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The Dynamics of the Implementation of Organic Farming in Romania

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Abstract: Organic farming is a branch of interest in the context of the global economy oriented at reducing pollution, increasing food quality and reducing the impact on the environment. The objective of this research is to identify the main components of organic farming in Romania and their dynamics in the period 2010–2020 to identify changes in agricultural policy elements with an impact on the development strategy of Romanian agriculture in the medium term. The methodology used aims at the analytical and empirical research of the changes in the agricultural policy in the period 2010–2020 and the quantification of a statistical tool to evaluate the impact of these changes in the development of organic farming. The results are useful for decision makers to adopt viable medium-term strategies for organic farming.

Keywords: organic farming; agricultural policy; agricultural production; SPSS statistical program; Romania

1. Introduction

Agriculture is a key economic sector for the European Union Green Deal, a program which focus on sustainable development in the context of maintaining high international competitiveness of European economy. Organic farming has important potential, contributing according to several authors [1], to the improvement of environmental, economic and social sustainability of agriculture production sector.

The common agricultural policy (CAP) is an important element of the development strategy, promoted both through customized financial packages for the agricultural sector and structural programs, in line with the funding provided from the European budget. There is a European effort to transform agriculture into a sustainable sector, adapted to modern requirements, focus on welfare and quality, as well as on minimizing the environmental impact. This approach has led to a structural change in agricultural production and consumers demands, a situation that increasingly promotes organic farming and organic products, respectively.

The diversity of agricultural production is based, at the European level, on production technologies, which had shifted, in the last decade, from extensive to intensive methods, but also on innovative technologies for agricultural production, by practicing organic farming and crop culture rotations, in order to increase sustainability in the branch.
Romania, as an EU country, has significant agricultural potential, given the large agricultural area owned. However, problematic issues such as land fragmentation or underfunding of productive activities (e.g., ending of the Tomato Program) persist in Romanian agriculture sector. According to some authors [2], the Romanian agriculture sector suffers from issues related to organization of the agricultural land and cadastral measurements that are not generalized, reduced concerns for value added for agricultural products and dependence of agricultural production on the climatic conditions.

The market for organic products is estimated to represent 2.5% of the global food products [2], and thus, Romania could benefit from this trend. The opportunity of developing organic agriculture in Romania is also revealed by other authors [3], who highlighted possible benefits that can assure a better sustainable development of present agriculture sector. Although the development of organic agriculture involves major efforts, both managerial and financial [2], an efficient agriculture management can positively contribute to the qualitative transformation of the Romania’s economy. Thus, it is necessary to develop an analytical framework in order to identify the opportunities and sustainable management strategies for optimum implementation and development of organic production within the Romanian agriculture sector.

1.1. Agricultural Production

Agricultural production is considered a popular topic within the scientific community since it offers multiple multi-dimensional analysis possibilities, focused especially on human needs, economic growth and sustainable development. Some authors [4] point out that organic farming is a factor that influences consumer behavior both through the increase quality of final products and value of products offered to consumers. The social culture in terms of organic farming products is experiencing rapid growth based on its impact components.

Agriculture production is a hot topic nowadays, especially due to Common Agriculture Policy debates. However, new research fronts derive from this topic and explore different niches, involving several aspects which contribute to the deepening process of this topic. Therefore, this paper became linked by the highly cited targets they cite in common. This may form new emerging research fronts identified by analyzing common keywords. However, this bibliometric analysis may indicate both the intensity of niche research studies correlations and the intensity of a niche subject, targeting to identify different gaps which can be explored by future research.

The bibliometric keywords analysis of agricultural production dimension (Figure 1) reveals strong niches of this topic such as agriculture management, food security, crops growth, agriculture efficiency, as well as a precision agriculture and agriculture emissions group of research subjects. However, organic agriculture does not appear within the most popular niches. Thus, this sub-topic can be developed in order to integrate it into new emerging agriculture hot research topics and to extend it into a multi-disciplinary research network.

According to some authors [5], agriculture and climate change are characterized by a complex cause–effect relationship. The negative impact of gas emissions, due to intensive non-organics agriculture practices, on the environment is well known. Therefore, climate change can be considered the main negative impact of neglecting organic farming. Additionally, on the other hand, climate change negatively impacts the natural environment, affecting, therefore, the agriculture production, revealing the boomerang effect of unsustainable agriculture practices. These findings are confirmed by other authors [5] who revealed that the increase in temperatures as well as changes in the precipitation regime have repercussions on the volume, quality and stability of the agricultural production.

