DIGITALIZATION IN FARM MANAGEMENT

Ştefan VIZITEU[1], Stejărel BREZULEANU[1], Elena LEONTE[1], Cătălin Răzvan VÎNTU[2], Marius Mihai MICU[2]

[1] "Ion Ionescu de la Brad" University of Life Sciences, Iaşi, 3, Mihail Sadoveanu Alley, 700490, Romania, Phone: 0040 232 407.518, Mobile:+40749362494, Emails: stefan.viziteu@yahoo.com, stejarel@uaiasi.ro, egindu@uaiasi.ro
[2] University of Agricultural Sciences and Veterinary Medicine Bucharest, 59 Marasti, District 1, 11464, Bucharest, Romania, Phone/Fax: +40741314038; Email: catalin.vintu@managusamv.ro, micumariusmihai@yahoo.com

Corresponding author: catalin.vintu@managusamv.ro

Abstract

The paper analyzes the influence of digitalization on managerial activity in agriculture and highlights how the use of farm management software has an impact on overall economic efficiency. Romania is at the level of the European Union the country with the largest number of agricultural holdings. Farm management is one of the factors of production that can favor a positive result of the activity carried out, and innovation in this field can bring added value to the activity both in terms of organizing production processes and forecasting and especially the control performed. The study highlights and proposes Geofolia software as an example of a useful tool in digitalizing agricultural activity and how to manage the farm indicating the advantages and the need for such a tool as part of the overall process of globalization. The statistical data used in the study is represented by the National Institute of Statistics, Eurostat and Faostat, the methods used being diagnostic analysis, statistical data analysis and case study. The results of this study are indicating that farm management needs to adapt to the global trend of innovation in organizational and informational systems in order to ensure efficiency, the advantages of a farm management software being ways to increase competitive advantage in a global market.

Key words: *digital farming, agribusiness, sustainability, farm management software, Geofolia*

INTRODUCTION

Digital farming is a new approach in the management of agricultural activity in order to increase the efficiency of information use, increase labor productivity and use of available resources with the help of more accurate and easy to access evidence and control tools [14].

Digital agriculture can leverage the smart use of data and communication to achieve system optimization, the tools being multiple and varied including cross-cutting technologies such as computational decision and analytics tools [11] because there are almost no limits to the diversity and innovation of digital technologies in the agricultural sector [10].

As a strategic option, the computerization of agricultural holdings involves the design of the necessary changes in their activities and the initial high costs are offset by the direct effects on economic results [3, 12].

As organizations deal with today's challenges - the worldwide economic climate, changing technology, everincreasing globalization, and so forth - managers play an important role in identifying critical issues and crafting responses [18], the existence of a wide range of information sources and transmission media allowing management and staff, especially to make informed decisions, based on an updated picture of the situation and knowledge of alternatives and their possible consequences [7].

Digitalisation allows greater business integration, beyond the information flows management within companies, for a variety of business functions [15] and therefore it will change every part of the agrifood chain. Management of resources throughout the system can become highly optimized, individualized, intelligent and anticipatory. It will function in real time in a hyper-connected way, driven by data. Digital agriculture will

create systems that are highly productive, anticipatory and adaptable to changes such as those caused by climate change [19].

Informational systems increasingly condition the overall efficiency of the activity of any economic entity, including agricultural holdings [20] because information technology and access to information, goods and services across the globe are changing the world [1].

One of the most important solutions being put forward in policy and agribusiness circles is that of digital farming. It is presented as a suite of innovations that serve solution for the current sustainability crisis facing the food and farming sector. The initial proposals for the ongoing reform of the European Union's Common Agricultural Policy, aim at modernising European agriculture through knowledge sharing, innovation and digitalisation [6]. In the field of control system, the information system is of great importance, because with its help comparisons can be made between achievements and proposed objectives or horizontal comparisons can be made between farms [4] in order to achieve the economic optimum, the optimization of economic activity being a process that takes place gradually, starting with a certain stage of development regarding production forces and production relations, using working tools [2] .

