the intersection of computers supported cooperative work, decision making, and knowledge management.

Program schedule (Central European time, CET)

Day 1 – Monday 29th November, 2021

10:00 – 10:15: Welcome Session (Jorge Hernandez)

10:15 – 11:00: KN1: Making food supply chains shorter, fairer, more resilient and more sustainable through common ownership (Nick Weir)

11:00 – 13:00: S1: Agri-Food Operations, Decision, Risk and Uncertainty Modelling and Simulation

13:00 – 14:00: BREAK

14:00 – 14:45: KN2: Development and extension for vegetables production through a regional program in La Araucanía (Chile) (Gabriel Saavedra)

15:00 – 17:00: Agriculture Innovation Experts Panel

Day 2 – Tuesday 30th November, 2021

10:15 – 11:00: KN3: Mapping Access to Healthy Food in Liverpool: The Role of Transport, Time, and Store Type (Ana Campos)

11:00 – 12:00: ICT1: Tools and application

- Digital Horticulture, Jorge Hernandez
- IFA platform, Deborah Crossan

12:00 – 13:00: Demonstrations, Project examples, Research, Publications

13:00 – 14:00: BREAK

14:00 – 14:45: KN4: Adding Value: Red and purple flesh potatoes a healthy and attractive alternative for the new global challenges (Maria Teresa Pino)

15:00 – 16:00: Consorcio Biofrutales, a public-private experience to undertake long term projects in Chilean Agriculture (Rodrigo Cruzat)

16:00 – 17:00: ICT2: Tools and application

- Agrosemantics, Federico Balaguer
- Agora, Diego Torres

17:00 – 18:00: KN5: Oracle Technology Enabling Traceability for Agribusiness in Latin America (Prasen Palvankar)

Day 3 – Wednesday 1st December, 2021

10:15 – 11:00: KN6: Decision Support Systems in pig production systems (Lluís Plà)

11:00 – 13:00: S2 Agriculture production systems, sustainability and climate change

13:00 – 14:00: BREAK

14:00 – 14:45: KN7: IoT and Data Technologies applied to minimize Frost Damages on Vineyards (Lucas Iacono)

15:00 – 16:00: ICT3: Tools and application

- GRUS, Guy Cumilleri
- BlockChain, Horacio Arias

16:00 – 17:00: KN8: The challenge of enhancing sustainability in urban and peri-urban agriculture production systems of AMBA region (Andres Polak)

Day 4 – Thursday 2nd December, 2021

10:15 – 11:00: KN9: Europe Horizon research challenges and opportunities (Néstor Etxaleku-Zabala)

11:00 – 13:00: S3 Decision support systems and digitisation in agriculture

13:00 – 14:00: BREAK

14:00 – 14:45: KN10: Knowledge investment per ha: taking global food production towards a sustainable future (Rejane Souza)

15:00 – 16:20: S4 Innovation and regional challenges in the agri-food sector

16:20 – 17:00: Awards and closing Session

The RUC-APS Project

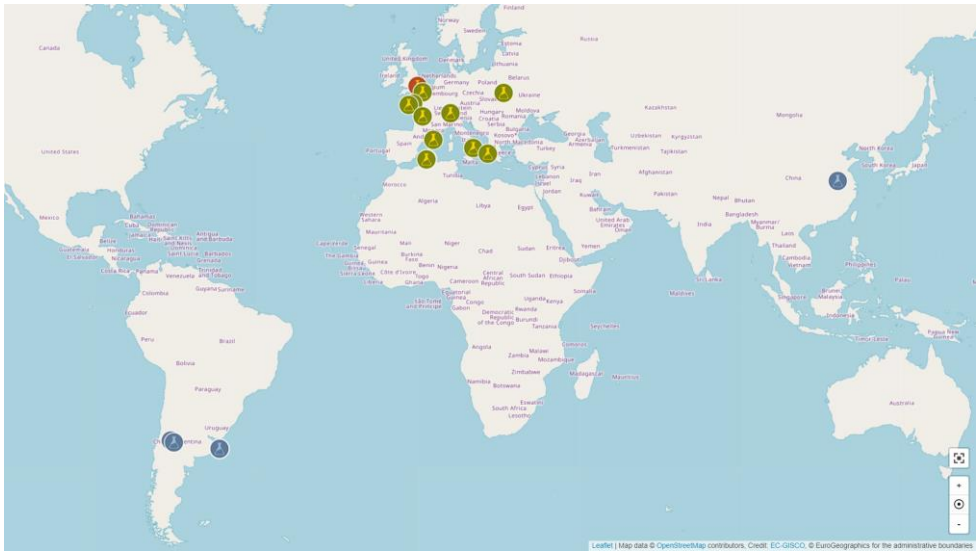
General information

- Coordinator: The University of Liverpool, UK
- Total cost: €1.332.000
- Project Coordinator and principal investigator: Dr. Jorge Hernandez (jorgehh@liverpool.ac.uk)

The consortium

The current RUC-APS project is novel cross-faculty and multi-continental H2020 project, the following institutions are involved:

- University of Liverpool, UK. Jorge Hernandez
- University of Plymouth, UK. Shaofeng Liu
- Riviera Produce, UK. Ellis Luckhurst
- Innovation for Agriculture, UK, Deborah Crossan
- CNR - Istituto di Scienze delle Produzioni Alimentari, Italy. Nicola Calabrese
- Agenzia Lucana di Sviluppo e di Innovazione in Agricoltura, Italy. Rina Iannacone
- Food Innovation Technology Center, Spain. Raquel Almarcha
- Valencian Agri-Food Business Federation. Spain. Juan Jose Rico
- Universitat Politècnica de València, Spain. Maria del Mar Eva Alemany
- Bretagne Développement Innovation, France. Cecile Guyon
- Université Toulouse 1 Capitole, France. Pascale Zarate
- TELECOM Nancy - University of Lorraine , France. Herve Panetto
- National Agriculture Institute of Chile – Ministry of Agriculture, Chile. Emilio Ruz
- BBlock SmarThinking, Chile. Horacio Arias
- Intelligent Systems Laboratory - Systems Research Institute Polish Academy of Science, Poland. Janusz Kacprzyk
- Faculty of informatics - Universidad de La Plata, Argentina. Alejandro Fernandez
- Faculty of Agronomy and Natural Sciences - Universidad de La Plata, Argentina. Mariana del Pino
- ServiVerde, Argentina. Adrian Simonetti
- Digital Stream (DS), Argentina. Federico Balaguer
- Agriculture University of Henan, China. Jiandong Hu



Summary

Farmers usually react to these high uncertain conditions by making decisions in a reasoned way, which is frequently based on their experience and traditional knowledge. Therefore, providing optimal and robust decisions still remains an open challenge for researchers and practitioners. For instance, decentralised and collaborative solutions might turn into acceptable solutions, especially to support farming production planning systems within high uncertainty. Nevertheless, enhancing the efficiency and effectiveness of agribusiness production systems is not an easy task and solutions must also consider external requirements and constraints (e.g. regulatory, physical risks, the full life cycle of agricultural products).

The modelling of risk in farming production systems requires the right understanding of how uncertainty impacts on the system, especially where decisions are to be made. This H2020-RUC-APS research project will focus on supporting collaborative and decentralised farming value chain planning under uncertainty, in global and local agriculture production systems. RUC-APS is oriented to provide access to agriculture value chain information from the seed genetic design process, going through the forecasting, planning and replenishments of planting and harvesting processes, to end-customers. This will be used to model, simulate and analyse several agriculture-based value chain decision-making scenarios and to understand the uncertainty and main risk implications by using in-house software for uncertainty quantification as well as linear programming models and multi-agent systems. Thus, this high impact research project will focus on integrating real-life based agriculture requirements, providing alternative land management scenarios, coping with unexpected weather and environmental conditions as well as supporting innovation in the development of agriculture production systems, operations, logistics and supply chain management. This should lead to the integration of standard and customised solutions for facilitating collaborative engagement within the agriculture value chain decision-making process. In total, the RUC-APS projects involved +200 researchers and +300 industries to support the research and impact activities.

Outcomes and impact

The RUC-APS projects, led by Dr. Jorge Hernandez and in collaboration with the co-investigator from each institution across this multi-continental project, has generated impact in several aspects across industry and academia. These spams from research outcomes, jobs promotion and industry influence. These are summarised and quantified as follows.

- **General benefits to projects participants**: the project has contributed to increase the internationalisation of all the institutions in the consortium, specially across European agencies to promote informed decision-making strategies for international agri-food domains. Also, institutions have increased the possibilities to apply to more national and international grants considering the RUC-APS experience.

- **New projects generated**: More than +30 projects have been generated as part of the RUC-APS framework research, which has contributed to +€10.000.000. Funders have been FONDECYT, FONDEF, STICAMSUD, H2020, ERDF, Argentinean Ministry of Agriculture, University of Liverpool and La Plata University.