Several authors [6] have analyzed the links between agricultural activities and environmental impact among European Union (EU) countries and revealed the importance of agricultural production factors on the agricultural output value. Thus, core agriculture [7] can be the result of the optimization provided by suitable understanding, elaboration
and implementation of multi-dimensional analytical frameworks which involves aspects related to urbanization, investments, labor, environmental pollution, health, food safety and security, political stability, as well as social and marketing aspects related to consumers education and preferences. Additionally, according to other authors [7], the domestically agriculture development must be analyzed by taking into consideration the global competitiveness, in order to assure both environmental and economic sustainability.

Figure 1. The bibliometric keywords analysis of agricultural production dimension, considering Web of Science (WOS) publications during the years 2017–2022. Source: Elaborated by the authors using VOSviewer software.

1.2. Sustainable Agriculture

Sustainability in global agriculture [8] has been analyzed in relation to the capacity to ensure the nutritional needs; thus, the result is that the increasing impact of agricultural policies on food supply systems is conditioned by the legislative component, the tax system, the stimulation of sustainable products demand and the improvement of performances based on the system of shifting agriculture to organic farming.

Achieving the goal of sustainable agriculture requires responsible actions by all participants in an economic system, including farmers, laborers, policymakers, researchers, retailers, and consumers.

The bibliometric keywords analysis of sustainable agricultural dimension reveals strong niches such as climate change resilience of agriculture (resistance), sustainable development, sustainable management, sustainable agriculture production systems, plant diversity, plant growth and environment (Figure 2).

Therefore, it seems that most of the topics are converging on the organic agriculture niche. Thus, organic production can be easily integrated into sustainable agriculture research and can benefit from the existing research direction which can potentiate the impact and applicability of future studies.

According to some authors [9], indicators of sustainable development can indicate the perception of both local authorities and inhabitants related to the link between sustainable agriculture and social, economic and environmental development. Previous research emphasizes that sustainable agriculture systems must aim to provide sufficient and nutritious food for satisfying the consumer’s needs, while minimizing environmental impact and assuring a sufficient rate of return for producers, in order to encourage the continuous adoption of environmentally friendly production technologies.
Figure 2. The bibliometric keywords analysis of sustainable agricultural dimension, considering Web of Science (WOS) publications during the years 2017–2022. Source: Elaborated by the authors using VOSviewer software.

Most of the growth in agricultural output from the last decades comes from increases in the efficiency with which both land and non-land inputs are used [10]. Therefore, the total factors productivity must be considered as an independent variable within the analytical frameworks that targets to predict the evolutions of dependent variables related to different production niches, as organic agriculture production.

Since EU political strategy is mostly focused on a Green Deal desideratum for reaching to a sustainable and competitive economy, a previous research paper [11] suggested that key parameters such as smart growth, knowledge, innovation-based agriculture, employment rate, social and territorial cohesion, greener resources, food security, agricultural potential, agricultural performance and spatial diversity must serve as the main foundation in establishing new sustainable policies.

Other authors [12] provide a comprehensive and integrated assessment of the drivers for and impacts of farm size and revealed that farm size has a substantial influence on agricultural sustainability from the aspect of economy, environment and society.

Additionally, a previous research paper [13] revealed that small farmers can have difficulties in sustaining intensive and sustainable agriculture technologies due to high shifting cost. The optimization of CAP can be a solution for overcoming this barrier, confirming the previous findings [12], according to which CAP has a favorable impact on the economic sustainability of the agricultural sector.

1.3. Organic Farming

The analyzed literature offers various definitions for organic agriculture (Figure 3). Thus, some authors [14] define it as the activity which emerges from production systems that sustains the health of soils, ecosystems, and people. Other authors emphasizes that organic agriculture [15] is the agriculture which promotes fair relationships and good quality of life for all involved, consumers and producers, respectively.
It is widely assumed that organic agriculture is more sustainable than non-organic or conventional agriculture [16,17]. According to previous studies [18], organic farming maintains and promotes soil, animal, plant and human health, sustains and enhances biodiversity and ecological systems, and is associated with comprehensive systems where specific processes are employed to ensure a sustainable functioning of ecosystems [19], meeting the goals of sustainable development [20] and offering undoubted nutritive and health benefits to final consumers [21].

The bibliometric keywords analysis of organic farming dimension reveals niches as nitrogen and phosphorus compounds, soil, yield, quality, environmental impact, health, conservation, biodiversity, or ecosystems services.

The research topics within organic farming dimension are therefore focused especially on environmental and social sustainability [22]. However, economic sustainability of organic farming does not result in being a popular research niche. Therefore, it seems that in order to facilitate the integration of organic production among the existing farm facilities and to encourage future investors to invest into this economic direction, research must target the knowledge transfer towards the industrial agriculture, targeting especially to reveal the economic performance, even if this can be identified as an advantage or as a barrier in future development of this sector.

