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An Analysis of the Influencing Factors of the Romanian Agricultural Output within the Context of Green Economy

Nicoleta Valentina Florea [1], Mircea Constantin Duică [1], Constantin Aurelian Ionescu [2,*], Anișoara Duică [1], Mihaela Cristina Onica Ibinceanu [3] and Sorina Geanina Stanescu [4]

[1] Faculty of Economics, Valahia University of Targoviste, 130004 Targoviste, Romania; floreanicol@yahoo.com (N.V.F.); mircea_duica@yahoo.com (M.C.D.); anisoara_duica@yahoo.com (A.D.)
[2] Faculty of Economics, Hyperion University of Bucharest, 030615 Bucharest, Romania
[3] Faculty of Economics and Administration Business, Dunarea de Jos University of Galati, 800008 Galati, Romania; cristina_onica@yahoo.com
[4] Institute of Multidisciplinary Research for Science and Technology, Valahia University of Targoviste, 130004 Targoviste, Romania; geaninastanescu@yahoo.com
* Correspondence: ionescuaurelian89@gmail.com; Tel.: +40-0762-738-675

Abstract: The objective of this study is to analyze the trends in agriculture and the factors affecting the output of agriculture (OA) in the EU and Romania in the context of green economy. The research used the quantitative (mathematical regression function, correlation matrix, and R-squared) and qualitative (the SWOT matrix of the agriculture sector in Romania) methods. The data on Romanian agriculture were gathered from Eurostat for the period of 2006–2019. The results showed that there is a direct and positive relationship between the OA and its influencing factors. Moreover, it revealed the negative relationships between the employees in agriculture (−0.58), air pollutants (−0.49), agriculture land (−0.42), irrigation norm (−0.39), agriculture training (−0.33) and the OA, and positive relationships between the area under organic farming (0.56), the average area per holding (0.56), the number of tractors (0.53) and the OA. Romania is a country where employment and agriculture areas are greater than in other EU countries; however, the results of our research highlight the significance of a careful analysis of the influencing factors, of making the difference between the thin line of sustainable performance, of developing new measures, of reducing risks, and of gaining new knowledge and agricultural skills, as an important activity, especially for Romania.

Keywords: agriculture determinants; agricultural output; simulation and modelling; green economy; agricultural performance

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1. Introduction

The importance of agricultural policy has been recognized in all cultures since the earliest times [1]. Moreover, agriculture plays an important role in economic development [2,3] and increasingly in the feeding of the population [4]. Land is not a mere commodity that is traded on the market at a particular value. The transfer of property rights among people makes land ownership a social relationship, and the connection between people and land amplifies the feeling of national and local identity [5]. The understanding of agricultural competitiveness improves the inland agricultural structure development [6]. To achieve sustainable performance in agriculture, the following factors are of great importance: soil properties, the ability to support and sustain crop growth and productivity, while maintaining long-term environmental quality [7], financial inclusion [8], water resources [9], and new plant breeding technologies, including the genetically modified and gene-edited crops [10].

This study aims to analyze the influence of the human, ecologic, natural, economic, social, and technological factors on the output of Romanian agriculture between 2006 and 2019 using mathematical modelling and simulation. Moreover, it analyzes these influencing factors in comparison with other EU countries to demonstrate the connection between these factors; therefore, any country, area, or farm may improve its agricultural performance by better results for any external and internal factor with an influence on the output of agriculture.

This study will present information on the trends of the agricultural environment in the European Union and Romania. Furthermore, the internal and external factors that have a significant influence on the output of agriculture (OA) are presented, such as human, ecologic, natural, economic, social, and technological factors. To observe the influence and the relationship between the analyzed factors, this research makes use of simulation and mathematical modelling. The topic is challenging for any country with a focus on agriculture; as Romania is an agrarian country, by knowing in advance the impact of the analyzed variables, it can estimate, forecast, make plans, and be ready for the upcoming changes and risks.

The study is organized as follows: Introduction and Section 1 offer a literature review in the field, highlighting the challenges and the opportunities for green agriculture practices; Section 2 presents the factors and the sub-factors that influence the output of agriculture; in Section 3, the research methodology is described; Section 4 provides the framework for the analysis of the relationship between the variables through the prism of the correlation between the variables under analysis by using simulation and modelling, as well as the results obtained by implementing the regression method, the correlation matrix, and the relationship matrix; Section 5 lays out the SWOT analysis based on the influence of the analyzed factors and, finally, the discussions and conclusions.

2. Literature Review

Currently, various challenges and transformations are registered worldwide due to long-term global changes such as human population growth, the degree of urbanization, the demand and the consumption of limited resources, the changes in world weather, affecting agriculture and resources, especially food security, migration [11], food prices, and leading to environmental degradation, increased levels of risks, uncertainty [12], and poverty due to pandemics [13]. Therefore, despite land degradation, the increased demand for food became a major task [14], and education must be in line with the needs of the world [15], as well as the people's behaviour and attitude towards consumption, having in view that consumption and economic growth are closely linked [16]. Agricultural growth leads to increased levels of employment and wages [17]. Human health and wellbeing strongly depend on food production, quality, and availability. The development of agriculture enabled people to produce large amounts of food on a more reliable basis and from smaller areas of land [18]. Since agricultural production is directly related to poverty reduction and sustainable development, its study becomes valuable during a crisis, e.g., one generated by the COVID-19 pandemic.

The Earth systems are under constant pressure due to adverse impacts from human activity: using more energy, creating more waste, and producing more air pollutants [19]. In Europe, 2014 was the year of food waste, an issue that must be considered by all states in the world. These issues and the goal of a green environment were taken into account by the world's largest companies that have embraced sustainability and eco-innovation; by the governments that develop new policies and regulations such as removing materials of concern, designing more recyclables, minimizing packages and facilitating product take-back at its end of life; as well as by the consumers who are more interested than ever in the origin and the content of the products, their own way of life, and impact on the environment.

The Common Agricultural Policy (CAP) from 2020, as the main agricultural policy of the EU, has as objectives to ensure a decent standard of living for farmers, to provide a stable and safe food supply chain at affordable prices for consumers, as well as to ensure the development of rural areas throughout the EU [20]. Given the need to modernize and simplify, Romanian agriculture must learn to develop smartly, resiliently, sustainably, and competitively by analyzing its performance based on the influencing factors. In Romania, during the transition from a centralized economy to a free-market economy [21], the limited financing possibilities of the agricultural producers led to an increase in the importance of European funds for agriculture [22]. Romanian agriculture is the turning point for any medium and long-term development strategy of the national economy [23]. Europe is dealing with major issues, such as population ageing and stagnation (28% of the population is over 65 years old; the total population of EU-27 is expected to increase by only 5% compared to the level registered in 2008). Romania is affected as well, its population is to decrease by 2050 to less than 18 million, being exceeded only by Bulgaria (−22.5%), Latvia (−20.5%), and Lithuania (−18.7%) [24]. Rural areas in Europe will be affected by demographic issues, as the urban area will increase by 10% and the rural area will decrease by 2.7% compared with 2011; therefore, agriculture might have to deal with a spatial development issue [25]. These tendencies will have a negative impact on rural development, will reduce the agricultural labour force, and will threaten the vitality of these areas, the green product quality, and the areas for future agricultural practices. CAP considers the economic, social, and environmental concerns. Today, 14 million farmers from the EU and 2.42 million farms from Romania wish to offer quality agricultural products, accessibility, and food safety [26].

The influence of the mentioned factors is examined by various specialists in the field. The authors of this study chose, based on the literature in the field, a series of determinant factors that have an important impact on the OA (Table 1). The ever-present financial crisis is not reflected in this analysis; however, it had an important impact on each analyzed factor, as it reduced the investment in training (from 157,896 in 2006 to 61,900 in 2019), in the irrigation norm (it decreased from 2196.5 in 2006 to 1190 in 2019), in the employment in agriculture (it decreased from 2,631,600 in 2006 to 1,981,491 in 2019), in the share of agriculture in the GDP (it decreased from 7.82 in 2006 to 4.1 in 2019), and in buying tractors for agriculture (it increased from 174.003 in 2006 to 200,000 in 2019).

Table 1. Factors and sub-factors with an influence on the OA.