- **Msc dissertations**: 23 Msc dissertations have been produced across the University of Liverpool, Universitat Politècnica de València and La Plata University. This has promoted international joint supervisions and Msc students has benefited from RUC-APS industry partners to study case studies and apply the RUC-APS framework model.

- **PhD dissertations**: 9 PhD thesis have been generated out of the RUC-APS research. PhD students had the chance to visit multi-disciplinary and multi-continental partners. These PhD dissertations were based on real industry life cases from agri-food stakeholders from the RUC-APS project.

- **Job Promotions**: There has been 8 promotions influenced by the RUC-APS project. These are as follows: 1 Promotion to Research Centre Director at La Plata University; 3 promotions at Universitat Politècnica de València such as: 1 promotion from PhD researcher to Assistant professor, 1 promotion from Assistant Professor to Associate Professor and 1 promotion from Associate Professor to Full Professor; 1 Promotion to National Director of horticulture at National Agriculture Institute of Chile; 1 Promotion to Full Professor at Université Toulouse 1 Capitole; 2 promotions at University of Liverpool such as: 1 promotion to assistant professor and 1 promotion to associate professor.

- **Publications**: There has been +115 publications, being the majority of them in ISI Q1 journals, Edited book, Book Chapters and conferences.

- **Additional collaborations:** The RUC-APS project has promoted established collaborations with public agencies and ministries of agriculture, as well the generations of MOU amongst participants, which is currently helping to develop more formal collaboration even after the project have ended. Creation of the RUC-APS NET initiative. The RUC-APS project has let 2 international conferences and has also run several special sessions in international conferences in Spain, US, UK, Italy, Poland, Chile, Argentina and China.

Useful Links international project recognitions

- Amazon - https://www.amazon.pl/dp/3030510492/ref=asc_df_3030510492163540440000/?tag=nie06a0-21&creative=380333&creativeASIN=3030510492&linkCode=asn&utm_source=skapiec.pl&utm_medium=referral
- Barnes & Noble: https://www.barnesandnoble.com/w/agriculture-value-chain-challenges-and-trends-in-academia-and-industry-jorge-hern-ndez/1137054788
- BDI: https://www.bdi.fr/fr/deux-chercheurs-espagnols-visite-cadre-programme-europeen-ruc-aps/
- BookTopia: https://www.booktopia.com.au/agriculture-value-chain-challenges-and-trends-in-academia-and-industry-jorge-e-hern-ndez/book/9783030510497.html
- Bookyage - https://bookyage.com/agriculture-value-chain-challenges-and-trends-in-academia-and-industry-ruc-aps-volume-1/
- CNR-ISPA - https://www.liceosimonemorea.edu.it/attachments/article/1478/Workshop%20RUCAPS%20locandina.pdf
- CONICYT - https://www.conicyt.cl/pci/files/2018/11/RUC-APS_JH.pdf
- FEDACOVA - https://www.fedacova.org/ruc-aps/
- GOODREADS - https://www.goodreads.com/book/show/53431605-agriculture-value-chain---challenges-and-trends-in-academia-and-industry
- GOOGLE.BOOKS: https://books.google.co.uk/books?id=LRjzDwAAQBAJ&pg=PA31&lpg=PA31&dq=RUC-APS&source=bl&ots=x_Wt1sSMUF&sig=ACfU3U0O0nkSmVBqmYogLZCszqR6xmzMHg

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- HAL - https://hal.archives-ouvertes.fr/hal-02001076
- IBSPAN: https://www.ibspan.waw.pl/2021/04/06/elementor-4189/
- IFA – Royal Agriculture Society of England: https://www.innovationforagriculture.org.uk/soil-and-water/projects/ruc-aps
- INIA - https://www.inia.cl/ruc-aps/
- PLYMOUTH - https://www.plymouth.ac.uk/research/institutes/sustainable-earth/sphere/intelligent-decision-making
- Pricecheck - https://www.pricecheck.co.za/offers/208478229/Agriculture+Value+Chain+-+Challenges+And+Trends+In+Academia+And+Industry+-+Ruc-aps+Volume+1+++Paperback+1ST+Ed.+2021
- SPRINGER - https://link.springer.com/book/10.1007/978-3-030-51047-3
- TWITTER - https://twitter.com/ruc_aps?lang=en
- ULIV - https://news.liverpool.ac.uk/2016/06/29/e1-3m-grant-help-agriculture-cope-unstable-climate-economics/
- ULIV - https://www.liverpool.ac.uk/humanities-and-social-sciences/research/blog/2018-posts/ruc-aps-online-workshop/
- ULIV - https://www.liverpool.ac.uk/humanities-and-social-sciences/research/blog/2018-posts/jorge-hernandez-brussels/
- ULIV - https://www.liverpool.ac.uk/humanities-and-social-sciences/research/blog/2018-posts/ruc-aps-online-2020/
- UNLP - https://memorias.lifia.info.unlp.edu.ar/project-profile?vid=OID(5DC45A216B50D99FF75326EF)
- UPV - https://rucaps.files.wordpress.com/2020/05/ruc-aps-ws-osafsc-demo.pdf
- WALMART - https://www.walmart.ca/en/ip/Agriculture-Value-Chain-Challenges-and-Trends-in-Academia-and-Industry-RUC-APS-Volume-1-Studies-in-Systems-Decision-and-Control-280/PRD600JHWDYTTDS
- WEB - https://ruc-aps.eu/
- YOUTUBE - https://www.youtube.com/channel/UCtNveXgqkBaeBE8YPJhvO8A/videos

Invited Industry KeyNote Speaker

Making food supply chains shorter, fairer, more resilient and more sustainable through common ownership. Nick Weir, Open Food Network, UK

Nick Weir is a facilitator working with farmers, growers, community food enterprises and software experts to build short food supply chains and resilient, sustainable local food economies. He was a founding Director of Stroud Community Agriculture which is now held up by the Soil Association as a Beacon Community Supported Agriculture project; Stroudco Food Hub CIC which is a producer and buyer co-operative that has provided inspiration for many other community groups to set up Hubs based on this model; and Open Food Network UK which is a fast-growing network of online community food hubs, farmers markets, buying groups, food banks and village shops building resilient local food economies.

Summary

The Open Food Network was developed in 2012 in the belief that if we are going to build better, fairer, more resilient, more sustainable food systems then we need to build them with fundamentally different tools than the tools that were used to build the current system. This means tools that are in common ownership and which are controlled by the large numbers of farmers, growers and food enterprises that are using those tools. The Open Food Network uses open source technology to build and evolve a toolkit for farmers.

This presentation will include live screen share demonstrations of how the Open Food Network works for farmers, growers, food enterprises and their buyers and shoppers. It will also cover how the global Open Food Network community is spreading with 20 countries currently using the software and another 15 in the process of deploying. There will be time for questions and answers and exploration of how the Open Food Network can integrate with other technologies.

Development and extension for vegetables production through a regional program in La Araucanía (Chile). Gabriel Saavedra, INIA Carillanca, Chile

Gabriel Saavedra Del Real was born in Santiago de Chile, studied agronomy at the Pontificia Universidad Católica de Chile, completed an MSc and PhD at the University of Edinburgh, United Kingdom. He has been working at INIA for 34 years, initially in the seed production area until 2001, then he began to work in the vegetable breeding program at INIA La Platina (Santiago) specializing in sweet corn, artichokes and garlic. In 2019 he moved to INIA Carillanca in Temuco to work on vegetable development programs up to the present. He has published several scientific papers in specialized magazines, written several book chapters in the vegetable area and published a series of technical bulletins on the subject. He was lecturer on the subjects of vegetables, weed control and Plant Production Engineering at the Faculty of Agronomy of the Universidad Mayor in Santiago. Founding member of H2020 RUC-APS and FAO consultant for the Republic of Equatorial Guinea.

Summary

The production of vegetables has been taking great importance in the Region of La Araucanía due to the effects of climate change in the country. The highest concentration of production is in the central area where, at the same time, there are the largest markets due to the large population that inhabits these regions. However, the lack of water for irrigation due to the lack of rain and high temperatures have caused the movement of vegetables production to areas that were not so benign before, but which have become very attractive now, such as the Region of La Araucanía in southern Chile. For this reason, INIA Carillanca proposed to execute a series of projects and programs financed by the State of Chile in the development of vegetables production in the region, in order to determine the existing gaps in the value chain of vegetables and propose a route in the short, medium and long term. Through these initiatives, the program "Improvement of the competitiveness of the vegetables production sector in La Araucanía with the purpose of transforming the region into the supplier of vegetables for the southern zone and export" was born, financed entirely by the Regional Government of La Araucanía and executed by INIA Carillanca. This program aims to improve the production and commercialization of the vegetables sector for regional family agriculture, contributing to its development as an alternative for the reconversion and diversification of production systems. At the same time, develop and attract investments with high growth potential, in order to increase the participation of the various sectors in the economic structure of the region and thus improve regional competitiveness and the international economic insertion of Araucanía, creating the conditions that allow more expeditious access to consumer markets, whether internal or external.

