Innovation and research in agriculture - The main components for a sustainable food security development in the world and Romania

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Abstract: In present days and for future generations, the responsibility to protect "life" has become crucial. A sustainable development of standards for generating welfare has to cover our needs for food security, which is a top priority for the worldwide population. Therefore, one of the biggest challenges is the discovery of a new way to change and improve food productivity, i.e. "to innovate".

Innovation is the main component of a sustainable development that produces food and nutrition security. The concept of innovation is translated into institutional, technological and social improvements for the agriculture system, as well as the interaction between people and institutions, responsible for demanding, supplying and disseminating knowledge, which is a valuable asset for crop yields and to reduce poverty in developing countries.

Research and development activities stand at the base of a sustainable agricultural system to overcome the lack of competitiveness and the deficiencies in the food market profitability. Innovation in rural farming and its core products, such as grains, the principle resources of food security, will remain a primary engagement to exceed insecurity.

Keywords: innovation, knowledge transfer, sustainable development, food security

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1. Innovation and sustainable development of the food sector

The food security dimension has changed over the past decades, because another factor put pressure on the human kind welfare. Nowadays, people have to face "extreme poverty", the main characteristic of food and nutrition insecurity. As the economist Paul Collier defines the poorest fifty countries in the Middle East and Asia as "the billion bottom"[1], we all should be aware that out of three billion people who live in economic and social inequalities, about one billion are still suffering of starvation.

Therefore, there is a worldwide need to reduce the poverty and to develop new ideas for a sustainable agriculture sector. Feeding the population is a top priority, but the process is difficult as the world has to face challenges such as poor food production and crop land, inadequate infrastructure, climatic changes and low incomes that all generate unsustainable development of agriculture.

Countries from Europe and Romania as well try to implement better policies to reach the standards of competitiveness, efficient technical equipment and specialized staff, which are involved in the process of innovation. Because the principal goal is to eradicate hunger, the innovation will focus on rural development and knowledge transfer among young farmers. Good education and training create professionals that will improve agriculture. The small and medium enterprises and family farms projects are among the first priorities in rural development.

But those targets can be transformed into policies only by the government and authorized institutions in coordination with private and public stakeholders that allocate financial and human resources to innovate the research and development agenda. In addition, if science is understood as a practical tool, the economic, environment and social benefits will change the status of the vulnerable population.

Innovation does not mean to erase a system from the bottom, but to make it better by changing and improving its mechanisms, coming up with new practical ideas. "The Oslo manual"[2] which comprises more targets of innovation as a guideline, based on a OECD survey of member and non-member countries, defines four types of innovation:

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[1] Paul COLLIER, Why the poorest countries are failing and what can be done about it, Oxford University Press, 2007.

[2] Oslo Manual, OECD, http://www.oecd.org/site/innovationstrategy/defininginnovation.htm.

- Product innovation: improvements in goods and services, with regard to their components, functions and technical characteristics.
- Process innovation: includes new methods of goods and services production and delivery.
- Marketing innovation: changes in product labels, packaging, advertising and pricing.
- Organizational innovation: refers to changes in an organization's structure and in the relationship with other partners.

All these types of innovation should support five different goals:

- Creation of new products for a sustainable food chain;
- Diversification of food production methods;
- Demand for new food markets;
- Supply for raw materials and inputs;
- Investments in new market structures in a particular industry.

2. Goals in food security for the next decades

One of the biggest challenges in agriculture and food security is "innovation", which represents an increase in food production to meet the need of a population, to enhance easier food access and to provide a more competitive and sustainable system. Therefore, the necessary tool is the "innovative financing", which involves a major cooperation between the private and public sectors, taking into account a couple of risks such as climate changes, greenhouse effect and a wide energy consumption that reduce the livestock and crop production.