Factors	Analyzed Sub-Factors
1. Dependent variable (Y)	1. The output of agriculture
2. Independent variables (X_1–X_9)	2. Determinant factors
2.1. Ecological factors	2.1.1. Air pollutants (X_1)
	2.1.2. Area under organic farming (X_2)
2.2. Economic factors	2.2.1. The share of agriculture in GDP (X_3)
2.3. Human factors	2.3.1. Average area per holding and the number of farms (X_4)
	2.3.2. Number of employees in agriculture (X_5)
2.4. Natural factors	2.4.1. Agricultural land (X_6)
2.5. Social factors	2.5.1. Agriculture and farm management training (X_7)
2.6. Technological factors	2.6.1. Irrigation norm (X_8)
	2.6.2. Number of tractors/agricultural machinery (X_9)

The primary and secondary pollutants, such as NO and SO_2, or the photochemical ozone and the acid rain will affect agriculture in the long term [27] and could be fatal [28] for people, animals, and agricultural production in the short term [29]. Agriculture has been the basic source of subsistence for humanity for thousands of years; having in view the increased levels of food production and the limited resources, as well as, with the green revolution, people are more and more interested in eating healthy food, breeding healthy animals/crops on healthy lands, and living in a healthy environment; therefore, sustainable agriculture [30], organic farming, and ecological agriculture [31] were seen as an important alternative to achieve these goals, thus, an important objective for CAP of the EU [32–34]. In many countries, agriculture is an important sector in the national economy/GDP, e.g., Poland 2.2%, Romania 4.1%, Russian Federation 3.4%, Spain 2.7%; the rest of EU-28 countries registered between 0 and 1%. Compared with the average in Central Europe and the Baltics—2.7%, the European Union—1.6%, and the world—4%, Romania with 4.1% is in a good position, being an agrarian country and ensuring agricultural production for itself and other countries [35]. There is a direct relationship between agriculture and the average area per holding in Romania; even though there is extensive arable land, the average area per holding is greatly reduced, due to the abolition of the Agricultural Production Cooperatives and the land restitution from 1990 [36]; 54% of holdings have an agricultural area under 1 hectare.

Furthermore, there is a direct relationship between agriculture and employment in Romania (40% of the active population worked in agriculture in 2002 [37] and 23% in 2018 [38]); the trend of employment is decreasing and depends on many factors but is still at a relatively high level. Studies show a direct relationship between agriculture and agricultural land; in 2015, the agricultural land covered 42% of EU land area; it is forecasted that the top 10 EU countries based on the percentage of agricultural land will remain on this top position in 2030; among them are France, Spain, Germany, Poland, Italy, Romania, and UK [39], having in view that many criteria may lead to an increase or decrease of agricultural land over time [37].

There is a direct, positive relationship between agricultural performance and agricultural training. Studies show that young farmers must attend training or courses in the field to get the necessary skills, this being directly related to the political and administrative structure of the country [40]. To improve the quality of the human capital, the agricultural enterprises might need to apply the principle "learn by doing" [41]; thus, the agricultural and farm management training was at 93% in 2005, 97% in 2010, 96.4% in 2013, and 97.31% in 2016 [42]. The education level of the agricultural labour force of the region highlights one of the major problems related to present and future developments of employment, particularly, in dual-speed agriculture where small agricultural households and farms are still very present and socially important [43]. The agricultural training, provided in the country or abroad, by individuals, companies, or governments [44], will lead to the development of the country and its people, to better performance and quality, as well as increased production, poverty reduction, and food security; thus, leading to new knowledge, skills [45], abilities, and increased farm productivity [46]. The studies, reports, and statistics show that to get agricultural income, some factors have to be considered, among them being the fluctuation of weather and irrigations in each region [47]. Irrigation depends on agricultural performance; thus, the crops demand and thermal imaging in smart irrigation are a solution for better performance in agriculture [48]. Moreover, there is a direct relationship between the number of tractors used in agriculture; in Romania, in the last few years the number of tractors increased [49]; however, compared with the EU-28 countries, it is very low, as, in Romania, there is 1 tractor for 100 farms, compared to EU-28, where almost every farm has its tractor. The factors presented above will be analyzed in this study, as they are considered by the authors and the specialists to have an important influence on the OA. As a result of the analysis of their influence, predictions can be made, activities and processes can be improved, the costs and risks can be reduced, and the agricultural product quality, food, and security could be improved.

The Determinants with an Impact on the Output of Agriculture

According to the literature in the field, many factors influence the output of agriculture. These factors, as it may be seen above, were divided into two categories; in the first category were human, ecologic, natural, economic, social, and technological factors, and in the second were the sub-factors examined below.

The estimated value of the agricultural output in 2018 inched higher; agriculture contributed by 1.1% to the EU's GDP in 2018. The agricultural industry created an estimated added value of EUR 181.7 billion in 2018. In 2019, the indices for the value of output by the agricultural industry, according to eurostat.com (accessed on 26 June 2021), were 146.74 for the average EU-28; for Bulgaria 307.93, Germany 168.42, Spain 117.04, France 108.81, Italy 116.28, Hungary 184.21, Poland 170.34, and Romania 316.52. Regarding the output of the agricultural industry, Romania is in seventh place (14,410 million euros), and after the following European countries: France (77,355), Germany (54,578), Italy (48,632), Spain (42,191), the Netherland (26,268), and Poland (23,198). As for Gross Value Added, Romania was also in seventh place in 2013 with 6201 million euros, after France (31,870), Italy (25,566), Spain (21,526), Germany (17,030), Poland (9013), and the Nederland (8426) [50].

From the various factors that influence the OA, we shall only examine the influence of air pollutants and the sales of fertilizers. Air pollutants have a significant impact on the quality of agricultural products. From 1990 to 2017, the EU-28 registered substantial reductions in emissions of all air pollutants: SO_2 emissions were reduced to 2.3 million tons in 2017 compared to 25 million tons in 1990. The trend for Romania is also decreasing. This reduction was "thanks to a wide range of environmental policy measures." Based on the data from eurostat.eu (accessed on 26 June 2021), Romania has a value of 137,595 for air pollutants; lower values were registered for Liechtenstein 203, Malta 1447, Cyprus 4309, Luxembourg 5503, and higher values were registered in Germany 723,950, Spain 458,562, France 664,063, Italy 377,937, Poland 259,188, and the UK 237,599 [51,52].

In 2017, the countries with the largest organic European markets were Germany (10 billion euros) and France (7.9 billion euros). The EU organic market is 37% of the total organic market worldwide. The highest per-capita consumption in 2017, of almost 300 euros, was registered in Switzerland and Denmark. The highest organic market shares were reached in Denmark (13.3%), the first country with an organic market share of over 10%, as well as in Sweden (9.1%) and Switzerland (9%). At the end of 2017, 14.6 million hectares of agricultural land in Europe (European Union 12.8 million hectares) were managed organically by over 397,000 producers. In Europe, 2.9% of the agricultural land was organic. The organic farmland has increased by over 1 million hectares compared to 2016. As we may see, the countries with the largest organic agricultural areas were Spain (2.1 million hectares), Italy (1.9 million hectares), France (1.7 million hectares), and Germany (1.3 million hectares). In ten countries, at least 10% of the farmland is organic: Liechtenstein takes the lead (37.9%), followed by Austria (24%) and Estonia (20.5%). In 2018, a major milestone was the publication of the new European Union (EU) rules on organic production and labelling of organic products [53]. The highest percentage of the share of organic farming is in Austria, which has 24.1%, Estonia 20.6%, and Sweden 20.3%. Romania is in the penultimate place, with 2.4% [54,55].

The average value added in the agricultural sector as per cent of GDP for 2018 based on 161 countries was 10.39%. The agricultural sector contributed 176.9 billion euros towards the EU's overall GDP in 2018 [50]. The value added in the agricultural sector as per cent of GDP for Romania, from the data obtained from the World Bank from 1990 (21.81) to 2019 (4.1) was 12.8% with a minimum of 4.06% in 2016 and a maximum of 21.81% in 1990 [56].

The farm structure in Romania is dominated by family farms, like in the EU; however, their size is very small, an average of 3.66 ha, Romania registering the 3rd smallest average farm size (above only Malta and Cyprus). Romania uses 97.9% of the farms between 0 and 10 hectares of land (from which 74.3% of farms are less than 2 hectares), this fragmentation not allowing for the development of intensive agriculture. The farms of an optimum size that can use production factors efficiently are a global objective for agriculture on which the food security of populations depends [20]. Still, Romania ranked 1st in the EU in 2010 for the number of holdings (3859 thousand farms), followed by Italy (with 1621 thousand farms), and Poland (with 1507 thousand farms), but was the last in the EU for the average output per holding [57].