Better agribusiness decisions play a vital role in the success of farm businesses. Informing and automating these decisions through the incorporation of innovative digital technologies is one way to remain competitive in a global field that has become increasingly high-tech. The key to incorporating a successful digital technology solution into an agricultural enterprise, from the tractor and weather station to the office computer, is the selection and use of appropriate software tools [17].

MATERIALS AND METHODS

In this paper the statistical data used in the study were provided by the National Institute of Statistics (NIS), EUROSTAT and FAOSTAT, the methods used being diagnostic analysis, statistical data analysis and case study. The study took into consideration one of the farm management software, namely Geofolia, exemplifying through images and data sets introduced in the Agricultural Management seminars in order to see its functionality.

RESULTS AND DISCUSSIONS

It is known that Romania is the country in the European Union with the largest number of agricultural holdings (Map 1). The efficiency of the agricultural sector and the increase of added value can only be achieved with the help of an performance-oriented management.

Map 1. Farms number in European Union, 2016
Source: [8].

Table 1. Active enterprises in Agriculture, forestry and fishing in Romania

Type	Indicator	2017	2019	2019/2017 (%)
Total	Number of enterprises	115,585	115,279	-0.26
	Average number of employees	144,013	139,830	-2.90
Commercial companies	Number of enterprises	19,174	18,982	-1.00
	Average number of employees	129,204	127,543	-1.29
Authorized Physical Persons	Number of enterprises	95,712	95,609	-0.11
	Average number of employees	9,788	7,721	-21.12
Other legal entities	Number of enterprises	699	688	-1.57
	Average number of employees	5,021	4,566	-9.06

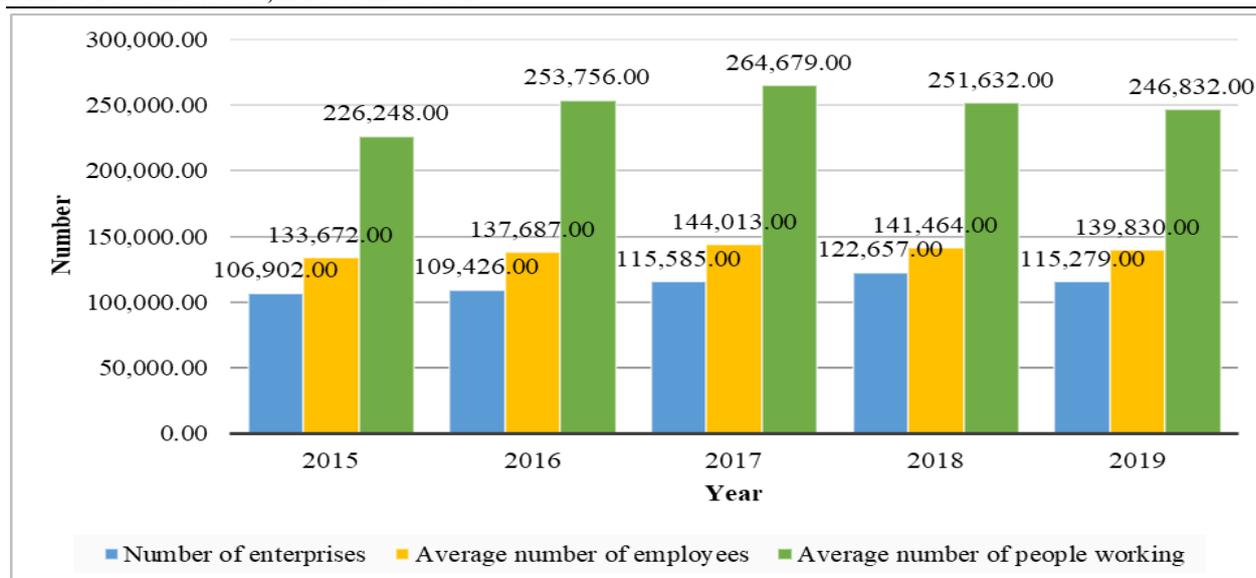Source: Own calculation using NIS Tempo on line data base [13]

Fig. 1. The evolution of active enterprises in Agriculture, forestry and fishing in Romania
Source: Own calculation using NIS Tempo on line data base [13].

