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EXPENDITURE ON ENVIRONMENTAL PROTECTION, TAXES AND INNOVATIONS AS DETERMINANTS OF THE LEVEL OF SUSTAINABILITY IN AGRICULTURE

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Abstract

The issue of sustainable development occurs in almost every kind of activity among all sectors, including agriculture as well. At the moment, the agriculture is facing many challenges, not only in the form of higher productivity, efficiency or consolidation, but it should also fulfil some certain criteria which are related to sustainable development. Today, agriculture should be more ecological, use resources in a more efficient way and try to use renewable sources instead of non-renewable.

But it is not all, the sustainability of agriculture could be also measured by certain expenditures such as environmental protection, taxes and innovations, which can also describe the level of sustainability in agriculture. Having in mind that agriculture is one of the most important sectors in all EU countries, it is worth to conduct such an analysis, which allow determining the level of sustainability in agriculture among all EU countries. Thus, the purpose of the article is to check the level of these expenditures in order to outline in which UE countries a sustainable agriculture is present.

Keywords: *sustainable development, sustainable agriculture, analysis, expenditures, environment protection, taxes, innovation*

JEL classification: *N53, O13, Q15*

1 Introduction

Agriculture in all EU countries continues to be a very important sector of the economy, next to the food, fisheries and forestry industries, it is one of the most important elements of broadly understood agribusiness. Agriculture and rural areas play a key role in the economic and social development of developing countries (Brzozowska, 2014). The agricultural sector is supposed to fulfil several goals together with societal values, such as increased food production, preserving and developing cultural heritage or climate change and recreational values, while at the same time being both economically and sustainable viable on a long-term basis (Lindbloom et al. 2017). Consequently, there is a need for a conscious agricultural policy aimed not only at the further development of agriculture, ensuring the continuity of food supply, but also guaranteeing adequate financial profits for farmers, reducing poverty but also ensuring food security ("The Common Agricultural Policy).

In 2011, CAP's reform took place, as a result of which a 10-point plan was drawn up and its main objective was to strengthen the economic and ecological competitiveness of the agricultural sector, support innovation, counteracting climate change and supporting employment and growth in rural areas (Wąsag, 2010). In turn, as the result of the next reform was the adoption a broader and strategic approach to the CAP. It will be primarily concentrated on the environmental, social and economic challenges implementation, which is in line with the Europe 2020 strategy objectives for smart and sustainable development(Rozwój lokalny…, 2017).

The food production goal will be achieved through an appropriate and stable level of income, strengthening the farms' competitiveness and supporting areas with unfavourable natural conditions. The Sustainable Natural Resources Management goal will be implemented by guaranteeing sustainable production activities, promoting the so-called green development and carrying out activities aimed at mitigating the effects of climate change. In turn, the Sustainable Development goal will be implemented through the rural areas activation, employment growth, promotion of diversification and creation of conditions for social and structural diversity in rural areas (CAP until 2020, 2017). Looking through the above-mentioned goals, it can be noticed that the concept of sustainable development has been presented in programs or projects aimed at strengthening agriculture, for many years, to a greater or lesser extent. And over the years, it is becoming clear that this issue is gaining importance.

Awareness of the close development of agriculture with the concept of sustainable development manifests itself in emphasizing the essence of this concept

in many documents related to the development of agriculture and rural areas. Reference to the concept of sustainable development can be found in the CAP (Common Agriculture Policy), which as a result of the reform of 1992, put on the farmers a responsibility for environmental protection and sustainable agriculture, and for the reasonable use of our natural resources, soil, air and water. These tasks have translated into practical activities such as diversification of crops, maintenance of permanent grassland and less intensive production (Wspólna polityka rolna…, 2012). And not to mention, that in order to achieve Sustainable Development Goals, much stronger attention to sustainable agriculture practices should be put (Braun et al, 2017).

This concept is even more important for agriculture and rural areas that directly affect the natural environment (Marsden & Sonnino, 2009). Due to the close link between the agriculture development and the development of rural areas, it is impossible to talk about the sustainable development of these areas without sustainable agriculture (Żmija, 2011). Sustainable agriculture implies an integrated system with a long-term outlook, one that is concerned with the different factors that contribute to a quality of life, the improvement of the environment, the efficient use of non-renewable resources, and the increased use of renewable alternatives (Gosetti, 2017).