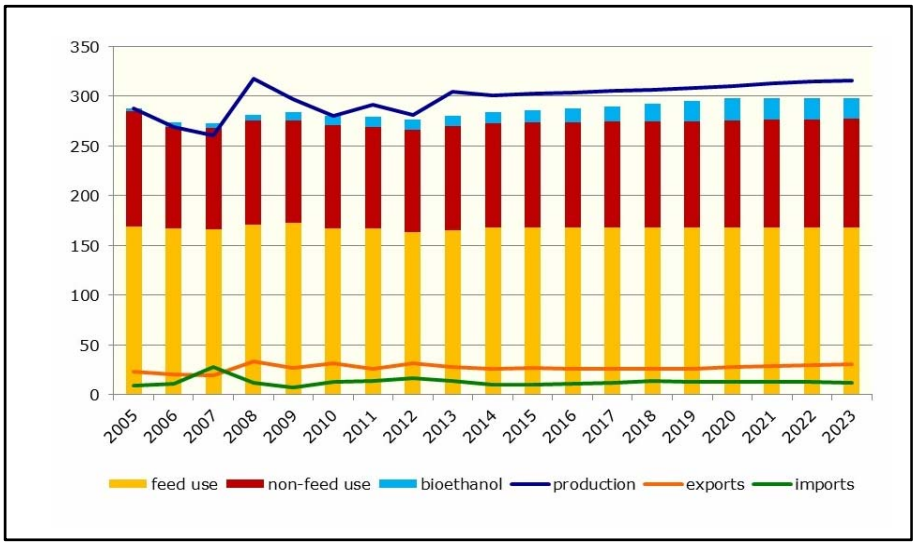
There are two funding mechanisms: the resources (taxes, voluntary contribution) and the use (creation of mechanisms). The investments are made in fertilizers to increase food production, because the growing population threat en the food security worldwide, to enhance crop land extension and conservation of biodiversity that ensure a sustainable environment.

Countries from Europe, including the Western Balkans, which have begun the negotiation of their integration into the EU and where most of the people are employed in agriculture, because of low land price and quality resources, join to reach the "Common Agriculture Policy" standards of EU. Its reforms should increase countries' competitiveness, both in agriculture and forestry, develop the

rural environment and better living standards, and improve the management of economic activity.

European countries should increase the production of basic food to meet the increasing consumption by 2020, shown in the graphic bellow:

Figure 1. EU Plant - cereals market developments (million tonnes) - Projections to 2023 (2009 =100%)



Source: Prospects for Agricultural Markets and Income in the EU 2012-2022.

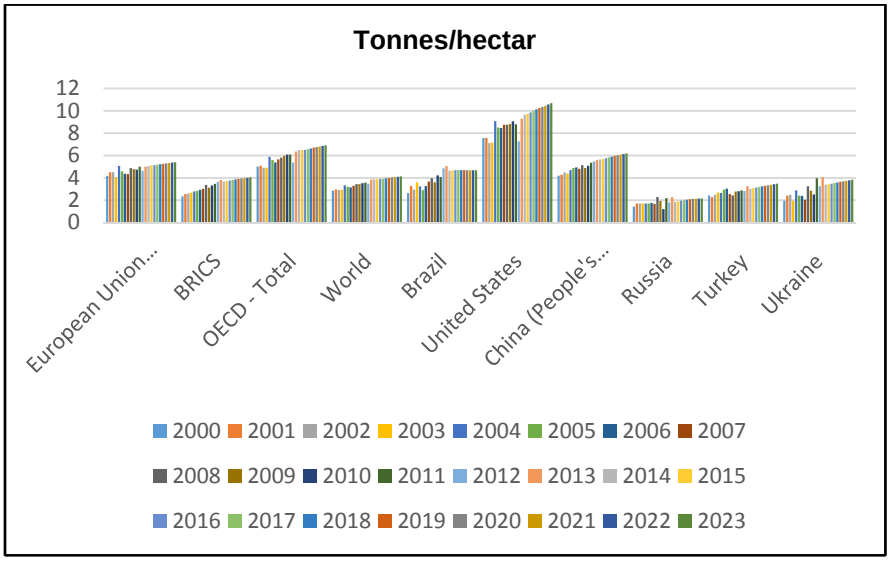
While world crop production in 2014 may not exceed the record one in 2013, large carryover stocks are expected to keep global supplies adequate to expected world demand. In 2014/15, food consumption of cereals and especially on grains is expected to keep up with the rise in world population, resulting in a stable per capita consumption at the global level.