Of these holdings, a small percentage has a sustained activity and an economic dimension necessary for commercial activity. At the level of 2019 for the Agriculture, forestry and fishing sector (Table 1) there were 115,279 enterprises (slightly lower by 0.26% compared to 2017).

Regarding the number of employees, a significant decrease is recorded within the category Authorized Physical Persons but overall the number of employees increased in 2020 related to 2015 by 4.6% (Fig. 1).

Globally, the value of agricultural production in the period 2015-2018 fluctuated depending on weather conditions and climate change, which increasingly affect the agriculture of all countries, standing in 2018 at 3,550.2 billion $ (Fig. 2).
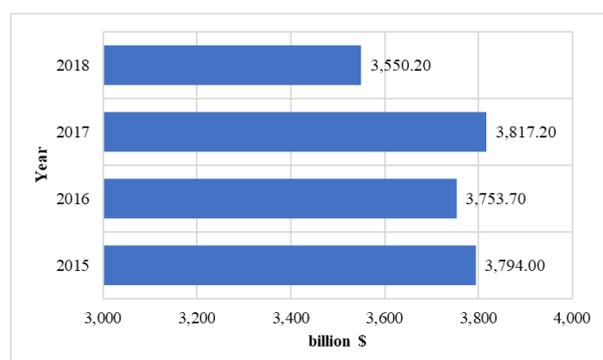

Fig. 2. The value of the world agricultural production 2015-2018 ($ billion)
Source: Source: Own calculation using FAOSTAT data base [9].

These numbers were also influenced by the technologies used in agricultural activity, by plant and especially animal diseases that affected this sector but also by the agri-food policies adopted by each country.

The value of agricultural production for 2020 in Romania was Lei 81,400 million, with a distribution depending on the specifics, characteristics and quality of the soil and the potential of each county (Map 2), the highest value being held by Timiș County with Lei 4,057 million.

Map 2. The value of the production for the agricultural sector in Romania by counties (Lei million) - 2020
Source: Own calculation/charting using NIS Tempo on line data base [13.]

The innovation and the level of innovative activities in the agriculture has to keep up with the other sectors from economy. FarmTech and AgriFood Tech need to

develop in order to insure performance for the agricultural holdings and the companies related to agri-food field. In 2019 global farm tech funding reaches its highest level since from 2012, investment growth beeing consistent over the years, investments in farm management softwares recording in 2019 a percentage of 19% from the total (Fig. 3).
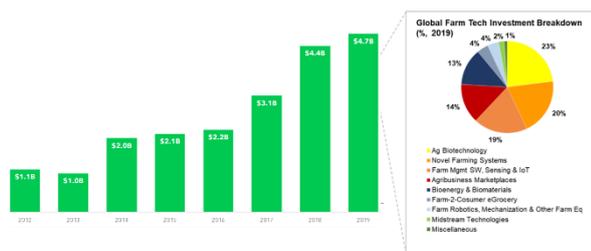

Fig. 3. Global Agritech Funding ($ billion, 2012-2019)
Source: [5].

The number of active smart farming services are increasing all over the world especially regarding smart shared assets (Fig. 4) needed in a digitalised era.
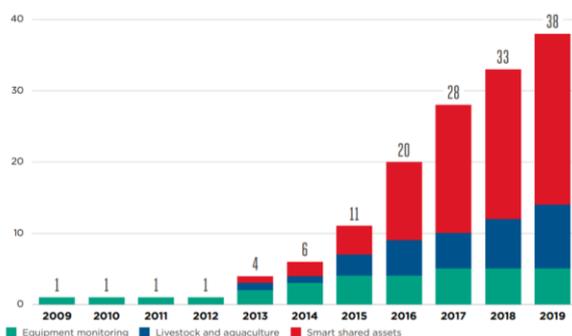
Fig. 4. Number of active smart farming services by sub-use case, 2009–2019, world
Source: [16].

