Bulletin of the *Transilvania* University of Braşov
Series V: Economic Sciences • Vol. 9 (58) No. 1 - 2016

Perspectives for Romania on adopting agricultural innovations

Lavinia DOVLEAC[1], Marius BĂLĂŞESCU[2]

Abstract: *This paper highlight the efforts Romania needs to do on the path of agricultural development through innovation. A smart, modern agriculture could contribute to a wide variety of economic, societal and environmental goals. Considering its potential in this sector, Romania should learn from the experience of other European countries how to manage its rich resources. Innovative technologies, products and practices can help make the most efficient and sustainable use of natural resources, and thereby improve farming process.*

Key-words: *innovation, agriculture, smart farming.*

1. Introduction

Research and innovation are crucial tools to achieve a smarter and sustainable agriculture sector. Anthea McIntyre, member of European Parliament said that "*As the global population rises, satisfying the demand for healthy food and optimal nutrition is one of the biggest challenges facing the world. Technological innovation is a vital part of the solution. Agricultural technologies, in particular, have the potential to make farming more productive and more sustainable*". (FoodDrinkEurope, 2015)

The agricultural sector needs to step into the digital era because of the rising demand for agricultural products. The introduction of the new technologies helps farmers to manage their farms in a sustainable way. Innovative technologies can range from IT solutions to cropping systems.

The introduction of new information and communications technologies in the agricultural sector could significantly contribute to its future sustainability, as well as the quality of life for farmers and consumers. Innovations will improve the

[1] Transilvania University of Braşov, Faculty of Economic Sciences and Business Administration, lavinia.dovleac@unitbv.ro
[2] Transilvania University of Braşov, Faculty of Economic Sciences and Business Administration, marbalasescu@yahoo.com

quality of crop production, the quality of livestock health, but also, crucially, the quality of life for farmers.

There are two areas where genuine innovation is required to drive the "sustainable intensification" agriculture. The first is from the policy perspective: international structures for cooperation in the agri-food sector must be strengthened and deepened. The second area is on farms and at all stages of the agricultural production process, where technology and innovation can create numerous improvements (Gotev, 2015).

The future agriculture will be agriculture of knowledge. New hardware and software systems will improve agriculture in a multitude of ways (European Crop Protection, 2014).

2. The agricultural context of Romania inside EU-28

The value of agricultural production in Romania last year amounted 3.95% of the total production in the European Union. France, whose agricultural production is estimated to 18% of the EU's production ranks first, followed by Germany with 13% of the total, Italy - 12.3% of total, Spain - 10.47% of total and the UK - 7.8% of the total (Lupu, 2015). The figure below shows the structure of agricultural production for the European Union.

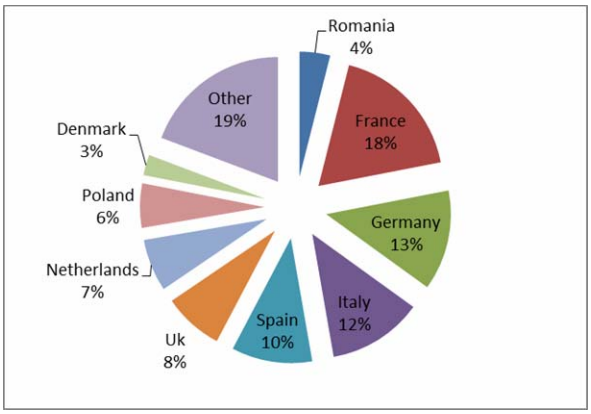

Figure 1. Structure of agricultural production in EU-28

Within the European Union, production is being concentrated on larger-scale farms, but progress is slow. About 70 per cent of EU holdings have an area of less than five hectares and around half are defined as semi-subsistent. At the current pace of change, it will be many years before EU agriculture arrives at an optimum structure. (Rickard, 2015).

Romanian farm sizes cover a wide spectrum, influenced by land use. Very large corporate farms are concentrated mostly in south and east. The persistence of the fragmented land structure of Romania through the last 20 years, despite the expectations of many land consolidation experts, is largely due to the important role subsistence and semi-subsistence farming plays in providing livelihoods where pension and welfare payments are extremely low, food prices are similar to that of Western Europe, and access to credit is difficult (ADEPT, 2013).

