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Agromatics: The Framework to Optimize the Agricultural Process with Information and Communication Technologies

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Abstract

To cover food necessities causing minimal environmental impact is one of the main objective of the agriculture, therefore to improve efficiency in the agricultural processes is the strategy to follow. Agronomy as the grouping of several science disciplines related to plant and animal production, has been successful in reaching this objective, however it needs to be more efficient in the information management: generation, recording, storing, and processing. Advances in information and communication technologies have been extraordinary in the last decades, and use of these technologies is relatively recent in agronomy. Convergence between agronomy and informatics requires a special framework due to the vast amount of informatics technologies that can be used for vast types of agricultural systems. Agromatics, as result of convergence between agronomy and informatics, is defined as the theoretical frame that faces the challenge of generating and managing vast amount of data coming from agricultural systems, to improve efficiency in production. To be successful in this task, agronomy uses information and communication technologies that can be grouped in those that generate and record information and those that process information. Agromatics improves agricultural processes in three ways: 1. standardizing processes to get disciplines in the processes owner 2. contributing to get high performance in the processes, and 3. synchronizing the processes.

Keywords: Agriculture; Agronomy; Animal Production; Informatics; Internet of Things; ERP; Cloud Computing; ICT

Abbreviations: ICT: Information and Communication Technology; IOT: Internet of Things; ERP: Enterprises Resources Planning

Introduction

Agriculture, understood as the crop growing and the animal rearing to get important products for the human beings, is the most important activity in any society because it provides the foodstuff for the humanity. Due to the importance of this activity, human beings have developed deep knowledge in different aspects of the production, both in the plant or animal and in the environment in which plant or animal is growing or rearing. All these knowledge, when has been systematized as different science disciplines, is grouped as agronomy. Conventional agronomy covers many different aspects such as genetics, physiology, reproduction, nutrition, soil (by itself and soil preparation for crops), climatology, entomology, pathology, infrastructure for production, etc. All these knowledge categories need to measure something on the plant/animal or on the environment in which they are growing/rearing, therefore, there is the possibility to generate huge amount of data in short time, data which many times cannot be analyzed because of time limitations.

Informatics is defined as the science of information, it means the science behind of the systems that generate, process, and store information. This concept is related to the automation of the information, therefore, informatics has the potential to improve the agricultural systems by means of generation, processing, and storing the huge amount of data derived of the agricultural activity, in an automatic way. The information and communication technology (ICT) has simplified and automated many real-world tasks [1], and agriculture is one of these tasks. Despite of agronomy is the grouping of disciplines aiming to improve the agricultural processes, is necessary to have a distinctive term which refers to the agronomy helped by informatics, this term has been defined as agromatics: application of principles and techniques of informatics to the theories of functioning and management of agricultural systems, understanding these systems at different levels such as plots, rural enterprises or productive regions [2]. Agromatics, word coming from the combination between agronomy and informatics, is the theoretical frame that faces the challenge of generating and managing vast amount of data coming from agricultural systems, to improve efficiency in production.

Tools of agromatics

The aim of using informatics tools in agricultural systems is to carry out the digital transformation, it means, to get intelligent agro-industry ecosystems. Most of the tools of informatics applied to agricultural systems can be grouped in the following categories:

To generate and record information: internet of things (IoT) is the tool with highest potential to get information of plants, animals, and environments in which they are growing. IoT is based on the concept that everyday objects can be equipped with identifying, sensing, networking and processing capabilities that will allow them to communicate with one another and with other devices and services over the Internet to achieve some useful objective [3]. For agromatics, the everyday objects will be plants, animals, or any aspect of the environment (soil, climate factors such as temperature, humidity, raining, etc.) and the useful objective will be to improve the efficiency in the agricultural process. To record information related to production, mobility devices are the best approach in agriculture due to they can be used in any place, it is not the matter if production field or farm is far away from the city. Furthermore, these mobility devices can be used to visualize information like data stored in ERP.