Digital farming represent the use of digital technologies in order to incorporate farm production from the field to the market. The innovations required will provide resources and knowledge for the agricultural industry helping in taking more informed decisions and in increasing productivity.

Digital agriculture market is forecasted to grow at a growth rate of 9.60% in the period of 2020 to 2027. The demand for agricultural food products which is growing will act as a driving factor to the growth of the digital agriculture market.

From potential agriculture digitalisation variants it was selected Geofolia software. GEOFOLIA is a farm management software developed by the ISAGRI company. Through this program farmers can achieve an integrated management of the agricultural system, can ensure a clear record of the processes carried out on the farm and can make analyzes and comparisons between different situations and identify areas for intervention. It is a software with an extensive coverage between farmers, only from the North-East area mentioning Semtop Group, Agricola Târgu Frumos, Agralmixt SRL, Agrocomplex Lunca Pașcani or Comcereal Vaslui For students who intend to learn or develop their skills to manage a farm using modern tools, the software can provide a modeling and simulation of the activity of a farm, being the managers of their own entities, with their own decisions regarding the structure of crops, applied technologies and capitalization of production. Through this software they can understand the practical operation of farms, given that many companies in the field use this application and they can determine the economic efficiency of the farm and immediately observe the changes as a result of new parameters. Geofolia makes connections with Agrotechnics, Agrochemistry, Phytotechnics, Phytopathology, Topography and Mechanization combined but also with Management, Production Systems, Accounting, Rural Economics or Economic Analysis, necessary elements for a manager of an agricultural holding.

The program uses Bing maps to highlight cadastral parcels, being a program developed in collaboration with Microsoft Company.

It can create records for several years and make comparisons between different situations, works and plots. The creation of the land parcels and the operations of modifying them are intuitive and with a friendly menu which facilitate understanding (Photo 1).
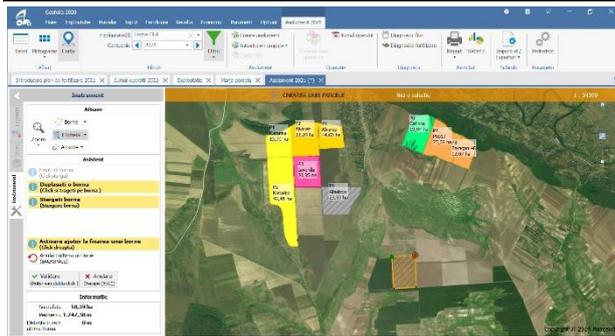
Photo 1. Cadastral land parcels in Geofolia
Source: Own records using Geofolia farm management software

The software allows the addition of specific operations for each land parcel (plowing, sowing, herbicide, etc.) and it can also make group introductions if a work is performed on several land parcels in the same period. Each work has a certain fuel consumption and, possibly, a certain input consumption that must be specified in order to quantify the total costs (Photo 2).

Photo 2. Records of the agricultural works in Geofolia
Source: Own records using Geofolia farm management software.

With the help of this software it can be identified, established and viewed the fertilizer doses for each land parcel and crop, the reports on the fertilization plan required in relations with third parties (eg APIA) being easy to generate based on the data entered (Photo 3).
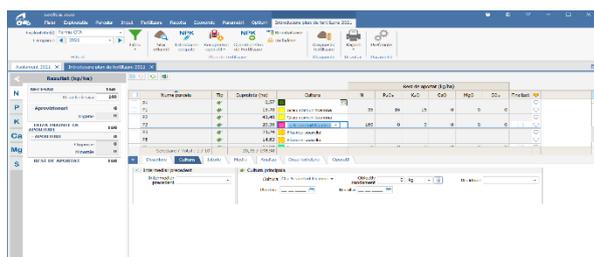

Photo 3. Records on the used fertilizers in Geofolia
Source: Own records using Geofolia farm management software.