The holdings of 10–50 hectares are found in Ireland (63.6%), Finland (54.9%), and Germany (46.5%), and over 50 hectares in Luxembourg (49.1%), United Kingdom (38.7%), and France (37.2%). Larger farms keep their advantage in agriculture [58]. Around 80.3% of all farms in the EU-28 had less than 10 hectares and cultivated 12.2% of the agricultural area, and only 5.9% of the farms over 50 hectares or more cultivated 66.6% of the total utilized agricultural area. In Romania, with the highest number of farms in EU-28, nine in every ten farms (91.8% or 3.1 million farms) were smaller than 5 ha [59]. One-third (32.7%)

of the EU's agricultural holdings were in Romania in 2016, much more than any other member state; compared to the farms from Poland (13.5% of the EU-28 total), Italy (10.9%) and Spain (9.0%) [38].

Romania presents some structural characteristics such as the other agricultural sectors from other EU member countries, but it is unique due to the gap between the category of large farms and the small ones, and due to the prevalence of subsistence and semi-subsistence farming. In 2010, 93% of Romanian exploitations were in these two categories; out of these, three quarters were operating on less than 2 hectares, and more than a quarter was managed by farmers over 65 years old [24]. Young farmers are scarce in EU-28, those over 65 are present in many member states; in Portugal, they represented 51.9% of all farmers, in Cyprus 44.6%, in Romania 44.3%, and in Italy 40.9%. These structures highlight the policy interest in farm succession and the need to encourage a new generation of farmers [38].

To study the evolution of employment in agriculture in Romania, we offer the statistics over the years. In 2012, 11.5 million agricultural workers were employed, Romania being the first at the number of employees in agriculture (2.8 million persons), followed by Poland (1.9 million), Italy (0.9 million), Germany (0.67 million), and Bulgaria (0.65 million). In 2013, the total agricultural workforce in EU-28 was 9.5 million employees (decreasing comparing with 2012). Out of them, 8.7 million were permanent employees (representing 92% of the total number). In Romania, 23% of the population work in agriculture, while 18% in Bulgaria, 11% in Greece, 10% in Poland, 2% in Germany, and 1% in the UK [60]. In Romania there are no special agricultural markets; they come from different fields and areas, providing unskilled work. Moreover, there is no local/regional or national policy for this branch of the economy and its workers [61].

Romania is a traditional agrarian country and plays an important role in European agriculture. The soil is fertile, and the climate is favourable. With a total area of 238,000 sqm, Romania has an important agrarian profile in the EU (almost 15 million ha of farmland, of which more than 9 million ha for arable crops). Romania owns almost one-third of the total agricultural land in the EU (33.5% of all EU farms, EU Commission updates, April 2017). Thus, Romania could be (after Poland with 17 million ha of agricultural area) the second largest producer of agricultural products in the CEE region. In 2013 there were 10.8 million agricultural exploitations in EU-28. Most of them were registered in Romania (3.6 million), registering one third (33.5%) of the total exploitations in EU-28. Poland is the second country with 13.2%, and then Italy (9.3%) and Spain (8.9%) [62]. To observe the real situation regarding the agricultural land per capita, we made a comparison between the years 2010, 2015 and 2017. Romania was in sixth place in the EU regarding the arable area per capita. The ratio between the arable area and the number of inhabitants shows that Romania registers a value of 0.41 ha, which is superior to many countries in the EU and almost double compared to the EU average (0.212 ha/capita) [26]. Romania is one of the European countries with good resources of land, water, as well as available human resources. Moreover, its utilized agricultural area (13.3 million ha) places Romania in the European Union on top places in terms of agricultural land per capita (approx. 0.7 hectares/capita) [63], however, 40% of the arable area is controlled by the foreign investors in Romania [64]. The year 2017 has been exceptional for Romanian agriculture with unprecedented levels of productions. Organic farming is still at its initial stage in Romania, representing only 0.4% of the agricultural land [57]. From the data offered by RGA in 2010, out of the 23.8 million ha of Romanian agricultural surface, the agricultural exploitations reach 13.3 million ha (55.9%), and out of this 8.3 million ha are arable areas (63.5% of the agricultural surface).

The human factors involved in agriculture will depend on the agricultural land and the productivity coefficient [65]. The investments in human capital gradually became a hot topic for researchers, due to its unique and valuable knowledge, skills, and competencies brought into any activity, especially now in the agricultural field [66]. Any marketing strategy aims to achieve its business goals and improve its marketing ability as an important symbol of modern agriculture [67]. In knowledge-based agriculture, human capital, knowledge, and information technology became the main strategic resources for the development of agricultural enterprises. Thus, the interaction between the marketing ability (research, channel analysis, and market analysis) and the human capital is likely to be effective in improving the performance and competitiveness of agricultural enterprises when the marketing costs grow. To improve the human capital quality, the agricultural enterprises may apply the principle of "learning by doing" [41]. Much knowledge on the human capital in agriculture was gained through various projects [68].

A large majority of European farmers have not received any formal training in agriculture; most of their agricultural skills are gained through practical experience. The agricultural training of farm managers was from the practical experience of 93% in 2005, 97% in 2010, 96.4% in 2013, and 97.31% in 2016 [43]. According to the statistics from 2018 [38], most farm managers in the EU only had practical experience; this was the case for seven in every ten (68.3%) of them in 2016. Less than one in ten farm managers (9.1%) had full agricultural training and the rest (22.6%) had basic agricultural training. In some member states, the level of agricultural training is low; in Romania and Greece, only 0.4% and 0.6% of farm managers, respectively. had full agricultural training. The overwhelming majority (96.7% and 93.2%, respectively) had only practical experience. Only in Luxembourg (52.5%), the Czech Republic (38.7%), France (34.9%), and Latvia (31.3%), the farmers had formal agricultural training [38]. Agriculture is the biggest consumer of fresh water in the world, amounting to up to 70% of the total use; the irrigation systems and field application methods for the cultivation of crops play an important role therein [69]. In 2013, the total irrigable area in EU-28 was about 18.7 million ha (an increase of 13.4% compared to 2003); however, only 10.2 million ha were irrigated. The share of irrigable and irrigated UAA in EU-28 in 2013 was 11.3% and 6.2%, respectively. The irrigable and irrigated areas greatly vary among the countries, mainly because of regional climates. The share of irrigable and irrigated areas was not surprisingly the largest in the Mediterranean countries. Spain and Italy had the largest irrigable areas in absolute terms (6.7 million and 4.0 million hectares, respectively) in 2013. The largest share of irrigable UAA in 2013 was recorded in Greece (44.9%), Malta (38.6%), Cyprus (34.9%), Italy (33.9%), and Spain (31.1%). In 2017, the agricultural water management in certain areas increased from 230.4 in 2013 to 334.7 in 2017. However, only 152,800 ha from 230,400 ha was irrigated in 2013 [70]. Along with the new technologies, the new knowledge, as well as the improved and well-adapted farming methods will help enhance the agricultural performance and awareness for the protection of the environment [68]. The impact of new technologies differs substantially by region and, within regions, by country. Adopting new technologies in agriculture will considerably improve productivity, especially if they are new, technically high, and precise [71]; it will improve food production and food security, increase crop productivity, develop and use the resource-conserving agricultural management practices, and increase the investments in irrigation [72]. Effective technology adoption will also require institutional, policy, and investment advances. In the countries where the land is not fertile, without sufficient water resources, or where the farmers do not have access to financing or new technologies, the agriculture is not developed, and the benefits are low. Those farmers who are aware of the techniques of precision agriculture (including grid soil sampling, yield mapping, and variable rates of input application) tend to be those who have more education [68]. Only in a few countries in the EU, more than 90% of farmers own a tractor (Finland, Germany, and Sweden), and more than 80% in many other EU countries (such as Luxembourg, Austria, Slovenia, Czech Republic, Belgium, Denmark, France, the Netherlands). Fewer than 20% (Hungary, Bulgaria) and Romania are considerably behind. In the EU, the production of tractors has reduced from over 10,000 in 2008 to over 6500 in 2017 [73]. The tractors used in agriculture are neither updated to comply with the safety regulations nor in line with modern and safer technical solutions [74]. The number of old (aged) tractors is very big, especially among the family-run companies, for whom to replace them with newer and safer models [75] or even upgrade them [76] is unaffordable from a financial point of view.