To store and process information: platform as Enterprises Resources Planning (ERP) are necessary in agro-industry groups, especially in those that integrate several productive activities. An ERP is defined as integrated business management applications used by industries to do all their functions as planning, production management, sales management, finance management, human resource, etc. [4], therefore, ERP has the potential to store vast amount of information, and also to analyze it to get, for example, production costs. Either sensors integrated as IoT or information coming from ERP, in agricultural systems data is generated in big amounts, it is necessary to use powerful tools to analyze all this data. Big data is the term used for this kind of information, and it is defined as the information asset characterized by such a high volume, velocity and variety to require specific technology and analytical methods for its transformation into value [5]. Such amount and variety of data, coming from sensor or coming from ERP, should be stored and analyzed in versatile structures, non-dependent on high-costs and heavy technical infrastructure. Cloud computing is the tool achieves these actions. Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction [6]. Data can be analyzed with very complex models trying to imitate the human mind, that is called artificial intelligence, and is defined as that area of computer science that mainly focus on the making on such kind of intelligent machines that work and give reactions same like human beings [7]. In agriculture, artificial intelligence can solve problems, and learn from previous cases, using logic programming, expert systems, neural networks, fuzzy logic, etc., furthermore, robots can be used for manipulating objects in agricultural processes, based on artificial intelligence.

Influence Levels of Agromatics

Agromatics influences agricultural processes at three levels: standardization of processes, high performance of individual processes, and synchronization of processes.

Standardization of processes: when an agricultural enterprises uses information and communication technologies such as an ERP, all the data and information coming from production, logistic, purchases, and sales, are integrated in only one platform [4], therefore is not necessary great affords in getting information from one to another section of the enterprise to calculate the financial impacts derived from a single production measure, or purchase, or sale, or inventory movement. When digital transformation is the objective in an agricultural enterprises, to get the standardization in the processes is the first step because it confers discipline through all the sections of the enterprise by means of administrative and operational control. Real costs and profitability analysis can be monitored in real time, giving the chance to reduce operational costs and risks.

High performance of individual processes: when discipline is reached in the agricultural enterprise, is necessary to become more efficient in the individual processes. Sensors connected as IoT may anticipate risks for the production [8], or may measure directly at the plant or animal some physiological variables related to production, or may control in detail the process. Data generated is enormous, therefore big data and cloud computing are tools to use all the information. Mobil devices let farmers to record all the information related to production *in situ*, it is not the matter if the location where the process is carrying out has not internet access. All this information in real time is useful to take correctives and improve the conditions of the process and then the results in production.

Synchronization of processes: when agricultural enterprises has discipline in the operation of its processes, and, when they have high performance, the only way to improve efficiency is to synchronize the group of processes, especially those related in the way that outputs of one are the inputs of the following. For instance, in poultry production chicken breeding and grow up farms produces as outputs female and male birds sexually mature, they are the input for chicken breeding farms, which produce as output fertile eggs, which are the inputs for the hatchery, and hatchery produces 1-day-old chicken as output, which are the inputs for broiler chicken farms. Or, for industry oriented to produce flour from any crop (wheat, maize), seeds from fields are the input for field which will cultivate these seeds to get grains as output, and this output will be the input for the industrial plant which will transform the grains in flour.

Conclusion

To improve efficiency in agricultural systems, especially those dedicated to food production, is an important task for the humanity, due to the need to cover food demand and to cause the minimal environmental impact. To use informatics tools in agriculture and join them to the agronomy is a successful strategy that has been used in the last years; however, it is necessary to build a robust theoretical frame to optimize it. Agromatics is a convergence science that takes part of informatics to contribute in increasing precision of generation, recording, storing, and processing of information coming from agricultural systems.

References

1. Shaikh FK, Zeadally S, Exposito E (2017) Enabling technologies for green internet of things. IEEE Systems Journal 11(2): 983-994.
2. Grenón D (1994) Agromática: aplicaciones informáticas en la empresa agropecuaria. Programa Nacional Prioritario de Aplicación y Transferencia de Tecnología Informática, Area de Agromática. Subsecretaría de Informática y Desarrollo, Secretaría de Ciencia y Técnica. Buenos Aires p. 151.
3. Whitmore A, Agarwal A, Da Xu L (2015) The internet of things – a survey of topics and trends. Information Systems Frontiers 17(2): 261-274.
4. Ahmed AM (2017) Evolution of enterprise resource planning. Excel Journal of Engineering Technology and Management Science 1(11): 1-6.
5. De Mauro A, Greco M, Grimaldi M (2016) A formal definition of big data base don its essential features. Library Review 65(3): 122-135.
6. Mell P, Grance T (2011) The NIST definition of cloud computing. National Institute of Standards and Technology. U.S. Department of Commerce. Special Publication 800: 145.
7. Verma M (2018) Artificial intelligence and its scope in different areas with special reference to the field of education. International Journal of Advanced Educational Research 3(1): 5-10.
8. Dlodlo N, Kalezhi J (2015) The internet of things in agriculture for sustainable rural development. Emerging Trends in Networks and Computer Communications (ETNCC). Windhoek 17-20.