Mapping Access to Healthy Food in Liverpool: The Role of Transport, Time, and Store Type. Ana Campos Marin, University of Liverpool, UK

Dr Ana Campos Marin joined the Virtual Engineering Centre (University of Liverpool) in 2018 as a Project Engineer, using her academic background in physics simulation to utilise digital technologies including simulation, data analytics, advanced modelling and visualisation, to support the digitalisation of SME's within Liverpool City Region.

Summary

The COVID-19 pandemic has multiplied the number of people suffering from food insecurity – disrupting opening times of stores, available transport and monetary costs associated with food access in ways that will likely persist for many months beyond government restrictions. This restrictive access to healthy foods could lead to long-term poor health outcomes, limiting child development, putting additional pressure on NHS resources, and reducing economic output.

The University of Liverpool's Centre of Excellence for Sustainable Food Systems underwent research into how different types of food is distributed across the Liverpool city region, highlighting variables including types of stores, availability of food types and access to these for a range of neighbourhoods through opening times and travel routes including bus paths. The Virtual Engineering Centre developed a digital interface which would capture all of these variables and demonstrates this data to food providers and local authorities, to encourage change and the reassessment of existing policies that could lead to better access to foods for disadvantaged and vulnerable groups, developing a resilient, sustainable regional food economy.

The session will start with a brief high level presentation of the project and will discuss how the dashboard can function as a tool for local actors in food retail, food provision, and infrastructure planning to identify critical areas of poor access to healthy food, identify the reasons for poor access, and design efficient interventions or alter business plans. The food mapping dashboard will be demonstrated showing the underlying factors that contribute to food access such as store distribution and opening hours, store type, transport networks, etc. Dashboard functionalities will be demonstrated by analysing example regions in the city with different levels of access to healthy food.

Adding Value: Red and purple flesh potatoes a healthy and attractive alternative for the new global challenges. Maria Teresa Pino (INIA, Chile)

Dr. María Teresa Pino, Head of National Food Area until 2021 and researcher from INIA Chile (Instituto de Investigaciones Agropecuarias). In 2006, she received a PhD in Horticulture Department, in Oregon State University, in EE.UU. She is working for new global challenges for agriculture, including raw materials for food Ingredients and their adaptation to climate change. Coordinator and research leader in several competitive national and international grants, and private covenants. She has authored or coauthored more than 100 publication (ISI, scientific, proceeding and extension). These publications have been cited more than 750 times by other articles. In 2021, she was recognized by "Guardianes de la Mesa Award for scientific excellence", as corresponding author by most cited publication of the year. In 2020, ANID (National Research and Development Agency of Chile) recognized PAI I7817020005, as outstanding Project for Program of Attraction and Insertion of Advanced Human Capital in the productive sector, M. Teresa Pino was postulant and advisor. In 2017, she received an IICA reward as leader women in agriculture science for Latin America. In 2014, she was recognized with "FONTAGRO Award for Scientific Excellence", as research leader project for international grant in climate change adaptation. Also, in 2004 she received Outstanding Graduate Student Award for Horticulture and Crop Science Department. in Oregon State University USA. She has been invited as speaker, in several conferences, such as: AGTECH conference in SILICON VALLEY FORUM California, USA (2017), in APEC Workshop on Greater Cooperation on Scientific and Technological Innovation for Higher Added Value in Food Production Chain, Beijing China (2018), in AGROTECH PUBLIC-PRIVATE LINKAGE FOR ATTENTION OF NICHE MARKETS-BID Nicaragua (2019), among others.

Summary

Red and purple fleshed potatoes are not only a promising crop for starvation problems, also their consumption may prevent chronic diseases. Anthocyanin-rich extracts from red and purple fleshed potatoes have high potential as natural colorants with multiple applications in the food industry (lake, flour, food colouring). Also, these potatoes contain an important group of secondary plant metabolites associated with antioxidant activity. In addition, potato is a very efficient food crop and it produces more dry matter and proteins per unit area in comparison to cereals. For every m3 of water applied to the crop, Potato produces 5600 kcal of dietary energy, compared to 3860 in maize, 2300 in wheat and 2000 in rice. Thus, and because of its high nutritional value and yield, cultivated potatoes constitute the bulk of the economically and agronomically important crop production. It accounts for large quantities of dietary daily energy intake compared to other crops.

Oracle Technology Enabling Traceability for Agribusiness in Latin America. Prasen Palvankar, Oracle

Prasen Palvankar is a Senior Director at Oracle responsible for product strategy and product management of Oracle Intelligent Track and Trace application. He has been with Oracle for over 20 years and has managed multiple products such as Oracle Iot Intelligent Applications, Oracle BPM, Oracle SOA Suite etc. He also has extensive experience as a technical consultant delivering complex application development projects having worked as Technical Director in Oracle Consulting for 6 years and also having founded and managed a consulting startup for 8 years prior to joining Oracle.

Summary

Gain multi-tier visibility into supply chain networks, track and trace products for faster results, detect and resolve issues, and establish trust between trade partners in different countries and continents. In this session, you will learn how Oracle Intelligent Track & Trace, can help customers record transactions from multiple sources to provide track and trace reporting in a purpose-built application. Using distributed ledgers to record non-disputable transactions from multiple partners, organizations can share information and documentation on animal conditions, vaccines, medication, feed type, genetic material, transgenic data, certificates, lot, licenses, and much more, into a single interface accessed by multiple parties sharing and guaranteeing provenience and compliance across multiple markets

Decision Support Systems in pig production systems, Lluís M. Plà, University of Lleida, Spain

Dr. Lluís M. Plà-Aragones is an associate professor in the Department of Mathematics at University of Lleida (UdL), researcher at Agrotècnio and a Senior Researcher in the Area de Producción Animal at the extincted UdL-IRTA Research Center. His research interests include operational research methods applied in agriculture and forest management, with special reference to simulation, dynamic programming, production planning, Markov decision processes and shceduling. Most applications and contributions have been done for the pig sector, but also in the fresh fruit and sugar cane industry. Co- ordinator of the EURO-Working group: Operational Re-search in Agriculture and Forest management and leader of the CYTED network devoted to BigData and DSS in Agriculture. He is a member of INFORMS and EURO.

Summary

Decision support systems (DSS) is the natural framework where decision models should be included in order to support farmers, advisers or livestock management specialists in the decision making process. During last years, the increment of competition between pig producers caused the marginal benefits per unit of product to reduce. A concentration of production to maintain past profit levels is performed. In this context, there is an increasing interest in DSS tools capable of dealing with the uncertainty inherent to pig production systems for practical decision support. In this talk the development of DSS for pig systems representing either the productive and reproductive behaviour of a group of breeding sows over time and their mathematical foundation are reviewed. It is in the aim to detect strong and weak points making DSS more suitable for practical use, explaining why actually few farmers and specialists are using them. New DSS tools adapted to particular production patterns beyond individual farms and the irruption of the internet of things are also important issues in future developments. In addition, Artificial Intelligence, Big Data, Data Analytics and cloud services are expected to impact on the development of a core of more intuitive, intelligent and integrable DSSs. Arguments presented, discussion and conclusion can easily extended to other livestock systems.

IoT and Data Technologies applied to minimize Frost Damages on Vineyards. Lucas Iacono, Know-Center, Austria

Dr. Lucas Iacono received the Electronics and Electrical Engineering degree from the University of Mendoza, Argentina, in 2007 and the PhD Diploma from the same institution in 2015. Currently, he is a Senior Researcher in the Knowledge Visualization group at Know-Center GmbH. In this position, he performs investigations in the fields of Data Acquisition and Data Analysis in both: Precision Agriculture and Automotive. His research interests include the Internet of Things, UAVs, Wearable Sensors, Driver in the Loop technologies, and Cloud Computing.

Summary

The last decade has been disruptive for Agriculture due to the new frontiers opened by data acquisition, processing and analysis technologies. Breakthrough technologies such as drones, the Internet of Things, multispectral cameras, Cloud Computing and artificial intelligence are a reality that is now available for farmers.

Among other advantages, these technologies can minimize crop's damages caused by different meteorological phenomena, such as frost and storms. In this case, weather data can be collected using IoT devices like wireless sensors and streamed to the Cloud in real-time. As soon as the data are available in the Cloud, AI algorithms can analyze them and provide valuable analytics about frost occurrences. Then, the analytics are used by farmers and specialists to activate different frost deference methods like wind machines or sprinklers. Besides the above example, other problems in Agriculture can be faced using these technologies. Some of them are pest and diseases early detection, yield forecasting, etc. In summary, thanks to modern technologies, it's possible to enhance the quality of crops and the economic benefits of small, medium and large agricultural producers.