3. Materials and Methods

The quantitative information is fundamental to the understanding of the contribution of agricultural science and technology (S&T) to agricultural growth. The indicators derived from such information allow the performance, inputs, and outcomes of agricultural S&T systems to be measured, monitored, and benchmarked. These indicators will help in formulating policies, setting priorities, and undertaking strategic planning, monitoring, and evaluation [77]. Simulation and modelling in any field offer important benefits, especially in the agricultural field, which needs productivity improvement: reduce costs, increase performance, and enhance experience, knowledge, and skills [78,79].

This article studies the possible influence of some factors, internal or external, called independent variables on the output of agriculture, called dependent variables, using modelling and simulation. In our study, we also aim to prove that by analyzing the connection between these factors, any country, area, or farm may enhance the agricultural performance by improving the results for any external and internal factor that impacts the output of agriculture. The data was collected in Romania between 2006 and 2019 (Table 2) and analyzed using the econometric tools mentioned above.

Table 2. The values of OA and determinant factors between 2006 and 2019.

Year	Output of the Agri. Ind. (Y)	Air Poll (X_1)	Area under the Org Far (X_2)	The Share of Agri. in GDP (X_3)	Ave. Area Per Hold (X_4)	No. of Employ in Agri. (X_5)	Agri. Land (sq km) (X_6)	Agri. Training (X_7)	Irrig. Norm (mc/ha) (X_8)	No. of Tractors (X_9)
2006	14,365	177,776	0.8	7.82	3.1	2,631,600	140,390	157,896	2196.5	174,003
2007	14,302	172,893	1	5.5	3.1	2,562,370	136,300	153,742	2196.5	174,790
2008	18,192	172,440	1	6.3	3.2	2,510,680	136,340	150,641	2196.5	176,841
2009	14,134	166,682	1.2	6.12	3.3	2,526,460	136,210	151,588	2196.5	176,841
2010	15,301	150,804	1.3	5	3.4	2,471,810	141,560	49,436	2196.5	180,433
2011	18,048	150,344	1.6	6.25	3.4	2,302,870	139,820	46,057	2196.2	180,064
2012	14,410	148,851	2.1	4.67	3.5	2,359,730	137,330	47,195	1676.3	184,446
2013	17,756	150,223	2.06	5.38	3.6	2,317,620	139,050	71,846	1676.3	191,301
2014	16,771	147,225	2.09	4.72	3.6	2,313,525	138,300	71,719	1676.3	193,120
2015	15,465	150,781	1.77	4.19	3.6	2,147,904	138,350	66,585	1360.1	194,000
2016	15,444	147,135	1.67	4.06	3.7	2,108,358	135,310	65,359	1246.7	195,000
2017	17,100	144,309	1.93	4.31	3.7	2,079,151	133,779	64,200	1230	197,000
2018	18,554	142,300	2.43	4.36	3.8	2,036,253	134,137	63,500	1200	198,000
2019	19,128	140,300	2.5	4.1	3.9	1,981,491	130,000	61,900	1190	200,000

Sources: [52,55,56,80–84].

The research was carried out using data and information from different official sites providing data on agriculture output and its factors of influence. The tools for data collection are observation and data analysis using simulation techniques and the E-views program. The tools for the analysis are descriptive statistics (to find out the normal distribution of the series), linear regression model (OLS to test the impact of some important factors could have on the output of agriculture), and correlation matrix (to find the correlation between the analyzed variables of agriculture). The regression method used allowed us to make predictions, in our case to estimate the value of a variable (Y) when we have associated variable values (X).

$$Y = b_0 + b_1 \text{ x } X_1 + \cdots + b_n \text{ x } X_n \quad (1)$$

where Y = dependent variable (output of agriculture), X_i = independent variables (internal and external factors that influence the output of agriculture and are presented in the literature review), b = the slope (or gradient) of the straight line, and b_0 = the intercept.

The research hypothesis is:

Hypothesis 1 (H1). *There is a direct and positive relationship between the output of agriculture and the analyzed factors.*

Hypothesis 2 (H2). *The training of farm managers in Romanian agriculture is weak.*

Hypothesis 3 (H3). *Even if the air pollutants are decreasing, they negatively influence the output of agriculture.*

Hypothesis 4 (H4). *The number of employees in agriculture is low and it has a negative impact on the OA.*

Hypothesis 5 (H5). *There is a weak correlation between the OA and the share of agriculture in GDP.*

4. Results

The summary of the statistics of the variables in the model is presented in Table 3. The difference between the mean value and the median is not so high or low. Looking at the data, it can be noted that X_1, X_3, and X_7 are positively skewed towards normality, while the other variables are negatively skewed (the distribution is left-skewed).

Table 3. Descriptive statistics.

	Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
Mean	16,355	154,433.1	1.67	5.19	3.49	2,310,702	136,919.7	87,261.7	1745.3	186,845.6
Median	16,118	150,283.5	1.72	4.86	3.55	2,315,573	136,835	65,972	1676.3	187,873.5
Maximum	19,128	177,776	2.5	7.82	3.9	2,681,600	141,560	157,896	2196.5	200,000
Minimum	14,134	140,300	0.8	4.06	3.1	1,981,491	130,000	46,057	1190	174,003
Std. dev.	17,777/6	12,424.3	0.5	1.09	0.25	212,330.7	3037.5	44,222.9	439.8	9530.4
Skewness	0.12	0.82	−0.11	0.95	−0.18	−0.08	−0.59	0.83	−0.09	−0.04
Kurtosis	1.5	2.15	1.81	3.17	1.97	1.7	3.07	1.87	1.3	1.37
Jarque–Bera	1.34	2.01	0.84	2.15	0.69	1	0.81	2.37	1.67	1.53
Probability	0.5	0.36	0.65	0.34	0.7	0.6	0.66	0.3	0.4	0.46
Sum	228,970	2,162,063	23.45	7,279,000	48.9	32,349,822	1,916,876	1,221,664	24,434.4	2,615,839
Sum sq. dev.	41,080,542	2.01×10^{11}	3.87	15.7	0.82	5.86×10^{11}	1.2×10^{10}	2.54×10^{12}	2,503,726	1.18×10^{9}

Calculations made by the authors using E-views 7.

The value of kurtosis is between 1.309 and 3.17, being almost all below the benchmark for a normal distribution of 3, and only two values are above 3 (3.17 for X_1 and 3.07 for X_6), which is positioned near normality. It is important to mention that the values of kurtosis are lower than 3 (except for two values), but higher than 0, making the distribution Leptokurtic and the values concentrated around the central tendency. Thus, the analyzed variables are characterized by a normal distribution. The *p*-value of Jarque–Bera statistic for the analyzed variables is statistically significant, at a 5% level indicating that the values are normally distributed. Thus, it is demonstrated that there is a normal distribution among the analyzed variables. The correlation matrix was obtained by using the E-views program (Table 4).

Table 4. The correlation matrix.

	Y	**X_1**	**X_2**	**X_3**	**X_4**	**X_5**	**X_6**	**X_7**	**X_8**	**X_9**
Y	1									
X_1	−0.49	1								
X_2	0.56	−0.90	1							
X_3	−0.25	0.82	−0.75	1						
X_4	0.56	−0.93	0.92	−0.82	1					
X_5	−0.58	0.87	−0.84	0.81	−0.95	1				
X_6	−0.42	0.34	−0.49	0.51	−0.56	0.63	1			
X_7	−0.37	0.92	−0.76	0.69	−0.75	0.70	0.04	1		
X_8	−0.39	0.77	−0.81	0.82	−0.91	0.92	0.63	0.58	1	
X_9	0.53	−0.86	0.88	−0.83	0.96	−0.94	−0.56	−0.67	−0.96	1

Calculations made by the authors using E-views 7.

