

Editorial preface for the special issue on "Decision Support Systems Innovation and Uncertainty Management in Agri-Food Systems"

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Abstract: This Special Issue publishes original papers that contribute to Decision Support Systems' Innovation and Uncertainty Management in Agri-Food Systems. Of particular interest to this issue are works that approach the topic with a perspective on sustainability, relying on a socio-technical contribution where human and social ingredients are important. The issue also includes high-quality ~~revised~~ papers, selected, and extended from the RUC-APS International Conference "Enhancing and implementing Knowledge-based ICT solutions within high risk and Uncertain Conditions for Agriculture Production Systems," held online, between November 29th and December 2nd, 2021. This editorial contains a brief overview of the seven research articles submitted by the international community.

It is undeniable that uncertainty is around every known system and agriculture is not the exception. In fact, climate change is one of the most crucial sources of uncertainty affecting not only the production systems, but also the agri-food supply chain environment which involves producers, suppliers, transport, retail, and consumers. Intelligent decision support systems are needed to better visualize and understand the real impact and implications from these kinds of uncertainties, to better support agri-food stakeholders decision making under this age of uncertainty. For this purpose, it is expected that scientific research should support this analysis by going beyond the frontiers to provide validated solutions as well as directions for future developments across the entire supply chain environment, making it more responsive to unexpected scenarios.

The Horizon 2020 RUC-APS project (ruc-aps.eu) was conceived to cover the genetic design of the seed, to the planting and harvesting processes going through all the supply chain stages and dimensions, such as agriculture, technology, innovation, science, operations research, operations management, artificial intelligence, sensors, government, public policy, regulations, industry, research and academia. Three continents (Europe, Asia, and South America) joined forces to reveal key aspects to be considered in agriculture supply chain systems once dealing with climate change. Hence, RUC-APS provided the knowledge of the full agricultural life cycle based-decision making process to realize the key impacts of every stage of agriculture-related processes. This implied the development of high impact research to integrate real-life based agriculture requirements, alternative land management scenarios, unexpected weather and environmental conditions as well as supporting innovation in the development of agriculture production systems and the impact of these systems and processes over the end-users and customers. The RUC-APS project provided the standards for integrating customized solutions to facilitate collaborative engagement with agriculture value chain stakeholders across the world.

As part of its dissemination and networking activities, and as a means to create synergy with related actions, the RUC-APS project organized special sessions, workshops, and conferences. The RUC-APS International Conference “Enhancing and implementing Knowledge-based ICT solutions within high Risk and Uncertain Conditions for Agriculture Production Systems” was held online, between November 29th and December 2nd, 2021. Following the conference, selected papers were invited to submit an improved and extended version. In addition, a call for articles was issued to the wider research community =. All submissions underwent a strict peer-review process. As a result, seven papers were selected for publication, authored by researchers from Argentina, France, India, Oman, and Spain. We summarize the contributions to this Special Issue.

The first two articles focus on planning and optimization in food supply chains, with special attention on sustainability.

The article "A fuzzy rough network data envelopment analysis approach for evaluating the sustainability of supply chains: A case study in the pasta industry", by Reza Farzipoor Saen, Seyed Amir Hossein Sadeghi, Abbas Toloie Eshlaghy, and Mahmoud Modiri, proposes a novel method to assess the sustainability of supply chains called Networked Data Envelope Analysis. The method improves upon the existing Data Envelope Analysis to deal with fuzzy rough data. The model is validated in a study of a supply chain for the pasta industry.

The article "Sustainable Agri-Food Supply Chain Planning through Multi-Objective Optimisation" by Ana Estesó, María del Mar Eva Alemany, and Angel Ortiz, tackles the frequently found imbalance between demand and supply in food supply chains. The authors approach this challenge as a multi-objective optimization problem. The proposed approach is validated in a case study of fresh tomato supply chain.

In the last few years there has been a surge of interest regarding Artificial Intelligence (AI) applications and tools in agri-food systems. The next article, "A scalable offline AI-based

solution to assist the diseases and plague detection in agriculture" by Mario Matias Urbieta, Martin Urbieta, Mauro Pereyra, Tomas Laborde, Guillermo Villarreal, Mariana del Pino, presents a mobile solution for the in-situ detection and identification of plant pests and diseases using AI to analyze photographs. The tool was evaluated in the detection of powdery mildew and cladosporium diseases in tomatoes.

A surge of interest, especially from academia, is not a synonym of a surge in adoption. In fact, adoption of innovative technologies has traditionally been a challenge in the agri-food domain. The last three articles approach the challenge of technology adoption from various perspectives.

The article "Towards Sustainable Agriculture: Key Determinants of Adopting Artificial Intelligence in Agriculture" by Amit Sood, Amit Kumar Bhardwaj, and Rajendra Kumar Sharma identifies fifteen factors that influence the adoption of AI in agriculture. This work is based on a systematic review of the relevant literature. It aims to support solution developers and service providers to enhance reachability and improve adoption of their proposals.

In a similar line, the article "An empirical investigation of barriers to the adoption of smart technologies integrated urban agriculture systems" by Vineet Kumar Yadav and Kumar Srinivasan. This research explores the barriers for the adoption of smart technologies in urban agriculture. By studying literature and interacting with stakeholders, the authors derive a decision-making framework that considers the key factors for the adoption of alternative food growing technologies.

The last article, "User acceptance test for software development in the agricultural domain using natural language processing" by Leandro Antonelli, Guy Camilleri, Diego Torres, and Pascale Zarate deals with adoption and acceptance from a different perspective. They propose a method to test software acceptance that takes into account the specificity of the agriculture domain. It uses AI (in particular, natural language processing techniques) to simplify the generation of test cases and improve their quality.

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