Sustainable agriculture development, which is a key element of sustainable rural development, as defined by the FAO Food and Agriculture United Nations in 1987, is the use and conservation of natural resources and the orientation of technology and institutions to meet human needs and future generations (Sydorovych & Wossink, 2008). Another definition specifies that sustainable agriculture implements, simultaneously and harmoniously, production, economic, environmental and social goals (Faber, 2001). The agriculture development also depends on the social inclusion, health, climate changes, energy, ecosystem processes, natural resources, good supremacy, etc., must also be documented in specific target oriented goals. Therefore, sustainable agricultural strengthening the practical opportunity to get rid of poverty and hunger of the people (Prasad et al. 2017).

Sustainable agriculture as one of the fields of sustainable rural development and an alternative to intensive industrial farming should rationally manage the land resources so that they can benefit from it and meet their needs for future generations of producers and consumers as well. Its essence is to strive for a stable and, at the same time, economically viable and socially acceptable production in a way that does not harm the natural environment.

2 Data and Methods

Having in mind the above, this article contains an analysis, whose obtained results, may become an answer to which extent agriculture in all EU countries can be perceived as a sustainable one. The conducted analysis concentrated on the following issues:

- Environmental protection expenditures incurred by the agricultural sector of all EU countries,
- Environmental taxes incurred by the agricultural sector of all EU countries,
- Innovation expenditures incurred by the agricultural sector of all EU countries.

Unfortunately, in case of agricultural environmental protection expenditures, only four countries have provided the appropriate data – thus the table with the results includes the data from these countries only. For the rest – all UE countries have provided the data and information, thus made it possible to conduct such analysis.

In order to fulfil the purpose of the article, which is the attempt to determine the level determine the level of sustainability in agriculture among EU countries, the following methodology was adopted:

At first, we have checked the data, provided by the Eurostat, in order to determines the following issues: number of farms in EU countries, total farm's area, standard output, labour force directly employed in agriculture castor and the total production of crops, milk and meat, which are the basic products of agriculture. Then we have checked the expenditures on: agriculture environment protection, environmental taxes and innovations, paid by agriculture sector from EU countries. In addition to innovation expenditures, we have also checked the level of these expenditures for every single farm.

It is worth mentioning that some of the data on the basis of which the analysis was carried out were estimated in 2009, 2010 and 2012. The year 2013 was adopted as the most current year, because of the majority of statistical data necessary for the analysis concerned this year as the most up-to-date.

3 Results and Discussion

The first stage of the analysis was the presentation of basic figures characterizing agriculture in all EU countries. These values were: the number of farms, their total area, the amount of income earned, the number of employees and the level of production (crops, milk and meat) presented in Table 1

Table 1 **The main volumes of EU agriculture**

Country	Number of farms	Total farms' area (ha)	Standard output (euro)	Labour force directly employed (per person)	Total production of crops, milk and meat (in thonnes)
Romania	3 629 660	14 661 380	11 989 578 640	1 552 630	20 926 360
Poland	1 429 010	16 487 480	21 797 461 420	1 918 550	31 379 860
Italy	1 010 330	15 933 790	43 793 881 650	816 920	22 125 610
Spain	965 000	30 042 210	35 978 946 920	813 550	25 954 280
Greece	709 500	5 062 500	8 103 007 120	463 860	4 670 360
Hungary	491 330	7 048 760	5 577 723 710	433 700	13 632 550
France	472 210	29 264 400	56 914 191 760	724 690	75 214 700
Germany	285 030	18 305 150	46 252 042 690	522 730	57 491 100
Portugal	264 420	4 625 700	4 509 024 200	323 470	1 447 650
Bulgaria	254 410	5 608 980	3 335 670 170	320 230	9 368 190
United Kingdom	183 040	18 663 950	21 818 581 460	274 520	28941060
Lithuania	171 800	3 125 370	1 919 223 290	144 770	4 511 570
Croatia	157 440	1 728 100	2 029 135 280	175 050	3 661 050
Austria	140 430	5 815 840	5 671 213 540	111 160	5 978 050
Ireland	139 600	5 277 990	5 012 538 820	163 690	3 457 890
Latvia	81 800	3 058 780	990 012 640	82 090	1 964 370
Slovenia	72 380	902 160	1 009 230 010	82 450	489 440
Netherlands	67 480	2 008 870	20 498 061 340	153 310	2 202 100
Sweden	67 150	6 424 370	4 678 580 280	59 320	6 349 460
Finland	54 400	5 786 690	3 398 060 700	57 550	4 143 220
Norway	43 270	5 372 090	3 410 100 700	44 000	965 000
Denmark	38 280	2 920 610	9 580 213 710	53 170	9 943 600
Belgium	37 760	1 350 200	8 406 674 190	56 730	4 909 470
Cyprus	35 380	123 810	495 411 360	16 550	140 600
Czech Republic	26 250	5 076 430	4 446 963 820	105 080	8 433 760
Slovakia	23 570	3 067 090	1 812 222 660	50 600	3 421 490
Estonia	19 190	1 229 420	676 317 090	22 060	1 149 360