This presentation will detail the latest trends about the technologies that specialists and farmers can use to acquire, process and analyze data in agriculture, specifically, the ones focused on Frost Predictions and Frost damages minimization on vineyards. We will also provide concrete examples of our experiences and research applying technologies to reduce frost damages and economic losses on Vineyards located in the Province of Mendoza, Argentina.

The challenge of enhancing sustainability in urban and peri-urban agriculture production systems of AMBA region, Andrés Polack, INTA, Argentina.

Andrés Polack obtained his degree as an agronomist with an orientation in zootechnics at the Faculty of Agronomy of the National University of Buenos Aires. He studied postgraduate studies at the Faculty of Natural Sciences and Museum of the National University of La Plata where he obtained a doctorate in Natural Sciences. As a researcher he has carried out work to develop adequate methods for the control of the main pests of horticultural crops under cover. These methods include monitoring systems, biological and low-impact pesticides, and biological pest control. In December 2018 he became director of the Buenos Aires Metropolitan Area Agricultural Experiment Station (EEA AMBA)

Summary

The INTA Experimental Station of Metropolitan Area of Buenos Aires, known as AMBA region, considers one of the major urban and peri-urban areas of Argentina and one of the biggest in Latin America. In addition, the highest levels of horticulture production in the country are found in that region. The Experimental Station focus on attending a wide range of variety of agriculture producers that include from self-consumption allotments to capitalised, high technology producers. Moreover, it is likely to find apiculture, dairy cattle, pork and poultry small-scale producers. The main challenge for the agriculture production system is to be sustainable through time maintaining competitiveness in terms of productivity and economic results. On the other hand, it is expected to reach resilience focusing on agroecological practices and ecosystem services in addition to local food supply. These challenging conditions became more complex since facing shocks such as COVID-19 pandemics, climate change and economic crisis. In this context, to promote sustainability of the agriculture production systems the strategy lays on a system and supply chain approach. It is vital to consider the efficiency in terms of minimising the use of external supplies and the optimisation of natural resources management. There is a high potential in using organic production wastes such as the ones from poultry, agriculture, food industry, as a basis for soil fertilisation and bio fertilisers for crops. In addition, combining biological control as an environmentally effective means of reducing and mitigating pests through the use of natural enemies as an alternative to chemical pesticides could be the basis for integrated pest management and disease control. Another key aspect to consider is the association among producers which will lead to strengthening their commercial networks and strategies, promoting high quality and traceability processes through the whole productive chain. Finally, it is necessary to enhance land management in peri-urban agriculture production systems and to promote new environmental policies in order to reach stability in terms of urban growth and production development, to provide valid answers to the current up-to-date challenges in AMBA region and to support decision-making processes that help producers to remain stable and to be valued as their role of food providers. The INTA AMBA is committed to this challenge through research and extension work considering a multi-disciplinary team that lead all those priority lines of work. The strategy includes collaboration with institutions such as universities and other national and provincial institutions related to agriculture production systems subject. One of the main aims is the development of sustainable productive models based on the previous experience revealed by pilot trials which are constituted as models to be replicated in the future. Some of the expected results are the reduction of food production costs in order for them to be affordable to the local population, particularly to those low-income segments which face limitations regarding access to quality food.

Europe Horizon research challenges and opportunities. Néstor Etxaleku, Zabala, SPain

Néstor Etxaleku is an Agronomist Engineer from the Public University of Navarra (Spain). He has worked at Zabala Innovation since 2007 becoming an expert in Corporate Innovation Management, Tax deduction for R&D and environmental investments, International bidders, Implementation of new businesses and Open Innovation. He was in charge of the start-up of the Zabala headquarters in Valencia for 2 years. He is currently a Senior Consultant focused on the fields of food and beverage, agriculture, bioeconomy, rural development and the environment. Within Zabala he has managed various projects and related activities oriented to these fields, being he the internal manager of European calls directed to these issues. He has been Zabal's representative in the Spanish Biocluster (SBIOC) and has actively participated in EU-funded projects such as SENSE with the aim of introducing Blockchain technologies in traditional sectors.

Summary

The Farm to Fork Strategy is at the heart of the European Green Deal aiming to make food systems fair, healthy and environmentally-friendly. With this strategy, the European Commission aims to redesign our food systems which today account for nearly one-third of global GHG emissions, consume large amounts of natural resources, result in biodiversity loss and negative health impacts (due to both under- and over-nutrition) and do not allow fair economic returns and livelihoods for all actors, in particular for primary producers.

A relevant tool to support activities that implement this strategy is the H2020 and now the Horizon Europe (HE) programme. The HE is the biggest European programme supporting the R&D and Innovation. Specifically, inside the HE there is the Cluster 6 – Food, Bioeconomy, Natural Resources, Agriculture and Environment in pillar 2. This cluster 6 will contain the main calls with opportunities for submitting proposals that aim to support the implementation of the Farm to Fork Strategy, as well as related ones as the Circular Economy, the Bioeconomy or the Biodiversity strategies.

In 2021, the calls for proposals area already closed, but new opportunities are going to be opened in the next months. Two specific calls for project for farm to fork projects will open next 28th October and will finish the 15th of February 2022. During our presentation will present these new opportunities as well as some examples of previous projects already funded by the European Commission in H2020 programme:

- FoodRUs: is working to tackle the food waste and losses by creating resilient food systems across nine European regions. To achieve this, the project will test 23 circular solutions through diverse forms of collaborative innovation, including: technological (blockchain solutions to manage food losses and waste), social (educational materials and citizen science activities to promote sustainable consumption habits), organisational (last mile networks to foster local consumption and donation), and fiscal (new ‘Pay As You Throw’ schemes).These innovative solutions will empower and engage all actors in local food systems, from farmers to end-consumers and everyone in between, to build a multi-actor alliance to tackle the challenge of food loss and waste
- GO GRASS: During four years, GO-GRASS is developing cost-effective and sustainable circular business models considering social, economic and environmental circumstances in rural areas across Europe. By harnessing regional assets, GO-GRASS aims to diversify and revitalise rural economies and provide quality jobs and opportunities in co-operation with entrepreneurs and local authorities. The raw materials obtained will go into the production of bio-based products replacing existing fossil-based alternatives, such as fertilisers or plastic-packaging. Reclaiming otherwise lost natural resources could have a considerable impact on the reduction of greenhouse gas emissions at EU-level. The project targets large-scale replication especially in remote communities with unexploited resources.

Knowledge investment per ha: taking global food production towards a sustainable future

Rejane Souza, Yara Americas, Brazil

Rejane Souza, Yara's VP Crop Knowledge and Agronomy is a passionate agronomist, who grew up on a farm and comes from the farming business. She has also pursued some other titles during her career and holds a masters degree in Strategic Marketing and Administration and another one in Commercial Management, besides more than 14 years of experience, in the agricultural business. She's had the chance to work in many areas such as agronomy, sales, marketing, R&D and also value chain projects. Her strong belief on a more sustainable food production system transformation for the future, is what drives her actions and projects

Summary

Have you ever wonder that technological development in the field and sustainable food production were antagonists processes? Have you imagined that the more we add input and investments, the more the risk of degrading the natural resources such as water, soil and the higher the emissions of GHG? It is unfortunately quite normal that people still reflect upon such questions, concluding that professionalizing agriculture to get scale and efficiency is a bad thing. Well, the great news is: development and conservation are not antagonists at all. In fact, they are the way out in terms of getting a more sustainable way of producing food now and in the future.

You may ask: how? The answer is simple, not easy to implement, but simple in a way. The more knowledge we are able to invest in the fields, in terms of rationalizing and optimizing the input of crop nutrition, crop protection and other materials, the more the chances of improving the yield, quality of food produced and hence, impact water use efficiency, land use efficiency, carbon footprint, biodiversity and soil health, due carbon addition to the soil. In times when we are invited to have sense of urgency, with people still starving and with only 9 seasons to reach the reduction of emissions promised by global leaders, it's of utmost importance to act.

Why do we still send to waste from +30% of vegetables and fruits produced globally? Would a longer shelf-life enable us to get more food to more people and avoid wastage? What about biofortification, would it be also a key topic for us to focus more in depth?

I am a strong believer. I believe that we already have most of the knowledge and tools required to do better in the field. We do have years of global research, public and private sectors have been strongly dedicated to find answers for the challenges faced by the farmers, the starting point of the whole food chain. So, why do we still have strong yield gaps worldwide? What is the missing link?

Scientia potentia est (Knowledge is power). This expression, attributed to Sir Francis Bacon, could not be more right! However, knowledge without application is almost useless. The answer then: make sure the knowledge grows and flows, towards the direction of millions of farmers across the globe. Demystify best production practices, simplify according different development levels but keep moving towards enabling farmers to become best every day.

