Revista Ciência Agronômica, v. 51, n. 5 - Agriculture 4.0, 2020
Centro de Ciências Agrárias - Universidade Federal do Ceará, Fortaleza, CE
www.ccarevista.ufc.br
ISSN 1806-6690

EDITORIAL TO THE SPECIAL EDITION ON AGRICULTURE 4.0 OF THE REVISTA CIÊNCIA AGRONÔMICA

Alek Sandro Dutra[1] and Daniel Albiero[2*]

MOTIVATION

Several authors claim that at the beginning of this, the 21st century, we are living in a time of technological disruption (SCHUELKE-LEECH (2018); AL-RAZOUKI (2016); PREVET (2016); BORT (2016); CAG (2015); WELLER (2016)); the obvious deduction being that these disruptive technologies must have an influence on the structure of our agriculture, especially with regard to modifications in the methods of agricultural production. As such, the techniques and methods of Agriculture 4.0 have become the current synthesis of this historical moment.

Aware of its role as a disseminator of state-of-the-art knowledge, the Revista Ciência Agronômica (ISSN 1806-6690, www.ccarevista.ufc.br, e-mail: ccarev@ufc.br) decided to launch an ambitious project and edit a special and/or thematic issue focused on state-of-the-art bibliographic reviews of the principal issues relevant to Agriculture 4.0. One special concern was choosing themes that would adhere to the concept of Lioutas and Charatsari (2020), where the digitisation of agriculture improves agricultural management/efficiency of agro-ecosystems via intelligent technologies that save time and resources, increasing food quality and reducing the environmental footprint.

Now, at the time of writing this editorial, after the long and sometimes painful process of assembling, regulating and formatting this special issue, it can be said that the result is a publication of high quality, including assertive information and deep understanding, that makes available to the research community in the area of Brazilian agriculture a state-of-the-art training tool on what is most modern in world agriculture.

SPECIAL EDITION OVERVIEW

This special edition features a collection of 25 state-of-the-art literature review articles on the subject of Agriculture 4.0. These can be divided into three categories: 1-Basics; 2-Infrastructure; 3-Applications. The complete set of articles focuses on topics of interest in terms of solutions and their application in agriculture.

In the article '**Trend of Technologies 4.0 in Brazil - what does the demand in the Public Selection of MCTI/ FINEP/FNDCT Innovation Scholarships 04/2020 tell us?**', a team from FINEP characterise the demand for innovation support from Brazilian high-tech companies operating in the area of Agriculture 4.0.

Researchers at EMBRAPA wrote the article '**Role of Research and Development Institutions and AgTechs in the digital transformation of Agriculture in Brazil**', in which they present the enormous potential for technological entrepreneurship in Agriculture 4.0, and define a methodology for technological acceleration and business.

Albiero *et al*., in the article '**Agriculture 4.0: a terminological introduction**', deal with the terminology of Agriculture 4.0 within a philosophy of the agricultural digitalisation that is concerned with environmental and social issues; the article undertakes an extensive survey of the technical terms employed.

In the article '**Artificial intelligence applications in the agriculture 4.0**', researchers from the *Instituto de Pesquisa Eldorado* carry out a bibliographic review of the principles of Artificial Intelligence, present interesting examples, and list the principal challenges for agriculture.

The article '**Survey on connectivity and cloud computing technologies: State-of-the-art applied to Agriculture 4.0'** by researchers from SiDi, explores ICT (Information and Communication Technology) applied to agriculture, especially the subject of cloud computing and field connectivity, using the example of a successful case study.

A team of specialists from CPqD wrote the article '**Agro 4.0: Enabling agriculture digital transformation through IoT**', where they give a broad presentation of IoT (Internet of Things) technology interfaced with other emerging technologies in Agriculture 4.0, and describe future opportunities.

Queiroz *et al*., in the article '**Sensors applied to Digital Agriculture: A review'**, carry out an extensive survey of the types, systems, characteristics and advantages of the sensors used to monitor soil, plants and crop productivity.

The article '**Computer vision applied to food and agricultural products**' by Fracaroli *et al*., presents an extensive state-of-the-art bibliographic review on computer vision systems and methods used in food and agricultural products.

In the article '**Precision agriculture and the digital contributions for site-specific management of the fields**', Molin *et al*. discuss the different approaches and technological resources of Agriculture 4.0 considering different data sources.

Costa *et al*., in their article '**Greenhouses within the Agricultura 4.0 interface**', undertake an extensive survey of the improvements that the technologies of Agriculture 4.0 have brought to the production sector under protected and controlled environments.

The article '**Precision conservation: from visual analysis of soil aggregates to the use of neural networks**' by Ribeiro *et al*., presents the concept of precision conservation as technologies linked to mappable environmental variables which can be used in planning management practices for the conservation of natural resources.

In the article '**Irrigation in the age of agriculture 4.0: management, monitoring and precision**', Silva *et al*. contextualise irrigation in the era of Agriculture 4.0 in order to address how these new technologies impact on the rational use of water.

