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# **An Overview of EAFRD Allocation and Innovation's Role Towards a Competitive European Agriculture Sector**

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**Please cite this paper as:**

Șerbănel, C.I., 2021. An Overview of EAFRD Allocation and Innovation's Role Towards a Competitive European Agriculture Sector. In: R. Pamfilie, V. Dinu, L. Tăchiciu, D. Pleșea, C. Vasiliu eds. 2021. *7th BASIQ International Conference on New Trends in Sustainable Business and Consumption*. Foggia, Italy, 3-5 June 2021. Bucharest: ASE, pp. 585-593  
DOI: 10.24818/BASIQ/2021/07/074

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## **Abstract**

The present paper investigates the allocation of the European agricultural fund for rural development (EAFRD) at the European Union (EU) 's member state level and pursues to confirm or deny, subject to the case, the existence of symbiotic relation amid the amount of EAFRD absorption and the value of agricultural exports. Furthermore, the article introduces a visual scheme to explore the role of innovation, research and development, and technology in achieving competitiveness in the agriculture sector.

The analysis employed a quantitative approach and extracted data from the European Commission database– the 2014-2020 period – regarding the European Structural and Investments Funds and the Atlas of Economic Complexity database – for 2018 - to evaluate agricultural exports' value. As a general perspective of the EAFRD fund absorption, for the eleven axes encompassed, at the top of the rank were identified Italy, France, Germany, and Spain while, at the opposite pole, there are classified Malta, Cyprus, and Luxemburg. The results validated a direct relationship between the amount of absorbed EAFRD and the agricultural exports for France, Germany, Italy, Spain, Poland. Besides, there were discovered exceptions among Netherlands, Belgium, and Denmark. Since there are few research pieces conducted to analyze the allocation of EAFRD, the current paper enriches the scientific literature in this sphere. Moreover, the article proposes an original scheme model that emphasizes the factors required to stimulate agricultural competitiveness.

**Keywords:** EAFRD, agriculture, competitiveness, Europe, innovation, fund, trade.

**DOI: 10.24818/BASIQ/2021/07/074**

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## **Introduction**

World food outcome necessitates doubling by 2050 to meet the population expected growth and the evolving food habits. For the before-mentioned exponential rise, solutions must be designed to mitigate climate change, impacts in biodiversity, water, and soil quality, and find unprecedented resolutions to streamline and optimize the entire value-chains food production process. Europe is an essential player in the global agricultural industry regarding agricultural production and agricultural land. The agriculture segment can be split into three major sectors: farming, fisheries and aquaculture, and forestry.

The European Union has a leading position in global agriculture production with a total agricultural production of EUR 181.7 billion in 2018 (European Commission, 2020). Despite being the most prominent world producer, the European Union still has untapped agricultural production potential.

For almost 60 years, the Common Agricultural Policy (CAP) has been the EU's most essential common policy. The European Agricultural Fund for Rural Development (EAFRD) is one of the European

Structural and Investment Funds (ESIF), and it is the funding instrument of the second pillar of the EU's CAP. EAFRD aims to finance the member states' rural development programs. Along with the EAFRD, other funds, such as the European Regional Development Fund (ERDF) and the European Social Fund (ESF), impact rural development.

Although the announced EAFRD planned budget in the year 2014 for 2014-2020 was EUR 96 billion, according to the latest available data, by the end of 2020, the budget surged to EUR 150 billion. Nearly half of this budget was scheduled for investments through grants and financial instruments, in agriculture, forestry, environment and natural resources management, and sustainable development of the rural areas. (Fi Compass, 2021)

The European Union's funds for the agriculture sector cause reverberations on rural development and agriculture, support people in their development in education and job integration, and small farmers expand. Competitiveness represents an essential concern for the European agri-food sector as continuously argued by the European Commission (European Parliament, 2014), (European Commission, 2018), (European Commission, 2019), (European Commission, 2020a).