If the obtained values are over 0, the relationships are positive and stronger, and if they are closer to one, it means that the two variables are very strongly related to each other. Therefore, the correlations are positive and negative:

1. between Y and X_1–X_9 variables:
   - Negative correlations are between:
     - ➢ Weaker correlations: X_3—the share of agriculture in GDP (−0.25), X_7—agriculture training (−0.33), X8—the irrigation norm (−0.39), X6—agricultural land (−0.42), and X_1—air pollutants (−0.49).
     - ➢ Stronger correlations: X_5—the number of employees (−0.58).
   - Positive correlations are between:
     - ➢ X_9—the number of tractors (0.53), X_4—the average area per holding (0.56), and X_2—the area under organic farming (0.56).
2. between independent variables X_1–X_9:
   - Positive correlations are between:
     - ➢ Weaker correlations: between the agricultural land and the agricultural training (0.04) and the air pollutants and the agricultural land (0.34).
     - ➢ Stronger correlations: between the average area per holding and the number of tractors (0.96), the number of employees and the irrigation norm (0.92), the area under organic farming and the average area per holding, and between the air pollutants and the agricultural training are also of 0.92.
   - Negative correlations are between:
     - ➢ Stronger correlations: between the irrigation and the number of tractors (−0.96), the average area and the number of employees (−0.95), the number of employees and the number of tractors (−0.94).
     - ➢ Weaker correlations: between the area under organic farming and the agricultural land (−0.49).

As it can be seen from the calculations above, the output of the agricultural industry is:

- Negatively influenced by:
  - ➢ The number of workers employed in agriculture (−0.58) has not got a very strong correlation and it is negative (thus, Hypothesis H4 has been confirmed: even if Romania is an agrarian country, the number of employees in agriculture is low), and to attract and keep the best agricultural specialists, some strategic plans must be developed and implemented at every farm level.
  - ➢ The air pollutants (−0.49) are in a similar situation; their influence is negative (thus, Hypothesis H3—even if the air pollutants are decreasing, they negatively influence the output of agriculture—is confirmed), as we know, the values for the pollutants have been decreasing in the last few years.

- ➢ The agricultural land (−0.42) is not joined under large cooperatives, it is divided into little farms after 1990, without being able to use a proper tractor or to irrigate them. The other factors with a negative influence are irrigation, training, and the share of agriculture in GDP, having values between −0.39 and −0.25. Thus, Hypothesis H2—the training of farm managers in Romanian agriculture is weak—is established, and H5—the share of agriculture in GDP is low, even if we are in the first place based on the share of agricultural land—is partially confirmed, taking into consideration their negative, but reduced values.

- Positively influenced by:
  - ➢ The number of tractors (0.53) in Northern Europe is very high (1 per farm), and in Romania, it is very low (1 for 100 farms); still, the correlation is positive, but not very high.
  - ➢ The average area per holding (0.56), the Romanian holding is much less than 10 hectares, compared to the Western European countries; thus, the correlation is positive, but not very strong.
  - ➢ The area under organic farming (0.56) in Romania registered 1.6% ecological agriculture in 2011, and 3.38% in 2012. Due to the lack of new technologies necessary for the production and labelling, Romania exported these products abroad, and the same products are imported back, at much higher prices.

The following results for the OLS regression method were obtained by using E-views (Table 5). After the calculation of the OLS method, we obtained R^2 = 0.7998.

Table 5. The results for OLS using E-views.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
X_1	0.42	0.31	1.36	0.24
X_2	1722.8	1959.1	0.87	0.42
X_3	687.5	794.2	0.86	0.43
X_4	646.8	11,605.7	0.05	0.95
X_5	−0.008	0.008	−0.999	0.37
X_6	−0.43	0.34	−1.28	0.26
X_7	−0.07	0.05	−1.34	0.24
X_8	12.1	4.04	3.0009	0.03
X_9	0.59	0.28	2.089	0.104
C	−105,927.2	87,449.8	−1.21	0.29
R-squared	0.869	Mean-dependent var.		16355
Adjusted R-squared	0.575	S.D.-dependent var.		1777.65
S.E. of regression	1158.1	Akaike info criterion		17.12
Sum squared resid.	5,365,131	Schwarz criterion		17.57
Log likelihood	−109.8	Hannan–Quinn criterion		17.08
F-statistic	2.95	Durbin–Watson stat		2.44
Prob(F-statistic)	0.154			

Calculations made by the authors using E-views 7; Dependent Variable: Output of Agricultural Industry; Method: Least Squares; Included Observations: 14.

As a result of making the summary output of regression using Excel, we obtained R = 0.869 (Table 5. The table above reveals that between the determinant factors as analyzed variables, there is a positive and high correlation (R-squared = 0.869), thus confirming Hypothesis H1—there is a direct and positive relationship between the output of agriculture and the analyzed factors—which established that between the OA and the determinant factors, there is a strong and positive relationship and that 57.55% of the evolution of variable Y is explained by the evolution of X_1–X_9 factors. The estimation equation and substituted coefficients:

$$OA = 0.42 \times 1 + 1722.87 \times 2 + 687.57 \times 3 + 646.81 \times 4 - 0.008 \times 5 - 0.43 \times 6 - 0.072 \times 7 + 12.12 \times 8 + 0.59 \times 9 - 105927.22 \quad (2)$$

To increase with a monetary unit, the OA will get an increase of 0.42 monetary units of X_1, an increase of 1722.87 m.u. of X_2, an increase with 687.57 m.u. of X_3, an increase with 646.81 m.u. of X_4, a decrease with 0.008 m.u. of X_5, a decrease with 0.43 m.u. of X_6, a decrease with 0.072 m.u. of X_7, an increase with 112.12 m.u. of X_8, and an increase with 0.59 m.u. of X_9.

We note that the value of the free term (105,927) is very high, allowing us to conclude that the factors considered in the model construction have an important impact on the evolution of y. The negative value of the free term reveals that the variables that were included in the econometric model have a negative effect on the evolution of the OA. The Durbin–Watson statistic of 2.44 shows evidence of autocorrelation. Thus, it was demonstrated that between the analyzed variables, there is a positive and very strong relation (0.869 being very close to 1).

The obtained results will help in formulating policies, setting priorities, and undertaking strategic planning, monitoring, and evaluation. When studying the facts at the Romanian level, we made a SWOT analysis (Table 6) from the prism of the analyzed factors considered to have an important influence on the OA.

Table 6. SWOT analysis for the agriculture sector in Romania.

Strengths	Weaknesses
The agricultural land—with a total area of 238,000 sqm, Romania has an important agrarian profile in the EU, owning almost one-third of the total agricultural land in the EU and being in the first place;	The output of agriculture is reduced compared to the natural potential;
The average area per holding—the average size of 3.4 hectares per holding ranks Romania second to last, ahead of Malta with 0.6 hectares;	With a value of 137,595 for air pollutants, Romania is far from the lower value registered for Liechtenstein—203, even if this value constantly decreases every year;
The number of employees in agriculture—Romania is the first at the number of employees in agriculture area (2.8 million people), followed by Poland (1.9 million), Italy (0.9 million), and Germany (0.67 million);	Organic farming—the total selling of bio—Romanian products represents less than 1% from the retail market, compared to the European average of 5–6%;
The output of the agricultural industry—Romania is in seventh place (14,410 million euros), after the following European countries: France (77,355), Germany (54,578), Italy (48,632), Spain (42,191), the Nederland (26,268) and Poland (23,198);	The share of agriculture in GDP—the GDP share of agriculture had a value of 12.02 in 2000 and of 4.34 in 2016 and it continues to decrease;
Romania owns 7.2% of the utilized agricultural area of the EU-28, being close to the agriculture of Germany (9.7%) and Poland (8.3%);	The tractors in agriculture—while many farms from EU-28 possess a tractor (on average more than 90% (Finland, Germany, and Sweden), more than 80% in many other EU countries (such as Luxembourg, Austria, Slovenia, Czech Republic, Belgium, Denmark, France, the Netherlands), under 20% are Hungary and Bulgaria; Romania is lagging considerably behind, being the last at this criterion;
The population employed in Romanian agriculture represents 20.1% of the farm labour force of EU-28;	Irrigation in agriculture—the largest share of irrigable UAA in 2013 was registered in Greece (44.9%), Malta (38.6%), Cyprus ((34.9%), Italy (33.9%), and Spain (31.1%), while Romania was on the last places in EU-28;
Romania's agriculture has 32.7% of the number of holdings in the EU.	Agricultural training—Romania reported that its specialists are trained mostly through practical experience, not by basic or formal training as in other countries;
	Low productivity—in the Romanian food industry, the productivity is 9086 euros per person, while the EU average is 40,875 euros.