The medium-term prospects for the EU[1] cereals markets are characterized by relatively tight market conditions, low stocks and prices which are expected to remain above their historical averages. These developments are driven by moderate supply growth reaching 316 million tonnes by 2023, mainly the result of

[1]Prospects for Agricultural Markets and Income in the EU 2013-2023.

low annual yield growth rates (0.6% on average) and an increase in the domestic use of cereals in the EU, most notably due to growing demand for ethanol within the RED. Some reallocation between crops in the context of a stable overall cereal area is expected, with maize and common wheat further increasing in share (up to 18% and 41%, respectively) at the expense of other cereals. The growing demand for rice will be satisfied by increasing imports, reducing the EU self-sufficiency slightly to 64%. (Figure 2)

Figure 2. OECD provisions for crop production, 2000-2023



Source: OCDE 2015, Statics provisions. https://data.oecd.org/agroutput/crop-production.htm

Romania, which is fully EU member state, has to face the same problems and the agriculture system does not make our country an independent one in terms of competitiveness. The food production is still low, the infrastructure is inappropriate and the business sector still struggle to cooperate with farmers in rural areas. Although Romania is a rich country, being on the 6th place in Europe in terms of arable area with high cereals production , its agricultural potential need to be improved to launch it on the global food market and to create a modern food system to overcome self-insurance levels of domestic consumption.

Table 1. World meat projections

Calendar year												
Average	**2012-14est**		**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	
WORLD												
BEEF AND VEAL												
Production ktcwe	67 139	68 091	68 205	68 778	69 820	71 084	72 006	72 944	73 921	74 657	75 391	
Consumption ktcwe	66 704	67 567	67 651	68 248	69 304	70 554	71 472	72 412	73 389	74 125	74 863	
PIGMEAT												
Production ktcwe	115 315	118 444	120 219	121 799	123 158	124 119	125 069	126 042	126 846	127 836	128 762	
Consumption ktcwe	114 641	118 230	119 733	121 327	122 680	123 642	124 604	125 574	126 365	127 344	128 265	
POULTRY MEAT												
Production ktrtc	107 638	111 954	114 386	117 474	119 941	122 164	124 630	126 935	129 294	131 552	133 785	
Consumption ktrtc	107 081	111 108	113 543	116 649	119 114	121 340	123 805	126 107	128 468	130 727	132 956	
SHEEP MEAT												
Production ktcwe	13 962	14 457	14 726	14 995	15 294	15 638	15 924	16 232	16 525	16 833	17 124	
Consumption ktcwe	13 846	14 416	14 685	14 963	15 243	15 586	15 873	16 181	16 476	16 780	17 071	
TOTAL MEAT												
Per capita consumption[1] kg rwt	**33.9**	**34.1**	**34.2**	**34.5**	**34.7**	**34.9**	**35.0**	**35.1**	**35.3**	**35.4**	**35.5**	
OECD[2]												
BEEF AND VEAL												
Production ktcwe	27 162	26 338	25 761	25 634	25 937	26 320	26 690	27 017	27 349	27 538	27 720	
Consumption ktcwe	26 366	25 849	25 301	25 206	25 502	25 871	26 216	26 495	26 778	26 907	27 053	
PIGMEAT												
Production ktcwe	39 858	40 347	40 793	40 609	40 819	40 964	41 064	41 243	41 471	41 744	42 087	
Consumption ktcwe	36 744	37 791	38 219	38 047	38 178	38 234	38 319	38 385	38 415	38 481	38 587	
POULTRY MEAT												
Production ktrtc	43 182	44 698	45 851	46 864	47 738	48 389	49 203	49 983	50 661	51 340	51 987	
Consumption ktrtc	40 361	41 848	42 787	43 714	44 299	44 700	45 316	45 858	46 317	46 807	47 315	
SHEEP MEAT												
Production ktcwe	2 639	2 690	2 710	2 726	2 763	2 798	2 832	2 861	2 891	2 919	2 947	
Consumption ktcwe	2 006	2 027	2 020	2 016	2 001	2 008	2 020	2 032	2 046	2 053	2 067	
TOTAL MEAT												
Per capita consumption[1] kg rwt	**64.7**	**65.4**	**65.6**	**65.7**	**66.0**	**66.2**	**66.5**	**66.8**	**67.0**	**67.1**	**67.3**	