### **Literature review**

Competitiveness is a substitute for development, performance, and convergence. Currently, the concept has been receiving progressing interest from policymakers, businesses, scientists, and the general population. The World Economic Forum, which has been assessing countries' competitiveness since 1979, defines competitiveness as "the set of institutions, policies, and factors that determine the level of productivity of a country." (World Economic Forum, 2016)

The concept can be both specifically and generally assessed, from individuals, companies, governments to countries' level. Several theories and indicators, which are under a continuous streamlining process, have been proposed to measure and foster competitiveness.

On the one hand, competitiveness can be measured as the computation of trade indices over a defined period. Several researchers have adopted this approach to estimate countries' competitive performance and/or sectors: (Gorton and Davidova, 2001); (Bavorova, 2010). On the other hand, other authors have measured competitiveness through the same indices and compared European countries with the extra-European ones (Wijnands, et al., 2008); (Qineti, et al., 2009). Another in-use approach to measure competitiveness is Porter's "Diamond Model" (Porter, 1990). In Porter's vision, competitiveness is supported by two axes: a significant volume of exports towards various cross-border partners and substantial investment in other markets based on the capabilities and resources created in-house. Some researchers used performance indicators (Liefert, 2002), others used profitability indicators (Davidova, et al., 2003), while others focused on efficiency and productivity (Brümmer et al., 2002).

Back to the present time, the modern business environment highlights the significance of RandD and technology investment as a generative source of efficiency and competitiveness. Considerations on the role of investments in RandD as a factor of economic development began in the '50s of the 20<sup>th</sup> century. There can be reminded neoclassical economists (Solow, 1956) and continued to (Romer, 1986), (Scerri, 1990), (Atzei, et al., 1999), (Dima, et al., 2018), (Lomachynska and Podgorna, 2018), (Lukovszki, et al., 2020), (Brancati, et al., 2021).

Innovation is recognized a strategic action that safeguards a competitive position in the global market (Freel, 2000), (Protogerou, et al., 2017), (Prokop, et al., 2019). This statement is particularly available for the agri-food sector, representing the largest manufacturing sector and one of the main drivers of the European Union's economy (Traill, 1998).

The agriculture sector advances in a dynamic environment: the demand is continuously increasing, consumers' preferences and food habits change. In response, companies, governments, universities, and RandD institutes should cooperate to innovate towards a continuously improving process among the agricultural value chain. Nevertheless, high-tech technology and solutions without well-trained users of technology may be powerless.

The concept of competitiveness in the agriculture sector represents a vivid source of interest among researchers. The subject is discussed at the international, regional, country, and type of crop level. Benesova, et al. discussed the competitiveness of the post-soviet countries' agricultural trade (Benesova, et al., 2020); Nurgazina, et al. examined the competitiveness of agriculture trade between China and Kazakhstan, (Nurgazina, et al., 2020); Lemus, et al. and Magana, et al. concentrated on Mexican agricultural competitiveness (Lemus, et al., 2020), (Magana, et al., 2020); while Erdem examined the competitiveness of the dried sector (Erdem, 2020) and Sheetal, et al. investigated the export competitiveness of major sugar economies with a focus on India (Sheetal, et al., 2020).

At the European level, several authors wrote about the effect of technology, innovation, and public funding in increasing the agriculture sector's competitiveness (Ramos and Au-Yong-Oliveira, 2018), (Bucci, et al., 2018), (Alarcon and Arias, 2018). Additionally, several research papers illustrate a general perspective of the agriculture sector's competitiveness at the European level (Bojnec and Ferto, 2018), (Matkovski, et al., 2019), (Forgacs, 2019), (Carrarese and Banterle, 2015).

The following authors enriched the specialty literature in terms of crop competitiveness or agricultural country's competitiveness as follows: (Greblikaite, et al., 2019) - berry farm's performance; (Hristov, et al., 2019) – Bulgarian sunflower; (Hochuli, et al., 2021) - the dairy farms in Switzerland; (Comanescu, et al., 2019) – Romania and the role of funding for a sustainable development; (Radzivil, et al., 2019) – Ukrainian agricultural sector and (Cosovic, et al., 2019) – wrote about the efforts Bosnia and Herzegovina are making to increase competitiveness in the agriculture sector.