Our answer as Yara: a digital transformation that takes more than one century of agronomic knowledge to farmers across the globe, in form of digital ag solutions meant to solve farmers' problems; a strong footprint of +1,000 agronomists who have their boots on the ground and keep the flow of needs mapping running, so we can focus on even more tailor made solutions; a portfolio of crop nutrition solutions which addresses crop, soil and climate specific situations (substantiated by a strong global research program), hence high performance and use efficiency of nutrients, water and lower CFP per unit of food is possible; and last but not least, strategic partnerships with food companies, academia and peers. The challenges are out there, but we truly believe we can act right now, if we stick together.

Abstracts Publications

Session 1: Agri-Food Operations, Decision, Risk and Uncertainty Modelling and Simulation

Sustainable Planning of Crops Planting, Cultivating, Harvest, and Commercialization through Multi-Objective Optimization. Ana Esteso, M.M.E. Alemany and Angel Ortiz

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Farmers usually plan the crops to be planted and harvested independently. However, planning the planting centrally offers advantages to the supply chain to which they belong, such as maximising the profits made. Centralised decision-making also has disadvantages, such as the creation of inequities in the distribution of profits among farmers. To exploit the advantages of centralised decision-making while reducing its main drawbacks, this paper proposes a multi-objective mixed integer linear programming model to centrally plan crop planting, cultivating, harvest and commercialization that optimises five objectives aligned with sustainability, namely: maximising supply chain profits (economic), minimising waste (environmental), minimising unsatisfied demand (social), maximising freshness (social) and minimising economic unfairness among farmers (social). The model is validated through its application to the case study of tomatoes in La Plata region of Argentina. The results obtained by this model are compared to those obtained by an equivalent model that only optimises the profits of the supply chain. From this comparison, it is concluded that: (i) the multi-objective model offers more socially sustainable solutions at the expense of reducing supply chain profits by 1 to 20%, (ii) all solutions of the multi-objective model provide higher freshness of products at the time of sale, and drastically reduce the economic unfairness perceived by farmers to be negligible, (iii) most of the solutions maintain similar values of unsatisfied demand, while the waste generated is higher than that obtained by the single-objective model, (iv) the area to be planted per tomato variety differs according to the solution obtained.

A comprehensive analysis on the agri-food supply chain risks and resilience capabilities through using a systematic literature review. Guoqing Zhao and Shaofeng Liu

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Agri-food supply chain (AFSC) is an area of significant importance because of providing sustainable, affordable, safety and sufficient food, feed, fiber, and fuel to consumers. However, it is still unclear about which resilience capabilities are more effective for reducing AFSC risks. For addressing this gap, this paper involves a systematic literature review (SLR) to provide a comprehensive analysis on the AFSC risks, AFSC resilience capabilities, and build relationships between different resilience capabilities and risks. From this SLR, eight types of AFSC risks, seven types of AFSC resilience capabilities, and a one-to-one correspondence resilience-risk model that address the key relationships and correlations between resilience capabilities and risks are discovered. Besides, six future research directions are suggested: (1) A cross-country comparative analysis to deeply understand risk and resilience management; (2) Identify the risk and resilience strengthen strategies considering a multi-sector approach in the areas of pork, infant food, animal feed, and beverage supply chains; (3) A longitudinal study to determine the long-term resilience capabilities effects; (4) Understand resilience from supply chain collaboration, traceability, redundancy, knowledge management, innovation, leadership and flexibility points of view; (5) Investigate the positive effects of AFSC risks for triggering resilience capabilities, and (6) Understand the relationships between resilience and other disciplines through academic cross-pollination.

Blockchain applications for agriculture supply chains. Maria Angeles Rodriguez, Llanos Cuenca and Ángel Ortiz

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Digital transformation is understood as the integration of digital technologies such as Internet of Things (IoT), Big Data and Blockchain into strategies, products and processes in all areas of the organization. This implies an adjustment in the way of working and a change in the culture of the company. In 2021, digital transformation has become one of the European Union's priorities. The European Parliament is working to create the right policies to digital transformation in order to provide new opportunities for companies. Hence, this is a call to action for organizations and companies in any sector. However, agriculture is one of the sectors that is lagging behind the race of digital transformation. For instance, in this sector the concept of Blockchain first appeared in studies from 2017 and the term IoT in research from 2010. Therefore, this paper provides the different applications of Blockchain in agricultural supply chains to offer help in the digital transformation path. Specifically, we begin by explaining the concept of Blockchain and how it works, focusing on the potential it has as a distributed database. Moreover, we offer a description of the applications of Blockchain to agriculture, how this technology can help automate and improve agricultural supply chain activities like quality control, storage, or distribution of products. Finally, we present issues, current trends and challenges of Blockchain in agriculture.

Optimization of the supply chain in the meat industry. The case of pork meat supply. Joan Anglada Llovera, Rudi De Castro and Oriol Solé Cases

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In Meat production activities, the management is aiming to reduce the cost of production along the supply chain, mainly raw materials as it makes up 80% of the total pricing of their products. Some of the ideas are related to reduce the sources of raw material and its inventory. For this project, we have designed a theoretical model which includes all the variables and production parameters of a company.
In order to optimize this model, we have coded a linear program so that, after its execution, we can have a solution with the minimum total cost, including storage costs, and taking into account all the constraints: non-negative stock, not exceeding the maximum amount that a supplier offers, supplying all the necessary meat for the orders and its relation of lean-fat for all the products and satisfying the limits of four more characteristics of the final products (such as collagen percentage and colour). Afterwards, this model will be implemented in a firm, so we have develop a view in order to assist to a more user-friendly program. We have created a spreadsheet to save all the data needed for the linear program, including possible types of meat to buy and all their characteristics and orders to produce. After the execution of the code, the spreadsheet will show the data of the solution: the total cost, the amount of each type of meat to buy and how to distribute it for the production orders, the characteristics of the final products and sensitivity analysis data.
This project will be a decision support tool for Casademont 1956 Meat SL which is a company that makes charcuterie products. The result is to establish a better relationship with suppliers and a better understanding of required materials. Moreover, the amount of raw material will be adjusted to production requirements.

Application Of Data Analytics To Agri-Food System Resilience To Exogenous Shocks: An Investigation Of The Horticultural Sector. Faith Olatoyan, Jorge Hernandez, Gabriela Sepulcri, Laura Galotta and Marie Mcintyre

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To meet the increasing demand of food consumption in an ever-growing global populace, the concept of resilience in Agri-food supply chains (AFSCs) has been established in literature to being an extremely important subject to be strengthened owing to prevailing supply chain volatility and uncertainties from exogenous disruptions. These uncertain conditions such as climate changes, unexpected economic and political changes, new regulations and invasion of pests and diseases among others have led to fluctuations of agri-food supply in the marketplace posing a challenge to food security. Today, the recent trend in the application of data analytics to many other fields has proven its relevance to further support Agri-supply chain concepts for improved efficiency and effectiveness. This study therefore explores the use of a structured questionnaire administered to AFSC stakeholders across the value chain in Nigeria & Argentina. The study commenced by drawing on concepts across fields on system resilience and narrowed down to the critical dimensions of agri-food system performance. Overall, agri-food supply value chain resilience was conceptualized as the ability of a value chain to recover on time in the provision of its essential services in the face of exogenous shocks and disturbances through on-time detection and on-time response to the unexpected shocks. The findings indicate that the complexity of AFSCs and subsequent exposure to almost constant external interference means that disruptions cannot be a one-off event. Thus, resilience must reflect the ability to not only maintain core functions but also adapt to changing conditions based on the occurrence of simultaneous risks in the environment. Conclusively, this study utilized the application of data analytics to agri-food systems in gaining an understanding of the prevalent elements of resilience across horticultural stakeholders in AFSC in Argentina & Nigeria, leading to the proposition of business models that will be helpful to AFSC stakeholders in rethinking their existing business practices and adopting new technologies to ensure that their business will continue to operate properly in the face of shocks and disturbances.

Review On Iot Applied To Operations Management In The Horticultural Supply Chain. Eduardo Cañizares and Faustino Alarcón

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The application of the IoT has already reached all sectors of society. In some sectors it is more advanced and developed, it is facilitating decision-making, optimizing resources, to achieve the best results. The supply chain of the horticultural sector has very specific characteristics in which the IoT and the application of new technologies can represent a great advance in its management so that decision-making is much easier and more accurate. This article shows a brief state of art with definitions, latest contributions in reference to the IoT applied to operations management and how it affects decision-making within the Supply Chain of the horticultural sector. Several questions are raised for research such as the following, What variables affect the Operations Management in a Supply Chain of the horticultural sector? What new technologies are available to reduce or eliminate uncertainty in this Supply Chain? Can the IoT solve the problems of the Supply Chain of this sector? This research work aims to review and analyze current trends, to assess the positive impact they may have and contribute to improving decision-making by each of the members of the Supply Chain.