Country	Number of farms	Total farms' area (ha)	Standard output (euro)	Labour force directly employed (per person)	Total production of crops, milk and meat (in thonnes)
Malta	9 360	11 980	96 790 090	4 450	11 300
Luxembourg	2 080	137 790	313 811 850	3 530	181 250

Source: Authors' own calculations based on Eurostat statistics, http://ec.europa.eu/eurostat/web/agriculture/data/database, access date 25-12-2017.

The yellow fields indicate the first five countries with the highest values for a given category, and the countries are being sorted by the number of farms. As shown in the table above, the first five countries with the largest number of farms are Romania (3,6 mln), Poland (1,4 mln), Italy (1,0 mln), Spain (0,9 mln) and Greece (0,7 mln). For the total area of agricultural land, Spain is on the 1st place, with more than 30 million hectares of agricultural land, on the second is France, with less than 30 million hectares of agricultural land. On further places, the following countries have been found: Poland (16,4 mln ha), Germany (18,3 mln ha) and United Kingdom (18,6 mln ha), in which the area of agriculture land is similar. In the case of revenues generated by farms, France is on 1st place, when in 2013 farms generated a total of more than 56 billion Euros. On the further places are Germany (46 billion Euros), Italy (43 billion Euros), Spain (35 billion Euros) and United Kingdom (21 billion Euros). It is worth to add that, right after the United Kingdom, Poland was located, whose farms in 2013 generated over 21 billion euro revenue. In the case of a number of employees in agriculture, on the first four place are the countries with the largest number of farms: Romania (1,5 mln employees), Poland (1,9 mln employees), Italy (0.8 mln employees) and Spain (0.8 mln employees). Whereas France is in the last place (0.7 million employees). But, in contrast, France is on the 1st place in the case of total production, being an undisputed leader, since French farms in 2013 have produced over 75 million tons of products. Germany, which produced nearly 20 million tons less - 57 million tons of products, is on 2nd place. Poland is on the 3rd place, whose production is less than half of the French farms' production - 31 million tons. The next is Spain, whose production is one third the size of French farms and is hovering around 25 million. Italy ranked fifth with 22 million tons of production. In general, looking at the table above, it is clearly visible that Romania, Poland, Italy, Spain, France, Germany and the United Kingdom are characterized by the largest values. On the

other hand, Greece is on the 5th place in terms of the number of farms, but the remaining values are far from the first five.

In case of agriculture environmental protection expenditure, only Poland, Czech Republic, Romania and Croatia provide this kind of information. In this ranking, Poland is on the first place, with expenditures at the level of over 36 million Euro. The Czech Republic is on the second place, with outlays amounting to over 21 million Euro. The next two places Romania and Croatia occupy, whose expenditure on agriculture environmental protection amounted to 8.2 and 7.2 million Euro, respectively.

Table 2 **Agriculture environmental protection expenditure in EU countries, 2013**

Country	Agriculture environmental protection expenditure in EU countries (mln Euro)
Poland	36,89
Czech Republic	21,73
Romania	8,2
Croatia	7,21

Source: Authors' own calculations based on Eurostat statistics, http://ec.europa.eu/eurostat/web/agriculture/data/database, access date 25-12-2017.

As was mentioned above, for this kind of information, only four countries have provided the data – all of them the above table includes. Having in mind the share of agriculture environmental protection expenditure in a total environmental protection expenditure, the biggest share can be noticed for Croatia, where agriculture environmental protection expenditure accounts for 5,17% of total environmental protection expenditure, on the next place is the Czech Republic with the share of 3%, and then Poland – in which agriculture environmental protection expenditure accounts for 1,96% of total environmental protection expenditure in 2013.