Figure 2 shows the structure of Romanian rural holdings by size. 2.8 million holdings (71%) are under 1 ha in size and hey account for 35% of Romania's agricultural area. 1.04 million holdings (27%) are between 1-10 ha, regarded as semi-subsistence farms and they account for 21.2% of Utilisable Agricultural Area (UAA), and mostly produce primary products for home consumption. These farms are estimated as producing 25-30% of national food consumption. 60,000 farms (1.6% of Romanian holdings) are between10-100 ha and they cover 10% of Romanian's UAA). Only 12,000 farms, 0.3% of holdings, are commercial operations over 100 ha which cannot be considered too large as family farms: they occupy 34% of UAA (Otiman, 2013).

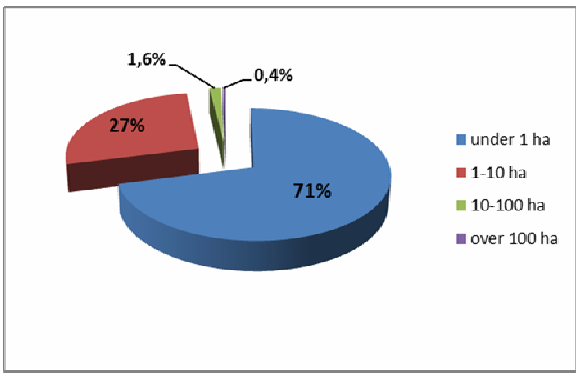

Figure 2. Structure of Romanian rural holdings by size

3. Sources of innovation in agriculture sector

Innovation has to be driven by farmers in order to be able to respond to their needs and they have to be involved in the research processes from an early stage. This is crucial for the future of rural areas. Farmers never stop innovating. Every generation brings new technological and organisational improvements. Farmers generate innovative solutions themselves that often go unnoticed by public. There is a huge amount of hidden knowledge that needs to be revealed and efficiently used and more should be done here.

Collaboration is the key to making innovation happen. Collaboration is especially relevant when speaking about opportunities in *digital agriculture* where technologies need to be adapted to users' needs. This means giving farmers and agri-business leaders the tools and confidence to reach out to new partners in the ICT and digital industry (Europa.eu, 2016).

The first step in innovating and adapting technologies is research. The development of new products, processes and practices always involves repeated testing both under laboratory conditions and in the field. Pilot projects are critical in understanding how the new technology can be implemented and what other solutions are required to make the business model work.

Climate smart agriculture is one of the key topics for the almost 3,000 innovation projects that are expected to receive funding from the Rural Development budget. Around EUR64 million will be dedicated to precision farming and digital technologies in the agriculture sector under the Horizon 2020 Work Programme for 2016-2017 while EUR30 million will be invested in the implementation of an Internet of Things Large Scale Pilot on "Smart farming and food security" (Michalopoulos, 2016).

An "*agri-tech revolution*" begins to express in this sector. The promotion of hi-tech in agriculture is sustained by programms like the European Innovation Partnership on 'Agricultural Productivity and Sustainability' (EIP-AGRI).

The innovation model under the EIP-AGRI goes beyond speeding up the transfer from laboratory to practice (referred to as the "linear innovation model"). The EIP-AGRI adheres to the "interactive innovation model" which brings together specific actors (e.g. farmers, advisors, researchers, businesses, etc) to work together in multi-actor projects to find a solution for a specific issue or developing a concrete opportunity (Whealbi, 2015). The new Common Agricultural Policy for 2014-2020 prioritises innovation in order to help the sector adapt to the new competitive environment, and promote "greener" policies.

4. Innovative solutions for agriculture development in Romania

There are many different techniques and technologies that can be applied to farming. They include crop improvement, biotechnology (including genetically modified organisms), GPS (global positioning systems), GIS (geographic information systems), planting, picking and spacing technology, water management, and irrigation (McClelland, 2013).

4.1 Tech-innovations in agriculture

The more traditional mechanical components of agricultural work are also modernizing and increasingly digitizing. Europe is a leader in automated farming

machinery. Machinery for working the land is becoming larger, smarter and more autonomous. While driver-less cars for general traffic are only beginning to show up on the horizon, robot farming is a hotbed for innovation (Europa.eu, 2016).

▪ *New information and communications technologies*

The European Commission wants to build "bridges" between agriculture and the ICT sector in order to better address the environmental challenges of farming. Information technologies could help farmers reduce the EU's emissions of greenhouse gases, 10% of which come from agriculture (Michalopoulos, 2016).

Smart farming apps could also benefit farmers and consumers. With the help of ICT solutions, companies can inform small-holders about weather forecasts and new products or services. A number of SMS-based services in developing countries provide up-to-date market and price information. Smallholders can inform companies about production status and demand for inputs or support. **Herdwatch** (https://www.herdwatch.ie/) is a cloud-based farming app, started 3 years ago in Ireland, which allows cattle farmers manage their beef or dairy herds via a smartphone, tablet or computer. **"Map your meal"** is an agriculture-related smartphone application which aims at enhancing the public awareness understanding of global interdependence via exploring the global food system (Michalopoulos, 2015b).