Session 2: Agriculture production systems, sustainability and climate change

Effects of Ca during bulking period on yield productivity in Solanum tuberosum var. Pukará-INIA. Ingrid Martínez and Ivette Acuña

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Calcium plays an important role in the productivity of Solanum tuberosum L., which moves with water in the xylem and very little water moves to tuber tissues as compared to leaves. The objectives were to evaluate the effects of different fertilization treatments: i) NPK, ii) Ca, iii) NPK+Ca-100, iv) NPK+Ca-200, and v) control treatment. For treatments NPK+Ca- 100 and NPK+Ca-200, the calcium was applied at a rate of 100 kg ha-1 CaNO3 and 200 kg ha-1 CaNO3, 6 weeks after crop emergence (bulking period), respectively. The variety evaluated was Pukará-INIA, released by INIA in 1993. The soil was volcanic in origin, an Andisol of the Osorno series (Chile), characterized by low bulk density. This study determined the effects of fertilization on aerial biomass, roots biomass and tuber dry weight evaluated three weeks after the calcium nitrate application. At harvest was measured yield productivity and calcium concentration on tubers. The results showed that NPK+Ca-200 increased aerial biomass compared to NPK and the control treatment by 28% and 36%, respectively. The same tendency was observed for root biomass but no significant differences. Tuber dry weight was higher at the NPK+Ca-200 by 30% compared to NPK. At harvest, the NPK+Ca-200 treatment averaged 74 Mg ha-1, which accounted a higher yield by 10% compared to the NPK treatment and by 28% with the control treatment. Moreover, calcium concentration on tubers was significantly higher in Ca-100 and Ca-200 with an average of 327 mg kg-1 Ca, while the others treatments obtained 184.8 mg kg-1 Ca, which is associated to a lower incidence of black spot bruise. Moreover, this could also reduce the incidence of tuber rot diseases caused by Fusarium and Pectobacterium. These results demonstrates that calcium concentration and tuber yield productivity can be significantly increased by appication of calcium nitrate during bulking period.

Genetic Base Broadening in vegetables, a breeding tool to mitigate the effect of climate change in quality and production. Gabriel Saavedra, Elizabeth Kehr and Maritza Bastias

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For years, breeders have confined their programs to a relatively small part of the overall genetic resource, producing increments in yield and quality, but from the environmental point of view, fragile populations. Climate change has been producing several modifications in agriculture and vegetables production through biotic and abiotic stresses, increasing the use of agrochemicals and moving the production areas toward less damage areas; however, more important facts are the decreasing available water for irrigation, new pest advent and global temperatures increases that directly affect the vegetables production. Then, observing the current situation of agriculture regarding the effect of climate change on its development, it is necessary to take initiatives that mitigate and lead to solutions for this area. Genetic base broadening (GBB)is one approach which has been suggested as a means to provide a viable sustainable genetic base. It has been defined as the incorporation and re-synthesis of populations from wild relatives, landraces, and/or old varieties into relatively new varieties and accessions. There are several wild relatives of vegetable species in the nature that can be exploited and used on breeding programs, generating new varieties with more rusticity, efficient in water use, and/or resistant/tolerant to biotic stresses. For example, the incorporation of multiple genes from Solanum cheesmanii have brought results in tomato tolerant to salt stress, solid soluble content increases and water use improvement in modern tomato hybrids. However, it is known that these processes have a long term to achieve results, but if the breeder has a wide genetic pool where to work, the probabilities of success are more real. This presentation pretends to analyse how GBB can help to mitigate the effects of global warming in vegetables production.

Climate change impact over brassica vegetables development. Adolfo Donoso

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Climate change most accepted consequence is a temperature rise to year 2100. Potential impacts over agricultural crops production systems are of high complexity. Vegetable's production system consists in short growing cycles along the agricultural season. A rise in temperatures is expected to increment the brassica crops duration in the field, thus the importance of quantifying the impacts of climate change for vegetables production systems. A greenhouse and field essay were stablished during 2021 in INIA La Platina. In this study, a nonlinear multiplicative phenological model was evaluated for brassica crops. Utilizing climate change scenarios, the effect of expected temperature increments over the duration of development stages in various brassica horticultural crops are assessed. A high phenological diversity is observed among the commercial brassica varieties. Further studies among diverse environments are need to asses local adaptability.

Brief survey of food technologies and biotechnologies facing food availability, accessibility, and adequacy. Loris Pinto, Nicola Calabrese and Federico Baruzzi

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It is well known that 20-30% of food production is lost along the agri-food chain as well as the global human population is expected to rise up to 9 billion people by 2050. The average food waste ranges from 13 to 91 kg/capita/year in households, food services, and retail. Recent estimates suggest that 8-10% of global greenhouse gas emissions are associated with the disposal of food waste. Uncertainty in the food production and its distribution across the world is one of the issues responsible for undernutrition. On the other side, developed countries have to face an increasing number of overweight and obese people. Thus, social policy addressed to food security and the research and technological efforts to extend food shelf life and recover nutrients from food waste and by-products have the goal to reduce food uncertainty across the food chain.
Here, we outline the application of different non-thermal technologies, such as pulsed and UV-light, high power ultrasounds and high-pressure processing, thermo-sonication, microwaves pulsed electric fields and advanced oxidation processes, and biotechnologies, largely represented by lactic and acetic fermentation, to extend food shelf-life as well as to recover bioactive compounds from by-products and wastes of the food chains The new strategies aimed at exploiting health benefits of specific phytochemicals extracted from these sources, that in some cases are pursued within academic-enterprise networks in the frame of national and European projects, are also briefly reported.

Circular economy. Use of industrial waste as organic matter in agriculture. Constanza Jana, Cornelio Contreras and Victor Alfaro

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Circular economy is a term used for the activities of reducing, reusing and recycling in production. Is characterized with low consumption of materials and resources, low pollution level and high efficiency. Soils of the northern part of Chile are characterized by their low content of organic matter, which is directly related to the moisture retention capacity of soil with productivity of horticultural crops. In order to improve the water retention capacity of the soils in arid zones and the productivity of the crops, organic amendments from industrial residues from the algae exportation industry were applied, in lettuce and potato crops, within a scheme circular economy. Algal by-products not used by the brown algae exportation industry (L. berteorana and L. trabeculata), were evaluated on desert storm type lettuce and in potato of cardinal variety. Both crops were grown in the Pan de Azúcar Experimental Plot (30° S), Coquimbo, Chile. The coberture fraction was evaluated in both crops. In the case of lettuces, two irrigation treatments were included, 100% and 80% Crop evapotranspiration ETc. Also doses of different algal waste were included. In the case of potatoes, brown algae were evaluated separately and in mixtures in doses different. In the case of lettuces, when soil moisture was restricted, it was possible to obtain a higher aerial biomass with amendments of algal residue than with a control without application, regardless of the dose. However, the dose equivalent to 35 t ha-1 was the one that obtained a lower percentage of non-commercial plants. In the case of potatoes, a higher commercial yield was obtained in relation to the control without application, when both algae were mixed and in doses equivalent to 30 and 40 t ha-1. The results of the study showed that is possible to recommend the use of algal waste in agriculture.

Seed vs. vegetatively propagated globe artichoke in Mediterranean environments: a life cycle assessment (LCA) study. Kledja Canaj, Vito Cantore, Francesca Boari, Andi Mehmeti and Nicola Calabrese

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Globe artichoke is an important vegetable crop native to the Mediterranean region where is widely grown; the European immigrants introduced this crop in the Americas especially in California, Argentina, Peru, and Chile. The crop is commonly propagated vegetatively utilizing offshoots, 'ovoli' (underground dormant shoots), or rhizome parts, often self-produced by the farmers. However, in recent years, new seed-propagated cultivars, hybrids, or open-pollinated, have grown in popularity due to higher uniformity, high crop productivity, resistance to diseases, and profitability. On other hand, seed-propagated needs a nursery procedure for producing artichoke plantlets, which environmental impact is usually underestimated or not acknowledged. With increasing attention to sustainability issues, there has come a rising interest in metrics for measuring and comparing environmental impacts farm-level practices. Using a classical environmental life cycle assessment (LCA) and exergetic life cycle assessment (ELCA) this study evaluated the efficiency of resource use and environmental impacts of 1 kg vegetatively propagated versus seed-propagated globe artichoke production in Southern Italy. The assessment considered all phases from the preparation of the seeds at the nursery to the harvesting of artichoke at the farm gate. It included resources for farming (fertilizers, agrochemicals, fuel, electricity, water, irrigation materials and infrastructure, machinery) and farming settings and productivity indicators (planting density, cycle length, and yield). The LCA results are characterized by employing a wide portfolio of environmental indicators (Climate change, acidification, toxicities, eutrophication, water consumption, etc) using the Recipe 2016 model. Thermodynamics-based resource indicator—cumulative energy demand (CED), cumulative exergy demand (CExD), and cumulative exergy extraction from the natural environment (CEENE) were further calculated. This is the first study of its kind to provide a thorough understanding of how propagation techniques of globe artichoke cultivation affect natural-resource consumption and the environment and which propagation technique has the better overall performance.