Table 3 **Environmental taxes paid by agriculture in EU countries, 2013**

Country	Environmental taxes paid by agriculture (mln Euro)	Country	Environmental taxes paid by agriculture (per one farm)
Germany	1 228,81	Denmark	6,74
France	1 016,85	Sweden	6,60
United Kingdom	886,57	**Netherlands**	5,88

Country	Environmental taxes paid by agriculture (mln Euro)	Country	Environmental taxes paid by agriculture (per one farm)
Italy	738,82	**Czech Republic**	5,61
Poland	519,49	**United Kingdom**	4,84
Sweden	443,28	**Germany**	4,31
Greece	423,12	**Norway**	3,69
Netherlands	396,81	**Slovakia**	2,90
Austria	276,75	**Finland**	2,17
Denmark	257,98	**France**	2,15
Spain	243,00	**Austria**	1,97
Norway	159,86	**Luxembourg**	1,58
Czech Republic	147,28	**Estonia**	0,94
Hungary	136,85	**Italy**	0,73
Finland	118,28	**Greece**	0,60
Portugal	83,71	**Latvia**	0,45
Slovakia	68,43	**Ireland**	0,43
Bulgaria	62,88	**Poland**	0,36
Ireland	59,46	**Malta**	0,33
Romania	51,75	**Portugal**	0,32
Croatia	41,77	**Hungary**	0,28
Latvia	36,82	**Croatia**	0,27
Lithuania	24,28	**Bulgaria**	0,25
Estonia	17,95	**Spain**	0,25
Luxembourg	3,29	**Lithuania**	0,14
Malta	3,05	**Cyprus**	0,07
Cyprus	2,32	**Romania**	0,01
Slovenia	1,5	**Slovenia**	0,00

Source: Authors' own calculations based on Eurostat statistics, http://ec.europa.eu/eurostat/web/agriculture/data/database, access date 25-12-2017.

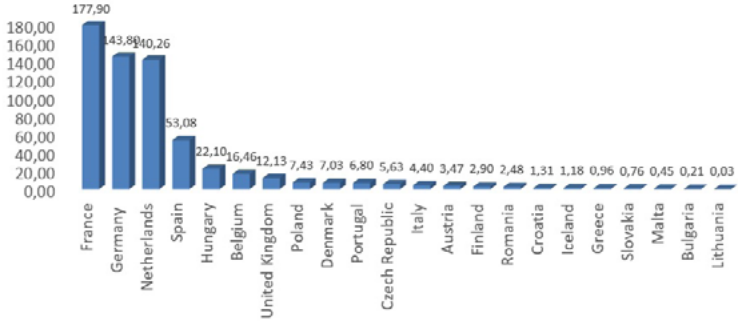
As it can be seen from the above table, Germany is on the first place, in which agriculture paid over 1.2 million Euro in environmental taxes in 2013. France is in the second place, with environmental taxes amounting to over 1.01 million Euro. Such high tax rates are caused by the fact that the areas of agricultural land in both

countries are the highest among the other EU countries, and the agriculture in both countries generates one of the highest revenues as well. On the other hand, comparing the amount of environmental taxes to total revenues, it can be seen that in the case of Germany, these taxes are just 2.66% of total taxes, and in the case of France - 1.79% of the total. In the case of the United Kingdom, in which agriculture paid over 886 million Euro in environmental taxes in 2013, the share of these taxes accounted for 4.06% of the total revenues generated by this sector. But the opposite situation can be observed in the case of Spain, whose total area of agricultural land is over 30 million hectares, but the level of environmental taxes paid amounts to 243 million Euro. Poland is on the fifth place, and according to the table, the amount of environmental taxes paid by agriculture in 2013 amounted to 519.49 million Euros, corresponding to 2.38% in the total income generated by Polish agriculture. On the last place, Slovenia is, where the environmental taxes paid by agriculture in 2013 amounted to just 1.5 million Euro, corresponding to 0.15% of the total income generated by Slovenian agriculture. In turn, looking at the size of environmental taxes from one farm, the highest taxes are paid by Denmark - 6.74 Euro, Sweden - 6.6 Euro, Netherlands - 5.88 Euro and Czech Republic - 5.61 Euro in the year 2013. While Germany, France and the United Kingdom are on the further places. At the same time, it is worth noting that the amount of this tax depends on such situations as introduction of gases into the air, sewage to the ground, water intake or waste storage. So the higher the number of gases, dust, sewage or waste, the higher amount of the environmental tax need to be paid. Thus, can be stated that Denmark, Sweden, Netherlands and the Czech Republic are characterized by their largest sizes.In contrast, countries with the lowest values can be seen as countries in which the agricultural sector generates the least amount of dust, gas, sewage or waste, having a negative impact on the natural environment. In this case, these are Slovenia, Romania, Cyprus and Lithuania.