▪ *Innovative solutions in agriculture*

Precision farming is emerging as an innovation-driven solution. Precision Agriculture (PA) is a farming management concept which involves data-based technologies, including satellite positioning systems like GPS, remote sensing and the Internet, to manage crops and reduce the use of fertilizers, pesticides and water (European Parliament, 2014).

Precision farming technologies are still expensive and unaffordable to most farmers, especially for the smaller ones. For certain technologies, larger farmers were among the early adopters of what have been smarter and more precise versions of farm machinery, while smaller farmers have sometimes been more hesitant (or unable) to make the necessary investments (Michalopoulos, 2015a).

Drones have emerged as one of the most promising technologies. The utilisation of drones to monitor fields investigating moisture and nutrient deficiencies in crops has massive potential for farmers while the highly advanced imaging equipment spots details too subtle for the human eye to detect (van Vark, 2015). The Chamber of Agriculture in Deux-Sèvres (France) organises farm demonstrations to show farmers in the area how drones and other technologies can be used as farm management tools. In November 2015, two of these farms hosted farm demonstrations on the use of drones as farm management tools. The Chambers of Agriculture have developed a service to control nitrogen fertilisation of rapeseed and wheat called "Mes dron'im@ages" (EIP-AGRI, 2016).

4.2. Romania's efforts for adopting innovation in agriculture

One of the challenges for Romanian agriculture is the adoption of new technologies and innovative practices. Solving this issue needs the support of Romanian institutions and associations together with European experience in this sector. Some examples of such measures and solutions for the development of Romanian agriculture sector are: the implementation of LEADER measures; the establishment of the National Rural Development Network and implementation of National Rural Development Programme; the support for Operational Groups created according to the European Innovation Partnership; the organization of national and international conferences for speeding the transfer of research results in practice.

For developing the agriculture sector, Romania needs to search for collaboration with other countries. So, Netherlands runs many projects to transfer to Romanian farmers' a better understanding of technology, given that" innovation is the key to the sector development in the future. Dutch farmers' knowledge and technological novelties may be so transferred to Romanian young entrepreneurs. The goal is to give the support of Romanian farmers for more effective costs, for being able to cope with market conditions through counseling for sustainable investment. The Netherlands can play an important role due to the experience with cooperation between businesses, including farmers, research institutions and authorities (EurActiv, 2015).

In 2013 the Management Entity of the Cluster "Sviluppo Insieme si Vince" created IND AGRO WEST, the first innovative cluster for research and development in Romania, aimed at achievement of modern agriculture equipment, appropriate to Romanian soil (Sviluppo, 2014).

5. Conclusions

Europe is a major global food importer and exporter and has some of the world's most fertile arable land. By constantly innovating and ensuring the competiveness of its farmers and its food industry, Europe will be able to continue delivering sufficient amounts of high-quality food at affordable prices every day.
Innovation needs to be stimulated. The EU must support science, growth and innovation and in doing so, boost investment and consumer confidence.

Digital technologies will transform the agriculture sector in the years ahead and will fundamentally reshape the agri-food value chain in Europe. Smart and digital agriculture hold many promises for a more sustainable, productive, and competitive EU farm sector.

Innovation is not restricted to a technical or technological dimension. It increasingly concerns strategy, marketing, organization, management and design. Farmers do not necessarily apply 'new' technologies: their novelties emerge as the

outcome of 'different ways of thinking and different ways of doing things' and in recombining different pieces of knowledge in an innovative way. Innovation is both 'problem solving' and 'opportunity taking'.

Romania needs agricultural innovations for sustaining the resource base, communities, farmers' cooperation and solidarity. This process starts from sharing farmers' collective experiential knowledge of natural resources, ecological processes and product quality, and open-source exchange of information. Scientific research could explain why/how some agro-ecological practices are effective. It is vital the cooperation between lab science, agronomy and farmers, especially for enhancing their knowledge of natural resources for sustainable production methods.

Another instrument which can support innovation is government policy. It can offer access to farmers to integrated agro-ecological research & advisory (extension) systems, incentives for actors along value chain to internalize as many externalities as possible. Empowering women to play central roles in all areas of agricultural production is absolutely crucial if Romania, like other developing countries is to achieve their full potential in the agri-food sector.

6. References

ADEPT, 2013. *Family Farming in Romania.* [online] Available at: <http://ec.europa.eu/agriculture/consultations/family-farming/contributions/adept_en.pdf > [Accessed 12 March 2016].