### **Research methodology**

The current research applies a quantitative approach to address the following research questions: What are the central directions EAFRD has been allocated between 2014-2020? Which are the European countries' priorities in the agricultural sector, considering the EAFRD fund allocation by axes? Is there any relationship between the amount of EAFRD absorption and the volume of agricultural exports?

The quantitative research consisted of extracting the latest available data from two databases: (1) the European Commission database (<https://cohesiondata.ec.europa.eu/>) for the 2014-2020 period regarding the EAFRD allocation and (2) the Atlas of Economic Complexity (<https://atlas.cid.harvard.edu/>) for 2018 (the latest available year) to evaluate the agricultural exports by member state.

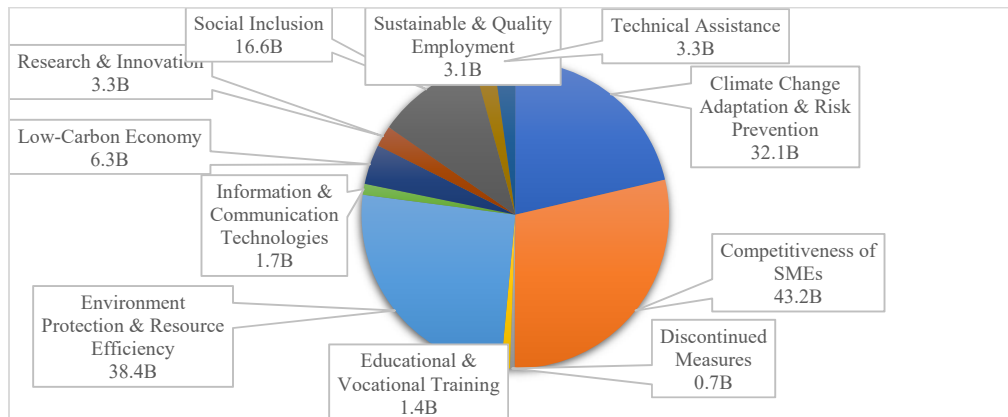
Out of the first database (<https://cohesiondata.ec.europa.eu/>), the extracted raw data covered more than 530 programs and contained both the EU and national co-financing covered by the adoption decision. Data was collected from the adopted financial tables and was broken down by fund, program, priority axis, thematic objective, with an up-to-date update of the available information agreed between the European Commission and the member states.

Out of seven European Structural Funds, the EAFRD fund was selected for 27 European Member States even though the United Kingdom is not an EU member state at the moment of the research. The following measures dedicated to the agricultural sector were included: Climate Change Adaptation and Risk Prevention; Competitiveness of SMEs; Discontinued Measures; Educational and Vocational Training; Environment Protection and Resource Efficiency; Information and Communication Technologies; Low-Carbon Economy; Research and Innovation; Social Inclusion; Sustainable and Quality Employment; Technical Assistance.

For the analysis of the agricultural exports, the Atlas of Economic Complexity was selected. The Atlas of Economic Complexity is a data visualization tool that allows exploring global trade flows across markets to track every country's dynamics. The raw trade data on goods result from countries' reporting to the United Nations Statistical Division (COMTRADE). The Atlas uses both commodity trade classification types - Harmonized System (HS) and Standard International Trade Classification (SITC).

**Results and discussion**

According to Eurostat data, the agriculture sector contributed by 1.1% to the EU's Gross Domestic Product (GDP) in 2018 with a total agricultural output of EUR 434.3 billion in basic prices and an estimated gross value added of EUR 181.7 billion. (Eurostat, 2019) The CAP's contribution to the EU rural expansion is supported through the European agricultural fund for rural development.