Table 6. *Cont.*

Opportunities	Threats
On 1 January 2007, Romania, as a member of the European Union, approved the Common Agricultural Policy (CAP), specific to the European Union. Accession to the EU has probably been the strongest factor of pressure for rapid reform of the Romanian agriculture and rural economy, given the need for the successful integration into the European rural economy;	Agriculture is still a less attractive field for young entrepreneurs;
The import of food is growing;	The incomes are too low;
A national brand for products could be the solution for Romanian agriculture;	Agricultural machinery is insufficient and under the European standards;
The associations and cooperatives could be the solution to improve the processing activities and increased quality;	The agro-food chains are inefficient;
Better training for farm managers could be a solution to bring the best practices in the field (the training of farm managers is 2.5% in Romania, compared to the EU average of 29.4%);	The access to loans for agricultural investments is poor;
Improving infrastructure could be the chance for the Romanian traditional production, due to the disparities between urban and rural areas;	The promotion of Romanian agriculture and food products is poor;
Bank lawns could be a solution to improve the agriculture sector (farmers in Romania have access to bank loans of only 110 euro/ha, well below the EU average of 1700 euro/ha);	The storage capacity is insufficient;
Foreign investments due to lower land prices compared to other European countries;	Its agrarian structure is inadequate and not in line with the agriculture of developed EU countries;
Romania is the country with the most favourable climatic conditions in the European Union.	The excessive fragmentation of agricultural land due to the restoration of land from 1989;
	The changing reforms in agriculture.

The results of the present analysis show that Romanian agriculture (with its many weaknesses and threats from the internal and external environment) continues to register an important growth potential, with a low degree of utilization. The agricultural restructuring and revitalization of the rural economy could be the important pillars for the economic development in Romania [63], the changing agricultural reforms affect agriculture development (14 in the 150-year existence of the modern state), as well as the foreign investment in agriculture, due to the low land price (Romania had the lowest price per hectare in 2017, 2085 euros, compared to France—6030, Poland—9699, or the Netherlands—68,197; in 2018, the price for a hectare in Romania rose, from 2085 in 2017 to 4904; in 2018, in France, the hectare was 6020, in Poland 10,318, and in the Netherlands 70,320. However, there are other countries with lower prices than Romania, such as Estonia—3174, Croatia—3285, Latvia—3856, Lithuania 3890, or Hungary 4632).

5. Conclusions

In this paper, to show the relationship between the analyzed factors and their influence, the authors examined the situation of the agricultural sector in Romania and its impact factors from 2006 to 2019 using the simulation and mathematical modelling: the regression and the correlation analysis. The paper investigated the complex relationships between the agriculture output and the six categories of impact factors, such as human, ecologic, natural, economic, social, and technological factors, aiming to prove that: (i) there is a strong and positive relationship between the output of agriculture and its factors of influence (R-squared is 0.869); thus, Hypothesis H1—there is a direct and positive relationship between the output of agriculture and the analyzed factors—is confirmed; (ii) there is a negative correlation between the output of agriculture and the number of employees (−0.58), air pollutants (−0.49), and agricultural training (−0.33); thus, Hypothesis H2—the training of farm managers in Romanian agriculture is weak—is established; H3—even if the air pollutants are decreasing, they negatively influence the output of agriculture—is confirmed; and H4—even if Romania is an agrarian country, the number of employees in agriculture is low—is partially confirmed, due to the negative value (−0.33); (iii) there is a negative correlation between the share of agriculture in GDP and OA (−0.25), not this strong, but still negative; thus, H5—the share of agriculture in GDP is low, even if we are in the first place based on the share of agricultural land—is partially confirmed.

Even if these factors have lower values compared to other European countries or the average of EU-28, the mathematical model shows a positive and a strong relationship between the analyzed factors, due to almost all lower values registered at the national level.

Romania is gifted with healthy and extensive agricultural land, with many employees, but with lower levels of training, mainly based on agricultural practical experience, as well as a lower number of tractors per holding, many agricultural taxes, and many crops and no processing technology. Romania is one of the European countries that may become an agrarian country with well-paid employees, with training programs for managers and employees in the agriculture sector [85], with more investments in multidimensional networks used to reduce environmental costs [86], open for European funds and programs, with more investments in agriculture and green economy.

In conclusion, the influence of the internal and external factors considered in our analysis on the output of agriculture is high ($R = 0.89$); thus, the human, natural, ecological, economic, social, and technological factors are important in determining the strength of this correlation. These results, next to simulation and modelling, are very important tools in predicting the evolution of a dependent variable and the influence of some internal and external factors on Romanian green agriculture performance.

The chosen variables set the limits of this study; the regression function would standardize the obtained values for each factor. As for the future research directions, we may add that a better output of agriculture could be obtained by using technologies in this field, by forecasting, simulating, modelling, or training the future employees in agriculture. Moreover, future research will be made by the authors to develop plans necessary to identify better ways to improve agriculture employment or training from the point of cost-efficiency and green economy, by using mathematical modelling and informatics simulation.

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References

1. Norton, R.D. *Agricultural Development Policy: Concepts and Experiences*; John Wiley & Sons: West Sussex, UK, 2004.
2. Christiaensen, L.; Demery, L.; Kuhl, J. The (evolving) role of agriculture in poverty reduction—An empirical perspective. *J. Dev. Econ.* **2011**, *96*, 239–254. [CrossRef]
3. Kjeldsen-Kragh, S. *The Role of AGRICULTURE in Economic Development*; Copenhagen Business School Press: Copenhagen, Denmark, 2007.
4. Berca, M.; Robescu, V.O. Researches on the management of economy dematerialization in the agriculture of Dambovita county, Romania. In Proceedings of the 7th WSEAS International Conference on Environment, Ecosystems and Development, Tenerife, Spain, 14–16 December 2009; pp. 162–167.
5. Bunkus, R.; Theesfeld, I. Land Grabbing in Europe? Socio-Cultural Externalities of Large-Scale Land Acquisitions in East Germany. *Land* **2018**, *7*, 98. [CrossRef]
6. Gheorghe, H.P.; Istudor, N.; Nica, E.; Vasile, A.J.; Ion, R.A. The influence of land-use change paradigm on Romania's agro-food trade competitiveness—An overview. *Land Use Policy* **2017**, *61*, 293–301. [CrossRef]