Session 3: Decision support systems and digitisation in agriculture

MLR-O: Semantic Web Support for Interoperable Food Safety Legislation. Carlos Enrique Pintor, Carlos Francisco Ragout, Diego Torres and Alejandro Fernández

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Agrochemical substances and its derivatives are used throughout agricultural processes to control the presence of different types of pests. The MRL (Maximum Residue Limit) is the maximum concentrations of residues (expressed as mg/kg) to be legally permitted in or on a food by national or regional legislation. Governments and Health Organizations throughout the globe determine and publish recommended values of MRL periodically, so that all interested parties (e.i. public health agencies, farmers, researchers, consumer organizations, traders, etc.) are able to adopt this information to conduct safe practices. These values have a significant impact in human health and in international food trade. Given the lack of official or standardized guidelines regarding how this data should be produced and published, organizations around the world use a wide range of methods and supporting media for publishing documents on MRL, involving different formats (e.g. pdf, xml, csv, etc.), content types (tables, graphics, lists, etc.) and language. There is no formal curation process on the data itself to prevent including inaccurate terms, syntax errors, omissions, synonyms and proprietary data structures. The diversity in publication formats makes it difficult to process and analyze the datasets by using computers due to incompatibility issues among documents from different sources, or even between versions of the same document. The Semantic Web offers an alternative to address this interoperability challenge.
In this work we apply semantic web technologies and tools to design and create MRL-O, a specific ontology to represent MRL-related data. In building MRL-O we reuse, as much as possible, existing ontologies and vocabularies. As a proof of concept, we present the results of feeding our pipeline with real datasets found in official documents from Argentina and Brazil to obtain MRL-O data, and we run SPARQL queries on the results to derive information of interest in different scenarios.

Knowledge discovering from multiple sources in agriculture value-chain. Diego Torres, Mario Lezoche, Alejandro Fernández, Leandro Antonelli and Herve Panetto

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The agri-food value-chain results from the interaction of multiple stakeholders. Each stakeholder contributes with a distinct perspective and interest. The diversity in activities and work forms in the value-chain results in a wide variety of data sources, and data management practices. It is common to find information managed in databases, document repositories, or even social media. Document formats also vary (e.g., CSV, PDF, XML, etc.), and so do content types (e.g., graphics, tables, lists, images, etc.). In this context, effective decision-making relies heavily on the availability of interoperable, comprehensive, accurate, and timely information. Knowledge graphs (KG) are graph-based data models for knowledge extraction from multiple structured and unstructured sources that support multilingual integration. KG are frequently combined with knowledge discovering approaches like embedding and multi-relational data mining methods like the Formal Concept Analysis (FCA) and its extension the Relational Concept Analysis (RCA). This work proposes an automatic pipeline process to combine and align different agri-food information sources to discover new pieces of knowledge based on KG and RCA. The approach combines several research lines: (1) entities and relations detection in different sources; (2) alignment with a shared ontology description, based on GACS and AGROVOC, and (3) discovering new knowledge with Relational Concept Analysis in the shape of association rules formalized following the description logic.

An approach to derive use acceptance test for software development in the agricultural domain. Leandro Antonelli, Guy Camilleri, Diego Torres and Pascale Zarate

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Developing software is a process involving several actors who have different knowledge and point of view of the domain. The activity remains still complex because of the technical complexity of building the software application but also because of the need to consolidate the knowledge of all the participants. This is even more complex in the agricultural domain, where practices and participants all over the world are very different although they pursue the same goal. Thus, the testing step is challenged and many systems fail to meet users' needs and expectations. This abstract proposes a strategy to make the testing step easier, generating User Acceptance Tests (UATs) in an automatic way from requirements captured through Scenarios that captures the situations in the agricultural domain regarding the knowledge of the stakeholders involved in different regions characterized by different concerns. Then, our proposed approach also uses the Task/method paradigm coming from the Artificial Intelligence field to deal with the situations described in the Scenarios in order to derive the UATs. The proposed strategy is an extension and evolution of an approach we have been developing during the last 4 years and consists of an iterative cycle of defining Scenarios using natural language, converting them in a semi-automatic way to a structured representation in Task / Method model, in order to obtain automatically a tree with all the combination that should be tested in order to assure the correctness of a software application that would implement the requirements stated in the Scenarios. We have developed some case studies in the agricultural domain as a proof concept of the applicability of our approach.

Exploring the impact of Big Data analytics capability on port performance: The mediating role of sustainability. Xiaotian Xie, Yi Wang, Sarah Tuck and Luciana Dalla Valle

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Recent interest in Big Data has led many supply chain practitioners to incorporate Big Data analytics capability (BDAC) into their strategies to enhance organizational performance. Despite ports being a significant node in the supply chain, limited attention has been paid to the port performance changes that BDAC entailed and how BDAC should be leveraged by ports. To fill this gap, the purpose of this study is to explore both the direct and indirect effects of BDAC on port performance, as well as using port sustainability as a mediator. This paper develops a higher-order BDAC model following resource-based theory and Big Data, sustainability, and port performance studies. To test the research model, this study used an online survey to collect data from 175 port managers and ports' IT employees with Big Data related working experiences. The study applies the partial least squares structural equation modelling for analysis. The study identifies that port BDAC can be built by data, technology, basic resources, technical skills, managerial skills, data-driven culture, and organizational learning resources. Especially, data-driven culture plays a significant role in developing BDAC. It also shows that BDAC positively and significantly affects port performance. Ports can enhance their operational efficiency and customer orientation by developing BDAC. Further, the result confirms the strong mediating impact of port sustainability on the relationship between BDAC and port performance. Thus, ports should improve BDAC and port sustainability together to enhance port performance. The study extends the supply chain management literature by evaluating the importance of various BDAC dimensions and testing the impact of BDAC on port performance. It also offers a new perspective on the BDAC mechanism that enhances port performance. Through enhancing port performance, food supply chain could become more flexible.

Knowledge Graphs for Phytosanitary Control of Musaceae. Wilmer Henry Illescas Espinoza, Diego Torres and Alejandro Fernandez

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In this study, research on Knowledge Graph in the agricultural context is analyzed to establish its potential applications in the phytosanitary control of Musaceae cultivation due to its economic importance for developing countries. Systematic qualitative and exploratory mapping was used, based on the following research question: What have been the trends in the use of Knowledge Graphs in the phytosanitary management of Musaceae cultivation? The search strategy of the articles was marked by the following keywords: Agriculture, Knowledge Graph, and diseases. The corpus was made up of 25 publications processed through content analysis. Agricultural studies with the Knowledge Graph were found to be an emerging field in technology research. They are used to improve the standardization, storage, and reuse of good practices in the field. Specifically, in the phytosanitary field, the following applications are envisaged: (1) Taking advantage of the semantic web, the crop life cycle traceability is integrated into an application to identify phytopathogens and diseases attacking it and suggest preventive care strategies to reduce the risks of the plantation. As a result, it promotes the intelligent phytosanitary control of Musaceae cultivation. (2) Integration of multiple and heterogeneous information silos for the service of recommender agents or APIs that generate fast and reliable responses to the requirements of the crop. The Knowledge Graphs strengthen the paradigm of intelligent agriculture, reducing uncertainty and improving the resilience of its value chain. Undoubtedly, its use expansion increases the profitability of the plantation, reducing risks during the development of the crop in correspondence with the 2030 SDGs.