**Figure no. 1. EAFRD Fund 2014-2020 by axes (EUR 150B)**

Source: Author's calculations based on data extracted from <https://cohesiondata.ec.europa.eu/>

Figure 1 shows the distribution of the EAFRD by axes among the EU's member states. Competitiveness of SMEs in the agriculture area was the most important scheme with a budget of EUR 43.2 billion. This measure was focused mainly on animal welfare, basic services, COVID-19 crisis, farm and business development, organic farming, restoring agricultural potential, and risk management. The immediately following two directions were Environment Protection and Resource Efficiency and Climate Change Adaptation and Risk Prevention with a budget of EUR 38.4 billion, respectively EUR 32.1 billion. At the opposite pole, the dimensions of the EAFRD Fund that received the least of the EAFRD budget were Discontinued Measures (EUR 0.7 billion), Educational and Vocational Training (EUR 1.4 billion), and Information and Communication Technologies (EUR 1.7 billion).

**Table no. 1. EAFRD Fund distribution by country and by type of measure (2014-2020)**

	1	2	3	4	5	6	7	8	9	10
Austria	++	+++	+++	++	++	++	+++	+	++	+++
Belgium	+	+	+	+	++	+	+	+	-	++
Bulgaria	++	++	+	++	++	++	+	+	++	++
Croatia	++	+	+	++	++	+	+	++	-	+
Cyprus	+	+	+	+	+	+	+	+	+	+
Czechia	++	++	++	+	+	+++	+	++	-	+
Denmark	+	++	+	+	+	+	++	-	-	++
Estonia	+	+	+	+	+	+	++	++	-	+
Finland	++	+++	+++	++	+	+++	++	+++	++	+++
France	+++	+++	+++	+++	+++	+++	+++	++	+	+++
Germany	+++	+++	+++	+++	+++	+++	+++	+	+++	+++
Greece	++	++	++	++	++	+++	+	+	++	++
Hungary	++	++	++	++	+++	++	++	+++	-	++
Ireland	+	++	+++	+	+++	++	+	-	-	+++
Italy	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
Latvia	+	+	+	+	+	+	++	+	-	+
Lithuania	++	+	+	+	+	+	++	++	+	+

Luxembourg	+	+	-	-	+	-	+	-	-	-
Malta	+	+	+	+	+	+	+	+	-	+
Netherlands	+	+	+	+	-	++	+	-	-	++
Poland	+++	+++	+	+++	-	+++	+++	+++	-	++
Portugal	++	++	++	++	+++	++	++	-	-	+
Romania	+++	++	+++	+++	++	+	+++	+++	-	+
Slovakia	++	++	+	+	+	++	++	++	+	+
Slovenia	+	+	+	+	-	+	+	+	+	+
Spain	+++	+++	+++	+++	+++	+++	+++	+++	+	+++
Sweden	+	++	++	+	+	+++	+++	+	+++	+++
United Kingdom	++	+++	+++	++	+++	+++	+++	+++	++	+++

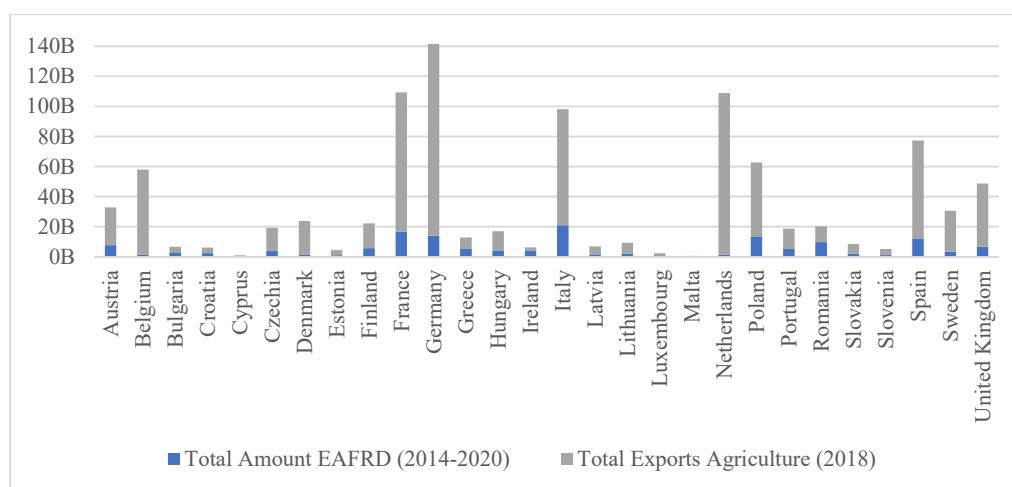
Source: Author's calculations and interpretation based on data extracted from <https://cohesiondata.ec.europa.eu/>