One of the documents required by various institutions is the Register of phytosanitary treatments (Photo 4). This document can be generated through the application that keeps the history for all land parcel for several years.
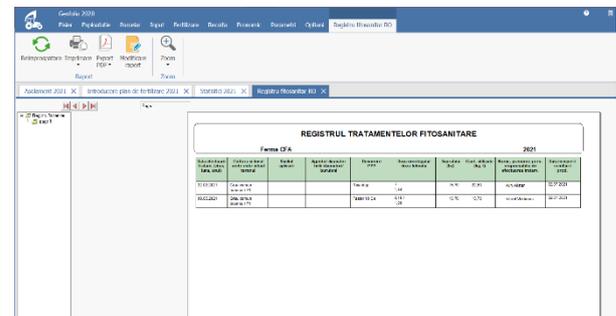

Photo 4. Register of phytosanitary treatments in Geofolia
Source: Own records using Geofolia farm management software.

Also within the reports it can be prepared situations that can be used to record works, plots, traceability of agricultural products, technology sheet for a particular crop, these can be done after entering the initial data (Photo 5).
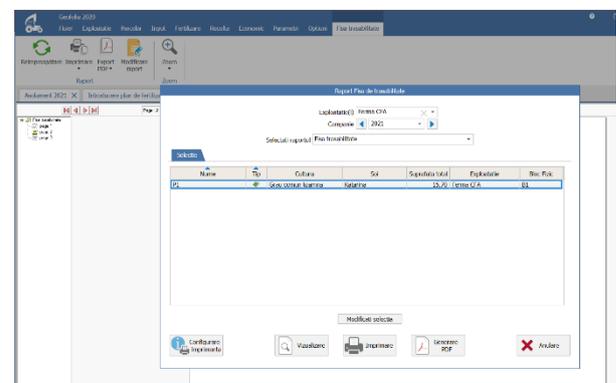

Photo 5. Generating reports in Geofolia
Source: Own records using Geofolia farm management software.

The report of the interventions on each land parcel indicating the chronological sequence of operations such as the equipment used, the related workforce and the inputs managed is another document that can be formatted, downloaded and listed in order to prepare activity files or simple records (Photo 6).

Photo 6. The report of the interventions in Geofolia
Source: Own records using Geofolia farm management software

One of the most important aspects revealed through this software is the economic efficiency of each crop, each land parcel or the whole farm. This element can be identified with the help of comparative data (Photo 7), suggestive graphs related to the allocation of expenses, the realized income or the realized commercial margin wich indicates the economic efficiency of the agricultural activity.

Photo 7. The economic efficiency in Geofolia
Source: Own records using Geofolia farm management software.

The efficiency can also be visualized during the data entry through the graphs associated with each land parcel and which express the situation of fertilization at a given time, the expenses allocated up to that time and the level of profitability established based on the elements introduced (Photo 8).

Photo 8. The expenses allocation in Geofolia
Source: Own records using Geofolia farm management software.

The performance and in general the economic results of a farm represent the elements that are analyzed mainly to understand the activity carried out. The software allows the updating of the efficiency elements as the data is entered or modified in such a way that the user can benefit from real-time changes and, consequently, take the necessary measures.

CONCLUSIONS

The digitalisation of agriculture has become an increasingly important „*sine qua non*" element in the development of the agricultural sector as part of the global economy, with the new technologies in the field evolving at a rapid pace.
The phenomenon of „smart farming" has become more and more widespread but it is not just a matter of surface because economic efficiency is increasingly influenced by the speed of information, easy access to data provided through electronic equipment and a efficient management based on an optimal organization of field data in a unitary and interconnected system.
Agricultural production is what supports many of the manufacturing industries and, most importantly, provides food for the population. Digitalization in global farm management and in Romania in particular leads to general economic development and efficient use of resources.
One of the tools that can be used to digitalize farm management is Geofolia software which provides better coordination of farm activities, facilitates the link between field and office work, creates necessary reports and data and

provides an overview of the general activity both technically and economically.

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