One of the most important factors determining the level of sustainability is innovation. Innovation in a technology dimension may be a basis for sustainable technologies, which mean "fulfilling people's needs in such a way that the recovery capacity of the planet, as well as the recovery capacity of local ecosystems, are not exceeded. The aim is to bring the worlds' use of natural resources within the boundaries that are set by the earth's recovery capacity. What are the preconditions that the need for sustainable development sets for these innovations" (Mulder, 2007)? Currently, sustainable development is seen as a concept based on three equivalent pillars, and innovation is now treated as a process also affects the environment or social environment (Bajdor, 2017). Therefore, among other things, expenditures on innovations to some extent reflect the innovativeness of

this selected sector. As shown in the figure below, countries such as France, Germany and the Netherlands were in the forefront

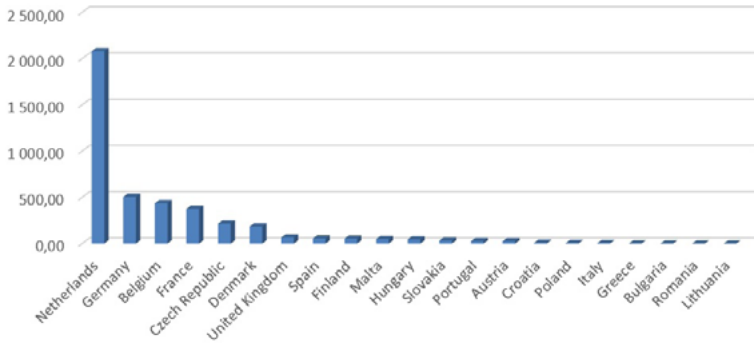
Figure 1 **Innovations expenditures by UE countries.**



Source: Authors' own calculations.

The largest expenditure on innovations in 2013 was borne by the agricultural sector in France - 177 million Euro, followed by Germany and the Netherlands in the second and third place, where the level of expenditure on innovation incurred by the agricultural sector in 2013 amounted to 143 million Euro and 140 million Euro respectively. The fourth is Spain - the spending on innovation borne by the agricultural sector amounted to 53 million Euro, representing 1/3 of the expenditure of the first three countries. However, taking into account the level of expenditure on innovations incurred by one farm, there are clear differences in the obtained results.

Figure 2 **Innovations expenditures by single farm.**



Source: Authors' own calculations.

The Netherlands is in the forefront, where in 2013, one farm has spent over 2,000 Euro on expenditure on innovation. Already, between the first and the second place, there is a clear difference - because the level of spending on innovations incurred by German households was only a ¼ of Dutch expenses - 504 Euros per one farm. A similar level of inputs is characteristic of Belgian and then French farms - 435 Euro and 376 Euro in 2013.

4 Conclusion

Based on the obtained results, it can be assumed that agriculture in Europe Union countries is partly sustainable. In this article, the following Assumption was adopted: besides the main factors determining the level of sustainability in agriculture, other factors such as environmental protection and innovation expenditures with environmental taxes have been checked. Thus, in case of the level of environmental taxes paid by agriculture in EU countries, Germany has the first place, France on the second. In both these countries, the amount of environmental taxes is higher than 1 bln Euro. While, it is worth to mention that the level of environmental taxes depends on the number of gases, ashes, waste generated by the agriculture sector. So, it would seem that agriculture sector in Germany and France generates the highest volume of these pollutants. But checking the level of this taxes paid by single farm – Denmark has the first place, then Sweden and Netherlands. And Germany and France are among the further places. Thus, agriculture in Denmark, Sweden and Netherland generate the highest volume of mentioned pollutants then. And in the last places are Slovenia, Romania, Cyprus and Lithuania – which means that agriculture in these countries generates at least amount of the pollutants. So we can concluded that is operates in more sustainable way.

In case of level of innovation expenditures, France, Germany and Netherlands are in the first place. But, again checking the level of these expenditures paid by single farm – Netherlands are in the first place, then Germany and Belgium. France is in the fourth place. But the high position if the Netherlands in both case, show that agriculture sector is characterized by the high level of innovation expenditures. But in the case of agriculture, environmental protection expenditure – only four countries gave access to their data – Poland, Czech Republic, Romania and Croatia. And it is clearly visible that Poland is in the first place. Thus its agriculture sector has the highest expenditures in order to protect the environment.

To sum up, it can be stated that by examining the level of expenditures on environmental protection, innovation and environmental taxes, Germany, France

and Netherlands have the most sustainable agriculture, on the further places we can put United Kingdom, Spain and the Czech Republic. But in order to draw a full picture, would be worthwhile to check the level and type of waste and greenhouse gas emissions and pollutants generated by each agriculture sector. Which would be the subject of the further analysis in this matter.

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