**Legend:** [1]: Competitiveness of SMEs; [2]: Environment Protection and Resource Efficiency; [3]: Climate Change Adaptation and Risk Prevention; [4]: Social Inclusion; [5] Low-Carbon Economy; [6] Research and Innovation; [7] Technical Assistance; [8] Sustainable and Quality Employment; [9] Information and Communication Technologies; [10] Educational and Vocational Training;

**Note:** +++ first in rank, + least in rank, [-] lack of data

As a general overview, *Table 1* reflects a homogeneous distribution of EAFRD by country, respectively by axes. With few exceptions, countries ranked in the top for the ten included axes were Italy, France, Germany, Spain while, at the opposite pole, there are identified the same European countries, respectively Malta, Cyprus, Luxembourg. For Environment Protection and Resource Efficiency, which included agri-environmental climate, forest, organic farming, and basic services, France ranked first with a total amount of EUR 5.052 million. It was followed by Poland (EUR 4.588 million), Italy (EUR 4.014 million), and Germany (EUR 3.579 million).

Compared to other measures, the budget for Research and Innovation was modest, with the highest amount registered by Italy (EUR 726 million), Spain (EUR 291 million), and Germany (EUR 284 million). In terms of Educational and Vocational Training, as the figures show, Italy is again ranked first with a total amount of EUR 196 million, being followed by the UK (EUR 136 million), France (EUR 129 million) and Austria (EUR 115 million). Lastly, Information and Communication Technology area was mainly a priority for Italy (EUR 582 million), Sweden (EUR 411 million), and Germany (EUR 335 million).



**Figure no. 2. An overview of EAFRD Fund (total amount) and agricultural exports by country**  
 Source: Author's calculations based on data extracted from <https://cohesiondata.ec.europa.eu/> and from Atlas of economic complexity (<https://atlas.cid.harvard.edu/>)(2021)

Figure 2 aims to distinguish whether there is a direct relationship between the value EAFRD absorption and agricultural exports' value at the country level. Although there seems to generally be a direct correlation between the EAFRD fund and the value of exports, there are few exceptions: Netherlands, Belgium, and Denmark (there were selected only the European countries with an agricultural export up to EUR20 billion).

Although Italy had the most considerable amount in EAFRD Fund (EUR 20.9 billion), its agricultural export placed the country in 4<sup>th</sup> place (EUR 77.2 billion). Analyzing the top European agricultural exporter, Germany, it can be noticed that despite its EUR 127.4 billion in exports, the country registered EUR 14.1 billion in EAFRD total amount (3<sup>rd</sup> place).

As stated above, Netherlands, Belgium, and Denmark are the countries that disrupted a direct relation between the EAFRD fund. Although they have registered a modest EAFRD absorption amount (Netherlands: EUR 1.2 billion), (Belgium: EUR 1.3 billion), (Denmark: EUR 1.2 billion), the nations have a notable contribution to European agricultural exports as follows: Netherlands: EUR 107.6 billion, Belgium: EUR 56.6 billion and Denmark: EUR 22.6 billion.

A distinctive report between EAFRD Fund and agricultural exports was registered by Romania, which has almost the same report between the two of them: EUR 9.6 billion in EAFRD fund and EUR 10.5 billion in exports.

Competitiveness in the agriculture sector can be perceived as a direct sum of several comparative advantages (CA). The higher the CA sum-value, the higher the competitiveness score in the agriculture sector can be achieved.