7. Khatoon, Z.; Huang, Z.; Rafique, M.; Fakhar, A.; Kamran, M.A.; Santoyo, G. Unlocking the potential of plant growth-promoting rhizobacteria on soil health and the sustainability of agricultural systems. *J. Environ. Manag.* **2020**, *273*, 111118. [CrossRef] [PubMed]
8. Farooq, U.; Gang, F.; Guan, Z.; Rauf, A.; Chandio, A.A.; Ahsan, F. Exploring the long-run relationship between financial inclusion and agricultural growth: Evidence from Pakistan. *Int. J. Emerg. Mark.* **2021**. [CrossRef]
9. Fuglie, K.; Dhehibi, B.; El Shahat, A.A.I.; Aw-Hassan, A. Water, policy, and productivity in Egyptian agriculture. *Am. J. Agric. Econ.* **2021**, *103*, 1378–1397. [CrossRef]
10. Qaim, M. Role of New Plant Breeding Technologies for Food Security and Sustainable Agricultural Development. *Appl. Econ. Perspect. Policy* **2020**, *42*, 129–150. [CrossRef]
11. Rogaly, B. Commentary: Agricultural racial capitalism and rural migrant workers. *J. Rural Stud.* **2021**. [CrossRef]
12. Norton, G.; Alwang, J.; Masters, W. *The Economics of Agricultural Development*, 3rd ed.; Routledge: London, UK, 2014. [CrossRef]
13. Zhang, S.; Wang, S.; Yuan, L.; Liu, X.; Gong, B. The impact of epidemics on agricultural production and forecast of COVID-19. *China Agric. Econ. Rev.* **2020**, *12*, 409–425. [CrossRef]
14. Liu, J.; Wang, M.; Yang, L.; Rahman, S.; Sriboonchitta, S. Agricultural Productivity Growth and Its Determinants in South and Southeast Asian Countries. *Sustainability* **2020**, *12*, 4981. [CrossRef]
15. Malassis, L. *The Rural World: Education and Development*; eBook; Routledge: London, UK, 2010. [CrossRef]
16. Haider, A.; Bashir, A.; Iftikhar ul Husnain, M. Impact of agricultural land use and 3economic growth on nitrous oxide emissions: Evidence from developed and developing countries. *Sci. Total. Environ.* **2020**, *741*, 1–15. [CrossRef] [PubMed]
17. Bresciani, F.; Valdes, A. *Beyond Food Production: The Role of Agriculture in Poverty Reduction*; Edward Elgar Publishing: Northampton, MA, USA, 2007.
18. Squires, V. *The Role of Food, Agriculture, Forestry and Fisheries in Human Nutrition*; EOLSS Pub: Oxford, UK, 2009.
19. Iannuzzi, A. *Greener Products: The Making and Marketing of Sustainable Brands*, 2nd ed.; CRC Press: Boca Raton, FL, USA, 2017. [CrossRef]
20. Burja, C.; Burja, V. Farms size and efficiency of the production factors in Romanian agriculture. *Econ. Agric.* **2016**, *63*, 361–374. [CrossRef]
21. Andrei, J.V.; Mieila, M. Applying Cobb-Douglas using gmm method. Evidence from Romanian agriculture. In *Sustainable Agriculture and Rural Development in Terms of the Republic of Serbia Strategic Goals Realization within the Danube Region. Rural Development and (un) Limited Resources*; MPRA: Belgrade, Republic of Serbia, 2014; pp. 292–309.
22. Istudor, N.; Petrescu, I.E. Influence of accessing European funds for rural development over the credits for the agricultural sector in Romania. *Calitatea* **2015**, *16*, 4.
23. Crecana, D.N.; Crecana, C.D. Increasing the Performance of Agricultural Holdings in Romania -an Imperative for their Management. *Rev. Int. Comp. Manag.* **2019**, *20*, 112–121.
24. Ministry of Agriculture and Rural Development. Strategy for the Development of the Sector Medium and Long Term Agri-Food Horizon 2020–2030. Available online: https://www.madr.ro/docs/agricultura/strategia-agroalimentara-2020-2030.pdf (accessed on 24 June 2021).
25. Sulle, E. Bureaucrats, investors and smallholders: Contesting land rights and agro-commercialisation in the Southern agricultural growth corridor of Tanzania. *J. East. Afr. Stud.* **2020**, *14*, 332–353. [CrossRef]
26. Eurostat. Statistical Books. Europe in Figures. Eurostat Yearbook. 2010. Available online: https://ec.europa.eu/eurostat/web/products-statistical-books/-/KS-CD-10-220 (accessed on 25 June 2021).
27. Unsworth, M.H.; Ormrod, D.P. *Effects of Gaseous Air Pollution in Agriculture and Horticulture*; Butterworth-Heinemann: London, UK, 2013.
28. Manisalidis, I.; Stavropoulou, E.; Stavropoulos, A.; Bezirtzoglou, E. Environmental and health impacts of air pollution: A review. *Front. Public Health* **2020**, *8*, 14. [CrossRef]
29. Banhazi, T.; Aland, A.; Hartung, J. *Air Quality and Livestock Farming*; CRC Press: Abingdon, UK, 2018; pp. 50–123.
30. Nandwani, D.; Nwosisi, S. Global Trends in Organic Agriculture. In *Organic Farming for Sustainable Agriculture*; Sustainable Development and Biodiversity; Nandwani, D., Ed.; Springer: Cham, Switzerland, 2016; Volume 9. [CrossRef]
31. NPCS Board of Consultants and Engineers. *The Complete Book on Organic Farming and Production of Organic Compost*, 2nd Revised ed.; Asia Pacific Business Press Inc.: New Delhi, India, 2021; pp. 320–400.
32. Eurostat. Future of the Common Agricultural Policy. Available online: https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/future-cap_en (accessed on 25 June 2021).
33. Alan, M. Improving Governance of the Future CAP. Available online: http://capreform.eu/ (accessed on 26 June 2021).
34. Renwick, A. The Common Agricultural Policy and Organic Farming. In *Experimental Agriculture*; Lynggaard, K., Ed.; CABI Publishing: Wallingford, UK, 2006; p. 531.
35. World Bank National Accounts Data, and OECD National Accounts Data Files. Agriculture, Forestry, and Fishing, Value Added (% of GDP). 2018. Available online: https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS (accessed on 26 June 2021).
36. Andrei, J.V.; Alecu, A. Trends and Transformations in European Agricultural Economy, Rural Communities and Food Sustainability in Context of New Common Agricultural Policy (CAP) Reforms. In *Food Science, Production, and Engineering in Contemporary Economies*; Andrei, J.-V., Ed.; IGI Global: Hershey, PA, USA, 2016; pp. 1–24. [CrossRef]

37. OECD. Introduction. In *Agricultural Support, Farm Land Values and Sectoral Adjustment The Implications for Policy Reform*; OECD Publishing: Paris, France, 2008.
38. Eurostat. Agriculture, Forestry and Fishery Statistics. Available online: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agriculture,_forestry_and_fishery_statistics&stable=0&redirect=no (accessed on 25 June 2021).
39. European Commission. Trends in the EU Agricultural Land Within 2015–2030. 2015. Available online: https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/trends-eu-agricultural-land-within-2015-2030 (accessed on 25 June 2021).
40. Food and Agriculture Organization of the United Nations, United Nations Development Programme. *China: The Agricultural Training System: Report on an FAO/UNDP Study Tour to the People's Republic of China 5 October to 2 November 1978*; FAO Economic and Social Development Paper; Food and Agriculture Organization of the United Nations, United Nations Development Programme: Rome, Italy, 1980.
41. Wang, L.; Wang, Y.; Sun, W. Study on the Relationship Between Human Capital Management and Agricultural Enterprise Performance—Based on Different Marketing Strategy. In *Proceedings of 20th International Conference on Industrial Engineering and Engineering Management*; Qi, E., Shen, J., Dou, R., Eds.; Springer: Berlin/Heidelberg, Germany, 2013. [CrossRef]
42. Kalsariya, B.N.; Kanani, P.R. *Key to Success in Agriculture: Objective (MCQ's for JRF, SRF, NET & Other Competitive Exams)*; Scientific Publishers-Competition Tutor: Jodhpur, India, 2017.
43. Agri Committee. The EU Farming Employment: Current Challenges and Future Prospects. *The EU Farming Employment: Current Challenges and Future Prospects, Policy Department for Structural and Cohesion Policies Directorate-General for Internal Policies PE 629.209—October 2019*. Available online: http://eprints.glos.ac.uk/7629/1/IPOL_STU%282019%29629209_EN.pdf (accessed on 24 June 2021).
44. Tugendhat, H.; Alemu, D. Chinese Agricultural Training Courses for African Officials: Between Power and Partnerships. *World Dev.* **2016**, *81*, 71–81. [CrossRef]
45. Mudege, N.N.; Mdege, N.; Abidin, P.; Bhatasara, S. The role of gender norms in access to agricultural training in Chikwawa and Phalombe, Malawi. *Gend. Place Cult.* **2017**, *24*, 1689–1710. [CrossRef]
46. Pratiwi, A.; Suzuki, A. Effects of farmers' social networks on knowledge acquisition: Lessons from agricultural training in rural Indonesia. *Econ. Struct.* **2017**, *6*, 1–23. [CrossRef]
47. European Parliament's Committee on Agriculture and Rural Development. Policy Department Structural and Cohesion Policies. Agriculture and Rural Development. Available online: https://www.europarl.europa.eu/RegData/etudes/STUD/2015/540369/IPOL_STU(2015)540369_EN.pdf (accessed on 24 June 2021).
48. Roopaei, M.; Rad, P.; Choo, K.R. Cloud of Things in Smart Agriculture: Intelligent Irrigation Monitoring by Thermal Imaging. *IEEE Cloud Comput.* **2017**, *4*, 10–15. [CrossRef]
49. Andrei, J.V. The Evolution of Agrarian Structures in Romania: From Socialism to the Beginning of the Free Market Economy. In *Green Economic Structures in Modern Business and Society*; Andrei, J.-V., Andreea, I.R., Adrian, T.R., Eds.; IGI Global: Hershey, PA, USA, 2015; pp. 39–60. [CrossRef]
50. Eurostat. Statistics Explained. *Performance of the Agricultural Sector. Value of Agricultural Output.* Available online: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Performance_of_the_agricultural_sector#Value_of_agricultural_output (accessed on 24 June 2021).
51. Eurostat. Air Quality Standards. Available online: https://ec.europa.eu/environment/air/quality/standards.htm (accessed on 24 June 2021).
52. Eurostat. Air Pollution Statistics—Emission Inventories. 2020. Available online: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Air_pollution_statistics_-_emission_inventories (accessed on 24 June 2021).
53. Willer, H.; Lernoud, J. *The World of Organic Agriculture. Statistics and Emerging Trends 2019*; Research Institute of Organic Agriculture FiBL and IFOAM Organics International: Landau, Suisse, 2019.
54. Eurostat: Statistics Explained. Organic Farming Area. *Share of a Total Organic Area in the Total Utilised Agricultural Area.* Available online: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Organic_farming_area_2018data-01.jpg (accessed on 24 June 2021).
55. Eurostat. Statistical Explained. *Organic farming REA (% of the Organic Area in Total Utilized Agricultural Area, 2019).* Available online: https://ec.europa.eu/eurostat/statistics-explained/index.php/Organic_farming_statistics (accessed on 24 June 2021).
56. The World Bank. The Share of Agriculture in GDP. 2019. Available online: https://www.theglobaleconomy.com/Romania/Share_of_agriculture/ (accessed on 24 June 2021).
57. Flanders Investment & Trade Market Survey. Agriculture in Romania. 2017. Available online: https://www.flandersinvestmentandtrade.com/export/sites/trade/files/market_studies/2017_Agriculture_Romania.pdf (accessed on 25 June 2021).
58. Liu, Y.; Yamauchi, F. Population density, migration, and the returns to human capital and land: Insights from Indonesia. *Food Policy* **2014**, *48*, 182–193. [CrossRef]
59. Eurostat. Statistical Explained. Small and Large Farms in the EU—Statistics from the Farm Structure Survey. Share of the Total Number of Farm Holdings, by the Economic Size of the Farm. 2013. Available online: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Small_and_large_farms_in_the_EU_-_statistics_from_the_farm_structure_survey&oldid=406560 (accessed on 25 June 2021).