Note: Calendar Year: Year ending 30 September. Average 2012-14est: Data for 2014 are estimated; 1. Per capita consumption expressed in retail weight. Carcass weight to retail weight conversion factors of 0.7 for beef and veal, 0.78 for Pig meat and 0.88 for both sheep meat and poultry meat; 2. Excludes Iceland but includes all EU28 member countries.

Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database). doi: http://dx.doi.org/10.1787/agr-outl-data-en

According to the "Romanian Strategy for Research-Development-Innovation in Agriculture on medium-long term, 2014-2020/2020-2030"[1], the innovation is based on seven specific purposes:

1. Ensuring appropriate production of food and agricultural commodities;
2. Maximizing flow stability of supply of agricultural products;
3. Ensuring access to available agricultural resources, to basic foods needed for human health;
4. The transition from net importer of food products to the exporter by actual production;
5. Using all of its agricultural potential;
6. Finding forms of "special" support for reentry into the circuit of about 4 mil. Ha. of agricultural land fallow per year;
7. Development of research and innovation and implementation of the results in the latest technologies (technologies available free through projects with full support, coordinated and prepared by the Department of Nuclear Sciences and Applications - Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture (NAFA), Division FAO - IAEA, based in Vienna).

An increase in the economic potential by innovating should lead not only to development of the production factors (labor force, capital and resources) and to lower costs, but to a better quality of products and price flexibility.

Romania has the potential to feed more than 40 million people, but its agriculture potential is not fully exploited, so that the country suffers from a trade deficit, being unable to balance the trade balance to its benefit. Its territory enjoys favorable pedo-climatic conditions that allow Romania to be a major agricultural producer of commodities (Table 2).

[1]Strategy for Research-Development-Innovation in Agriculture on medium-long term, 2014-2020/2020-2030, Ministry of Agriculture and Rural Development, Romania.

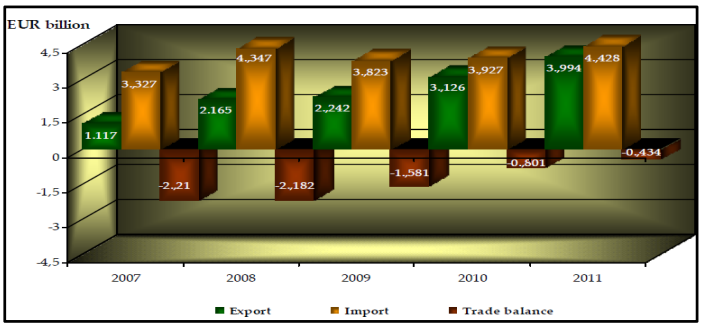
Tabel 2. Vegetables production in Romania, 2009-2012

	2009	2010	2011	2012
Cereals:	14873	16713	20842	12824
Wheat	5203	5812	7132	5298
Rye	33	34	31	18
Barley	1182	1311	1330	986
Maize	7973	9042	11718	5953
Leguminous for grains	53	61	77	63
Potatoes	4004	3284	4077	2465
Sugar Beet	817	838	661	770
Oil Plants, of which:	1764	2378	2687	1668
Sunflower	1098	1263	1789	1398
Vegetables	3902	3864	4176	3535
Fruits	1323	1420	1480	1129
Grapes	990	740	880	746

Source: National Institute of Statistics, Yearbook 2013.[1]

The major trade partners of Romania are Italy, Hungary, Bulgaria, the Netherlands and Germany which import large quantities of agri-food products, such as wheat, oilseeds, sunflower oil, rapeseeds and live animals such as sheep's and bovines. Yet, Romania's imports from Brazil, Poland, Spain, France and Germany exceed the exports, because fertilizers use is less than 70 kg/ha compared to an average of 200-500 kg/ha in Europe and Romania has a negative food balance.