There is an interconnectedness relationship between the CA identified below. This type of relation signifies that all the identified factors function together. *Land* represents the country's natural endowment, and the arable surface can be optimized through technology and innovation (e.g., Netherlands case for Tomato Production). The *input factors* directly impact the production quality and can be continuously optimized through RandD and technology investments. For a product to reach the final consumer, *human capital* is mandatory among the coordinated value chain. However, the employees ought to be highly trained in technology usage. Furthermore, the *production process* involves a mix of technologies and operations, which is directly influenced by the employed technology's quality. These are the main factors contributing to the *Agricultural Output* and implicitly determine the *Agricultural Competitiveness Score*. (See Figure 3)

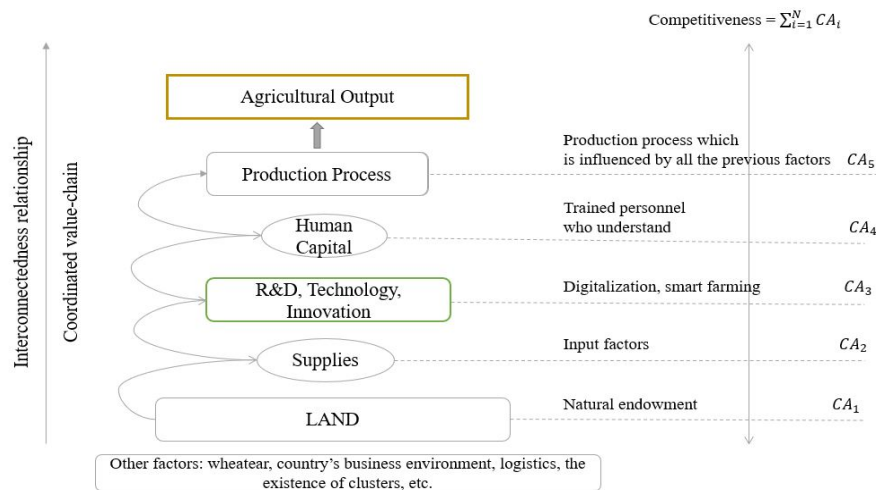


Figure no. 3. How is competitiveness in the agriculture sector built?

Source: Author's creation (2021)

## Conclusions

Overall, the present study validates that there is a positive relationship between the amount of absorbed EAFRD Fund in the 2014-2020 period and the country's agricultural exports performance. The symbiotic relationship was found among France, Germany, Italy, Spain, Poland, and the exceptions among Netherlands, Belgium, and Denmark.

Another positive sign discovered during the present research paper was a total top-up of EUR 50 billion in the EARDF fund as the latest up-to-date data found on the European's Union database (<https://cohesiondata.ec.europa.eu/>) compared to the initial fund allocation proposed in 2014. This rise in budget highlights the agriculture sector's significance on the European Union's agenda and safeguards the EU's agricultural sector's increased competitiveness on the global board.

Competitiveness in the agriculture sector is stimulated by investments in RandD, technology, and innovation. At present, agricultural efficiency and sustainability are directly linked to terms such as smart-farming, precision-farming, digitalization, farming 4.0, concepts which all are based on innovation and technology. However, as the results indicate, during 2014-2020, the EAFRD budget was mainly directed to Competitiveness of SMEs (EUR 43.2 billion), Environment Protection and Resource Efficiency (EUR 38.4 billion), Climate Change Adaptation and Risk Prevention (EUR 32.1 billion), while a small part of the budget was orientated towards Research and Innovation (EUR 3.3 billion), Sustainable and Quality Employment (EUR 3.1 billion) and Educational and Vocational Training (EUR 1.4 billion).

All in all, as the results of the current research show, Europe is heading towards a more competitive agricultural sector. Still, the results measured in terms of financial terms, productivity per ha, and sustainability may appear in the medium/long term since competitiveness is not achieved in the short run. Competitiveness is built step-by-step and represents a long-term commitment.

## Acknowledgment

*The present study is part of the post-doctoral project "Analysis of the competitive sectorial position in the global business network. Romania and the agricultural sector" coordinated by the Post-Doctoral School of Economics and International Affairs.*

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