60. Eurostat. Products Eurostat News. Employment in Agriculture. Available online: https://ec.europa.eu/eurostat/web/products-eurostat-news/-/wdn-20190612-1 (accessed on 25 June 2021).
61. Study—The Situation of Agriculture in Romania. Available online: http://www.eurodetachement-travail.eu/Situatia_agriculturii_in_Romania.pdf (accessed on 26 June 2021).
62. Eurostat. Farm Structure. 2019. Available online: http://ec.europa.eu/eurostat/Farm_structure_statistics/ro (accessed on 26 June 2021).
63. Barbu, C.M. The Romanian "Agricultural Power" in the European Context. *Acad. J. Econ. Stud.* **2015**, *1*, 27–37.
64. Peuch, J.; Kay, S.; Franco, J. *The Extent of Farmland Grabbing in the EU Agriculture*; No. UCL-Université Catholique de Louvain: Ottignies-Louvain-la-Neuve, Belgium, 2015.
65. Bravo-Ortega, C.; Lederman, D. *Agriculture and National Welfare around the World: Causality and International Heterogeneity Since 1960*; World Bank: Washington, DC, USA, 2005; Volume 3499.
66. Qi, E.; Shen, J.; Dou, R. *Proceedings of 20th International Conference on Industrial Engineering and Engineering Management. Theory and Apply of Industrial Management*; Springer: Berlin/Heidelberg, Germany, 2013. [CrossRef]
67. Valentinov, V. Why are cooperatives important in agriculture? An organizational economics perspective. *J. Inst. Econ* **2007**, *3*, 55–69. [CrossRef]
68. Bergan Holmelin, N.B. National specialization policy versus farmers' priorities: Balancing subsistence farming and cash cropping in Nepal. *J. Rural Stud.* **2021**, *83*, 71–80. [CrossRef]
69. Kamienski, C.; Soininen, J.-P.; Taumberger, M.; Dantas, R.; Toscano, A.; Salmon Cinotti, T.; Filev Maia, R.; Torre Neto, A. Smart Water Management Platform: IoT-Based Precision Irrigation for Agriculture. *Sensors* **2019**, *19*, 276. [CrossRef] [PubMed]
70. Aquastat—Food and Agriculture Organization of the United Nations. Irrigation Areas Sheet. Available online: http://www.fao.org/nr/water/aquastat/data/irrs/readPdf.html?f=ROU-IRR_eng.pdf (accessed on 25 June 2021).
71. Campenhout, B.V. The Role of Information in Agricultural Technology Adoption: Experimental Evidence from Rice Farmers in Uganda. *Econ. Dev. Cult. Chang.* **2021**, *69*, 1239–1272. [CrossRef]
72. Rosegrant, M.W.; Koo, J.; Cenacchi, N.; Ringler, C.; Robertson, R.D.; Fisher, M.; Cox, C.M.; Garrett, K.; Perez, N.D.; Sabbagh, P. *Food Security in a World of Natural Resource Scarcity: The Role of Agricultural Technologies*; International Food Policy Research Institute (IFPRI): Washington, DC, USA, 2014.
73. European Agricultural Machinery Industry Association. Production of Tractors in EU, 2008–2017, CEMA Report 2019. Available online: https://www.cema-agri.org/images/publications/brochures/2019_CEMA_report_priorities_key_figures_web.pdf (accessed on 26 June 2021).
74. Cividino, S.R.S.; Pergher, G.; Zucchiatti, N.; Gubiani, R. Agricultural Health and Safety Survey in Friuli Venezia Giulia. *Agriculture* **2018**, *8*, 9. [CrossRef]
75. Cavallo, E.; Ferrari, E.; Bollani, L.; Coccia, M. Attitudes and behaviour of adopters of technological innovations in agricultural tractors: A case study in Italian agricultural system. *Agric. Syst.* **2014**, *130*, 44–54. [CrossRef]
76. Hallman, E.M. ROPS retrofitting: Measuring the effectiveness of incentives and uncovering inherent barriers to success. *J. Agric. Saf. Health* **2005**, *11*, 75–84. [CrossRef]
77. Lynam, J.; Beintema, N.M.; Roseboom, J.; Badiane, O. *Agricultural Research in Africa: Investing in Future Harvests*; International Food Policy Research Institute (IFPRI): Washington, DC, USA, 2016.
78. Florea, N.V. Green Attitudes and Thinking in The New Green Market: Using Mathematical Modeling to Satisfy Green Customers' Needs. In *Driving Green Consumerism Through Strategic Sustainability Marketing*; Quoquab, F., Thurasamy, R., Mohammad, J., Eds.; IGI Global: Hershey, PA, USA, 2018; pp. 72–98. [CrossRef]
79. Florea, N.V. *Simulare si Modelare in Afaceri. Aplicatii si Studii de caz*; Mustang: Bucuresti, Romania, 2017.
80. Eurostat. Statistical Explained. The Average Area Per Holding. Available online: https://ec.europa.eu/eurostat/statistics-explained/pdfscache/1191.pdf (accessed on 26 June 2021).
81. Eurostat. Statistical Explained. The Number of Employees in Agriculture. 2019. Available online: https://ec.europa.eu/eurostat/statistics-explained/index.php/Farmers_and_the_agricultural_labour_force_-_statistics (accessed on 26 June 2021).
82. Eurostat. Statistical Explained. Agricultural Training. 2020. Available online: https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ef_so_mptrain&lang=en (accessed on 26 June 2021).
83. The World Bank. Number of Tractors in Romania. 2019. Available online: https://data.worldbank.org/indicator/AG.AGR.TRAC.NO?locations=RO (accessed on 27 June 2021).
84. Bucur, S.I. Rural Development in Romania: Evolutions and Disparities at the Regional Level. In *Agrarian Economy and Rural Development-Realities and Perspectives for Romania. International Symposium*, 10th ed.; The Research Institute for Agricultural Economy and Rural Development (ICEADR): Bucharest, Romania, 2019; pp. 254–261.
85. Eurostat. Statistical Explained. Monitoring Developments on Farmland Markets. 2019. Available online: https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=apri_lprc&lang=en (accessed on 27 June 2021).
86. Fric, U.; Roncevic, B.; Ursic, E. Role of computer software tools in industrial symbiotic networks and the examination of sociocultural factors. *Environ. Prog. Sustain.* **2020**, *39*, e13364. [CrossRef]