Agro-Knowledge Integration: Developing a FAIR data science approach for adding value to the agricultural supply chain. Diego Torres, Mario Lezoche, Cesar Collazos, Victor Codocedo, Regina Motz, Leandro Antonelli, Herve Panetto and Alejandro Fernandez

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Farms are the engine to support rural employment making a considerable contribution to territorial development. Even though they have always been considered a cornerstone of agricultural activity in the European Union (EU) and in Latin America, this sector most often suffers from very low efficiency and effectiveness, sensitivity to weather, market disruptions and other external factors. Two different problems in knowledge sharing are present in this domain. First, the various interoperability regulations between the countries. Although some efforts are done to bypass this problem, like the EU-Mercosur signed in the summer of 2019, the different process semantics implemented in each region are a serious threat to the fulfillment of the process interoperability. Another problem is that in most of the cases, the knowledge transferred from generation to generation is paramount from a cultural point of view, but most of the time, it does not answer to the needs nor the requirements of the agri-food value chain. We aim at creating the core technology for a knowledge hub that integrates and aligns international regulations in agricultural activities, such as FAO's best practices, and possibly the last-born EU-Mercosur regulations with the local restrictions, such as national policies, allowing the small farmers to access, in an easy way, a wider market through the certification of the practices and products. In order to develop this core technology, we propose to deploy various methodologies and tools working on the domains of knowledge formalization, domain alignment and visualization. The domain of formal representation allows for the semantic alignment of rules and restrictions from different institutional regulation bodies. Simultaneously, we will propose a model for incoherence detection letting us to highlight contradictory regulations. Those knowledge atoms and constructs will be represented through some visualization information interfaces according to the users' needs. The methods and tools that will be employed are at the same time the pillars from the multi relational data mining (MRDM), the artificial intelligence (AI), the knowledge formalization (KF) domains, but will extend the interoperability properties of those domains to become a new interesting and valuable tool for the presented problem. This abstract is issued from an accepted Stic-AmSud project that wad elaborated during the secondments of the RUC-APS project.

Session 4: Innovation in regional challenges in the Agri-Food Sector

Chemical alternatives characterization in crop protection on tomato, in the horticultural belt of La Plata, Argentina. Susana Gamboa and Mariana del Pino

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Tomato cultivation is the most important of the horticultural crops in the Green Belt of La Plata, for its cultivated area, high production cost and technology involved. Since January 4, 2021, the mandatory implementation of Good Agricultural Practices (GAP) for horticulture is in force. GAP would provide safer products for consumers, production with lower environmental impact, and greater job security for workers. Crop protection is generally a limitation for the implementation of GAP. Analysis of phytosanitary applications carried out in this crop, indicate the application of up to 10 and 15 different molecules throughout the crop. Insecticides predominate (60%); 13 and 19% of them are of high toxicological categories, mainly for the control of Thysanoptera and Lepidoptera (Metomil, Piridaben). Various compounds from the group of neonicotinoides are used; they are criticized for their impact on bees and their high persistence, which makes it difficult for natural enemies to be installed. In pests, such as the whitefly, an excessive amount of insecticide applications is observed and all of them represent risks, either for their toxicology or their environmental impact (Piridaben, Imidacloprid, Pyriproxifen, Metomil and Acetamiprid). For the control of moths (Tuta absoluta), excessive use of Thiamethoxam and other highly toxic compounds (Piridaben and Chlorfenapyr), is observed, instead of using alternatives with lower ecotoxicological risk profile. Fungicides use is mainly focused on the control of Phytophthora spp., Sclerotinia spp. and Botritys cinerea; up to 15 applications of various compounds are registrated (Mancozeb, Carbendazin and Metalaxil among them). Residues analysis carried out in the Central Market of Buenos Aires (2019) laboratory, in tomato fruits, highlights presence of certain substances (Azoxystrobina, Procymidone, Chlorpyrifos Ethyl, Carbendazim, Lambdacialothrina, Thiabendazol, Cypermethrina, Difeconazol, Bifenthrin, Promethrina, Propiconazol).

Healthy effects of functional foods from the Mediterranean and Nordic Diet. Isabella D'Antuono and Angela Cardinali

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The positive effects of the Mediterranean Diet on health have stimulated a considerable research effort to better understand the role of bioactive molecules present in foods typical of this area. Similarly, the Nordic Diet is rich in bioactive molecules that have proven effects on health. Both the eating habits are focused on healthy foods and on the development of functional foods, as whole grain, fruits, vegetables, berries, olive oil, table olives, etc. These foods are rich of bioactive components as polyphenols and secondary metabolites, carotenoids, fatty acids, polysaccharides, recognized for their beneficial effects on human health. In vitro studies and preclinical models allowed to highlight the mechanism of action of bioactive compounds in the containment and prevention of diseases related to aging, neurodegenerative, metabolic, immune system, etc. Moreover, even the human intestinal microbiota is affected by the bio-actives present in typical foods of both diets. In particular, scientific evidences shown synergic and reciprocal actions between gut microbiota and bio-actives through the modulation of microbial species and metabolites production. The proposed topic aims to highlight similarity and differences between the two Diets suggesting that the Nordic Diet could also have an advantageous effect as Mediterranean Diet.

Enhancing land management in AMBA's peri-urban areas of Buenos Aires, Argentina. Maria Gabriela Sepulcri, Jorge Hernandez, Nestor Barrionuevo, Maria Gabriela Herrera, Jacqueline Bereterbide, Gustavo Maurelis and Facundo Ventura

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The Metropolitan Area of Buenos Aires, known as AMBA region, considers the highest levels of horticulture production in Argentina. However, considering the sustained development of cities, peri-urban areas are constantly threatened, hence finding the balance between cities and agriculture developments has become a great challenge. Moreover, agriculture production systems are also vulnerable to shocks and stresses, thus mid and long-term planning processes have turned into a complex target to achieve. In fact, unexpected changes in agriculture production systems equally affect producers and local food suppliers, thus food security management becomes risky and inefficient. For this purpose, land management and natural resources of the peri-urban areas are crucial to be analysed in real time to promote informed decisions across agri-food supply chain stakeholders. Thus, this research is in line with the project "Enhancing land management in AMBA's peri-urban areas", which considers research methods such as multi-temporal analysis of high-resolution satellite images, ecosystem services assessment, soil properties analysis and interviews conducted to stakeholders. These are correlated with historical urban growth in peri-urban areas data in order to detect and quantify key changes and future scenarios, which will support the mitigation of unexpected negative effects from those changes. Including technicians from different areas, institutions like INTA, universities, municipalities, national projects and platforms, the aim of this research is to optimise the land management processes of the peri-urban areas at AMBA. By doing this, pivotal aspects are to be enhanced, like sustainability of the main agri-food activities and food security. Therefore, this research work is to provide a valid answer to current up-to-date challenges and requirements to land management in the AMBA region, specially by considering the integration of methods and technologies to support decision-making processes. Although this research does not tackle a specific scientific approach, the results are expected to contribute to a better land management in the peri-urban areas of AMBA and could be replicated in any other peri-urban areas as well. Therefore, and based on historical data from the last 40 years, the current urban evolution has been revealed, which has helped to create several roundtables across parties in AMBA to analyse the current situation using the multi-method approach proposed in this research, which has helped to increase informed decisions processes across agri-food stakeholders. In future, this research will consider land and environmental management together within a view of leading to the economic stability of producers, local markets, food supply and food security in the peri-urban areas.

Digital Livelihood Planning for Rural Transformation and Economic Transformation - A case study on Comprehensive Village Livelihood Planning. Shivam Sharma and Gajanan Rauta

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Deendayal Antyoday Yojana - National Rural Livelihoods Mission is the flagship poverty alleviation program by the Government of India. After a lot of impetus and success in community institution building the program is gearing up for the next phase where the current livelihood outreach is scaled up from existing 10% to at least 50% coverage of women Self Help Group members in the next three years. A digital livelihood planning tool called Comprehensive Village Livelihood Planning has been developed by Transforming Rural India Foundation, supported by a grant from Bill & Melinda Gates Foundation. Transforming Rural India Foundation developed a livelihood planning tool on top of it's proprietary TRI-mForm platform. The digital tool is used by the field level users (600 users) to collect data for seasonal planning (credit, material and training need) for women farmers from Self Help Groups (1.35 Lakh women farmers). The tool sends data to a custom dashboard which generates 10+ types of reports which includes plans to be submitted to Gram Sabha for inclusion into the annual planning of line departments. The seasonal plans are used by the government functionaries and local vendors to supply credit and material needs of the farmers before every season. The architecture utilises the existing National Rural Livelihood Mission MIS system and refers to the master details. The community members engage at village level forums to collect data for community assets (Land, Water, Processing Facility, Markets, Community Lands) and the gaps in the asset utilisation is discussed. Plans are prepared for these assets for improved utilisation - For Example if a pond is identified to have been silted with soil, the community can plan for digging of the pond under the National Rural Employment Guarantee Act. Secondly at the women Self Help Group level forum individual assets are planned according to the asset gaps and needs of the family, For example - Families plan for animal shelters, irrigation equipment etc for every season. These plans are shared with line departments, banks and vendors to support the farmers with credit, assets and materials for the livelihoods. It is envisaged that the following system can lead to direct benefit transfer to women farmers who miss the benefits from Pradhan Mantri-Kisan Samman Nidhi due to non-availability of agriculture land titles on their names. Secondly it can be connected to digital marketing platforms like Government E-Marketplace and Electronic-National Agriculture Market for the sale of agriculture and handicraft produce. The platform has been beneficial in mobilizing asset development funds and credits for more than 5000 women in the state of Uttarakhand. The program is being scaled up to three other states to create village and household-level livelihood plans to boost family income.