Figure 3. Romania- Agri-food trade balance, 2007-2011



Source: ITC/ UNCTAD/WTO Trade map, National Institute of Statistics of Romania and Romania Trade and Invest[2].

[1] National Institute of Statistics, Romania Year-Book, 2013, p.48. http://www.insse.ro/cms/files/publicatii/Romania%20in%20cifre%202013_ro.pdf.

[2] Agriculture Overview, Agriculture and Food Industry http://www.dce.gov.ro/Info_business/RoExpDir/Agriculture_2012/content/Sector/Romania%20-%20Agriculture%20and%20Food%20Industry.pdf.

Romanian "*Strategy on Research, Development and Innovation"* provides specific tools of access to European funds through EAFRD projects, World Bank support, "The Seventh Framework Programme for Research and Technological Development" and structural funds,[1] for research in livestock, fruit and cereals production, forestry and fishery.

Romania must invest at least 1.5% of the GDP in innovation, because it brings sustainable investments with high added value and an increase in economic competitiveness in agriculture, forestry and rural areas, in general, on medium and long term. However, it is far from reaching the EU standards of 2% of the GDP (consist of public and private investments), that is why Romania had made very limited progress.

For each country worldwide the progress is met only when people are involved in. The FAO, the largest organization of agriculture, is promoting good practice to stimulate the agri-food production, soil and biodiversity conservation by making a call that sustainable investments lead to food security.

Innovation should be encouraged at the national and international level by entrepreneurship and development of intellectual property. Therefore, for the next decades, the steps to be taken will be the constant evaluation of research performance for all public actors, universities and experts in agriculture and investments in human resources and technical support.

Conclusions

Labor force, the environment and the capital are the main factors of production, but the worst enemies as well, because in the absence of their cooperation, the system itself collapses. Innovation takes shape after policy-making becomes functional in a certain area, according with a careful monitoring of the agriculture system to avoid the inefficient mechanisms, in order to develop the domestic and international food market, to ensure not only the nutrition need of the population, but their health and welfare stability.

Many poor countries from Asia and the Middle East have land resources, but are not yet rich. They have chances to turn into exporters only when domestic trade is valuable. The internal wealth does not matter, as long as those countries do not have markets nearby to compete with their products, leading to a decrease in state budget and economic insecurity. Food insecurity associated with lack of innovation should be the biggest concern for the Governments that stands at the

[1] Idem, Strategy for Research-Development-Innovation in Agriculture, p. 25.

bottom of development of agriculture and risk management system for 2020-2050 period.

Romania like other countries in Europe needs to develop the agriculture sector, providing socio-economic and human research, to adapt the education system, the labor force and the transfer centers of research results, creating European technological platforms and implement models at national level.

More specifically, every area should cooperate in creating national and local strategies according to their characteristics to ensure enough food and water resources to satisfy producer' and consumers' needs and finally to become an attractive and independent food market.

The framework for our analyzing the performance of policies in achieving productivity growth sustainably identifies three drivers: innovation, structural change and natural resource use. The whole range of macro-economic, institutional, and sectoral policies in the economy will influence these drivers and, in turn, outcomes in terms of productivity growth and sustainability.

Based on this, we can conclude also that innovation is more than a process, because its purpose is to apply the best solution to meet new requirements, develop new products and markets, without harming the environment with a careful attention for soil conservation which is a non-renewable resource, transforming the agriculture sector and enhancing food security worldwide for a sustainable development.

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