In the article '**UAV applications in Agriculture 4.0**', Amaral *et al*. address the potential for using UAVs in agriculture, and describe the principal applications of UAVs in agriculture in the context of digitisation.

The article '**Agricultural unmanned ground vehicles: A review from the stability point of view**' by Fernandes *et al*., deals with agricultural robots and carries out a literature review from the point of view of stability, in addition to presenting criteria for the design and selection of agricultural robots.

In their article '**Technological trends in digital agriculture and their impact on agricultural machinery development practices**', Reis *et al*. discuss digital systems in agricultural machinery, and the way they affect the process of equipment design in the context of developing digital agriculture.

Cardoso *et al*., in their '**Development of a robotic structure for acquisition and classification of images (ERACI) in sugarcane crops**', present a complete project for an agricultural robot capable of classifying images by the recognition of pre-established patterns.

Weisbach *et al*., in '**Agriculture 4.0 - A state of the art review focused on electric mobility**', discuss electric mobility, such as tractors, in agricultural systems, where this discipline is becoming increasingly important.

The article '**Agricultural tractor engines from the perspective of Agriculture 4.0**' by Schlosser *et al*., gathers information on the current state and perspective of the use of artificial intelligence and advanced electronics in evaluating engines for agricultural tractors.

Lanças *et al*., in '**Agricultural Tractor Test**', present the state of the art in carrying out tests with agricultural tractors within the philosophy of Agriculture 4.0, incorporating new and advanced features.

Rodrigues *et al*. wrote '**Geostatistics and its potential in Agriculture 4.0**', where they present a long and in-depth review of the literature on geostatistics and its potential in agriculture, including a summary of geostatistical approaches.

The article '**Advances in hyperspectral sensing in agriculture: a review**' by Oliveira *et al*., presents a review of the state of the art in hyperspectral sensing in agriculture, where they describe the use of sensors and analytical techniques.

Camargo *et al*., in '**Applications of computational fluid dynamics in irrigation engineering**', present techniques and provide an overview of the use of computational fluid dynamics in the application of irrigation engineering.

The article '**Potential of using Statistical Quality Control in Agriculture 4.0**' by Silva *et al*., makes a broad bibliographic review of the use of Statistical Process Control in Agriculture, demonstrating its potential for incorporation into Agriculture 4.0.

In the article '**Energy in agriculture in Brazil**', Bhandari *et al*. present a bibliographic review of the most-recent studies to be published in the field of energy in the agricultural sector, with specific focus on highlighting improvements in current practices.

The article '**Physical and mechanical properties of biological materials**' by Dal Fabbro *et al*., reviews the literature pertinent to an analysis of the physical and mechanical properties of plant materials, focusing on scientific advances associated with the relevant techniques.

ACKNOWLEDGEMENTS

We should like to thank all the people who helped make the publication of this special issue possible. First of all, Messrs. Kildare Ferreira de Almeida and Arlindo Garcia da Silva of the editorial office of the RCA for their tireless and indispensable technical and administrative work in carrying out all the activities involved in publishing a Scientific Journal. We should also like to thank Mr. Stephen Hocker for his meticulous and accurate grammatical revision of the English language. Finally, and most importantly, we should like to thank each of the authors who have produced these wide-ranging works of excellent quality. All the authors of the articles published in this special edition were invited, based on their extreme expertise in the subject and their great international renown.

REFERENCES

AL-RAZOUKI, M. **Seven global medical technology trends**.

BORT, J. **9 tech trends from 2017 that will make billions - Business Insider**. Disponível em: <https://www.businessinsider.com/9-tech-trends-2017-billions-2016-10>. Acesso em: 22 ago. 2019.

CAG, D. **11 Awesome Disruptive Technology Examples 2019**. Disponível em: <https://richtopia.com/emerging-technologies/11-disruptive-technology-examples>. Acesso em: 22 ago. 2019.

LIOUTAS, E. D.; CHARATSARI, C. Smart farming and short food supply chains: Are they compatible? **Land Use Policy**, v. 94, n. November 2019, p. 104541, 2020. Disponível em: <https://doi.org/10.1016/j.landusepol.2020.104541>.

PREVETT, R. **15 Disruptive Technology Trends to watch in 2017 - Disruption Hub**. Disponível em: <https://disruptionhub.com/15-disruptive-technology-trends-watch-2017/>. Acesso em: 22 ago. 2019.

SCHUELKE-LEECH, B. A. A model for understanding the orders of magnitude of disruptive technologies. **Technological Forecasting and Social Change**, v. 129, n. September 2017, p. 261-274, 2018. Disponível em: <https://doi.org/10.1016/j.techfore.2017.09.033>.

WELLER, C. **11 tech trends that will define 2017 - Business Insider**. Disponível em: <https://www.businessinsider.com/tech-trends-that-will-define-2017-2016-12>. Acesso em: 22 ago. 2019.