EIP-AGRI, 2016. *Farm demonstrations, discovering drones*. [pdf] Available at: <https://ec.europa.eu/eip/agriculture/sites/agri-eip/files/field_core_attachments/nw_drones_20160112_en_0.pdf> [Accessed 01 April 2016].

EurActiv, 2015. *Inovarea, cheia succesului în agricultura olandeză, ajunge şi la fermierii români*. [online] Available at: <http://www.euractiv.ro/video/agricultura-olanda-2008 > [Accessed 12 March 2016].

European Crop Protection, 2014. *Food for Thought. A vision for unlocking the potential of agriculture and the food industry in the EU*. [online] Available at: <http://www.ecpa.eu/files/attachments/FoodforThought_2014-04-25.pdf> [Accessed 01 April 2016].

Europa.eu, 2016. *Europe's Opportunity in Digital Agriculture.* [pdf] Available at: <http://ec.europa.eu/agriculture/commissioner-speeches/pdf/hogan-digital-agriculture-workshop-14-01-2016_en.pdf> [Accessed 22 March 2016].

European Parliament, 2014. *Precision Agriculture: An opportunity for EU farmers – Potential support with the CAP 2014-2020*. [pdf] European Union. [online] Available at: <(http://www.europarl.europa.eu/RegData/etudes/note/join/2014/529049/IPOL-AGRI_NT%282014%29529049_EN.pdf> [Accessed 10 March 2016].

FoodDrinkEurope, 2015. *Agri-Food Chain Coalition: EU Industry Calls for Innovation for Agriculture*. [online] Available at: <http://www.fooddrinkeurope.eu/news/press-release/agri-food-chain-coalition-eu-industry-calls-for-innovation-for-agriculture/> [Accessed 01 April 2016]

Gotev, G., 2015. *Hogan: Empowering women farmers in developing countries is 'absolutely crucial*. [online] 14 September. Available at: <http://www.euractiv.com/section/science-policymaking/interview/hogan-empowering-women-farmers-in-developing-countries-is-absolutely-crucial/> [Accessed 18 February 2016].

Lupu, V., 2015. Eurostat: Romania's agricultural production – EUR 15.5 billion in 2014, i.e. 4 pc of the EU's. *The Romania Journal.* [online] 21 Febr. Available at: <http://www.romaniajournal.ro/eurostat-romanias-agricultural-production-eur-15-5-billion-in-2014-i-e-4-pc-of-the-eus/> [Accessed 15 March 2016].

McClelland, J., 2013. Technology grows fields of hope. *Raconteur.* 25 March. [online] Available at: <http://raconteur.net/sustainability/technology-grows-fields-of-new-hope> [Accessed 29 March 2016].

Michalopoulos, S., 2016. *Commission promotes smart farming to mitigate climate change*. 29 January. [online] Available at: <http://www.euractiv.com/section/ agriculture-food/news/commission-promotes-smart-farming-to-mitigate-climate-change/> Accessed [21 March 2016].

Michalopoulos, S., 2015a. *Europe entering the era of 'precision agriculture'* [online] Available at: <http://www.euractiv.com/section/science-policymaking/ news/europe -entering-the-era-of-precision-agriculture/> [Accessed 1st March 2016].

Michalopoulos, S., 2015b. *'E-agriculture' could save EU farmers time and money*. [online] Available at: <http://www.euractiv.com/section/agriculture-food/news/e-agriculture-could-save-eu-farmers-time-and-money/> [Accessed 1st March 2016].

Otiman, P., 2013. *Romania's present agrarian structure*. Bucharest: Romanian Academy

Rickard, S., 2015. Time for another agriculture revolution. *Raconteur.* 29 July. [online] Available at: <http://raconteur.net/sustainability/time-for-another-agriculture-revolution> [Accessed 19.03.2016].

Sviluppo, 2014. *Primul cluster agricol inovativ din România*. [online] Available at: <http://www.sviluppoinsiemesivince.ro/primul-cluster-agricol-inovativ-din-romania/ > [Accessed 19 March 2016].

van Vark, C., 2015. Drones set to give global farming a makeover. *The Guardian.* 26 December. [online] Available at: <http://www.theguardian.com/global-development/2015/dec/26/drones-farming-crop-problems-uavs> [Accessed 19 March 2016].

Whealbi, 2015. *An EIP for more productive and sustainable agriculture and forestry.* [online] Available at: <http://www.whealbi.eu/eip-agri-one-stop-shop-agricultural-innovation-europe-httpsec-europa-eueipagriculture/> [Accessed 1st March 2016].