The economic sustainability of organic farming depends directly on consumers behavior [23]. Therefore, defining a certain niche of consumers with strong environmental and nutritional education is critical for new incomers in the organic production industry. Products transability and willingness to pay more for organic food [24] can be considered as main determinants in evaluating organic farming success. The organic farming market growth among EU countries [25] can be due to consumer interest in topics such as chemization agriculture, processed food, or health issues occurrence due to unproper nutrition [26].

Previous studies [9] pointed out that organic production requires higher competences from producers in order to become profitable, since it consists of an increased labor requirements [27]. Thus, organic farming encounters numerous barriers and various limitations on its development pathway [28]. Other independent variables that can be considered in creating an organic farming analytical framework are the financial factors connected with the availability of support and subsidies [19], environmental conditions and landform features.
The main opportunities and challenges of organic farming are, according to some authors [29], the increase in resilience to climate change, increase in farmers’ incomes, increase in social capacity and development of opportunities in the labor market. These aggregate elements can reduce the risk of hunger by ensuring an optimal level of productivity and increasing food quality, and they can represent a future solution for increasing the quality of life in general.

In their review research [30], several authors draw attention to the risks and opportunities of increasing the economic size of organic farms. Opportunities include providing organic food considering the growing world-wide population and reducing the negative aspects of consuming conventional products with an impact on increasing biodiversity [31], reducing greenhouse gas emissions, increasing soil fertility, increasing food quality and health status, but also with an impact on maximizing the profitability of growing organic farms economic activity. The identified risks include the management and active mitigation of adverse effects, skilled labor, and the growth of the company’s ecological culture.

Conversion to an organic farm [32] is a major change that is affected by economic considerations (performance) [33], and which is directly related to the social perception of organic agricultural production benefits.

In order to promote food security and, in particular, organic farming, several sustainable development goals have been identified [34]. Thus, net profitability and cost reduction with specialized staff are vulnerabilities in the development of organic farming, compared to conventional agriculture, these being complemented by a lower cost–benefit rate. However, public policies can introduce benefits because organic farming is neutral compared to environmental costs and costs for ecosystem services [35]. This means that in the long run, through an adequate policy, ecological agriculture/organic farming can gain ground [28,36].

The consumption of organic fruits and vegetables in Romania [37] has a social benefit characterized by understanding the beneficial contribution to the body of the consumption of organic fruits and vegetables, but also the consumption attitude determined by the purchase barriers imposed by high prices of organic products. The study shows that consumers are concerned about the health and nutritional value of the products consumed, so that the consumption of organic products has gained more and more advancement along with the growth of social culture and concern for environmental protection. Public policies should be aimed at reducing national disparities [38].

In Romania, predispositions of consumption are observed based on the perception of quality of life and organoleptic characteristics [39,40], unlike other European countries where the predisposition to consumption is generated by the non-polluting impact and the size of sustainable economic growth [41].

The present study targets to analyze and elaborate an analytical framework based on data that emphasize the dynamics of the organic farming implementation in Romania. Thus, the research follows five main objectives:

O1—the identification of the main organic farming components in Romania;
O2—the analysis of organic farming components dynamics in the period 2010–2020, through descriptive statistics methods and procedures;
O3—quantification of an ecological productivity model for the period 2010–2020;
O4—dissemination of the results of the proposed model;
O5—evaluation of the changes of agricultural policy captured by modeling and designing strategic directions for the organic farming development in Romania.

The results of the established models within the analytical framework can be used as a tool for both policy makers and economic agents in order to elaborate better sustainable development and planning strategies, based on the use of organic farming, in accordance with the efficiency and effectiveness objectives of the modern management of both economic sectors and economic entities.
2. Materials and Methods

The analysis starts from the elements of organic farming for which data were collected in the period 2010–2020, namely the following: Total number of operators in organic farming (OperatorsAE); Total cereals (ha) (CerealsAE); Dried legumes and protein crops for the production of grain (including seeds and mixtures of cereals and legumes) (ha) (CropsAE); Total tuberous and root plants (ha) (RootsAE); Industrial crops (ha) (IndustrialCropsAE); Green harvested plants (ha) (GreenPlantsAE); Other arable crops (ha) (OtherCropsAE); Fresh vegetables (including melons) and strawberries (ha) (FreshVegetablesAE); Permanent crops orchards, vines, fruit bushes, nuts, etc. (ha) (PermanentCropsAE); Permanent crops pastures and grasslands (ha) (GrasslandsAE); Uncultivated land (ha).

Based on these indicators, we built a picture of productive efficiency, noting that the years 2013, 2019 and 2020 represent peak years related to the two financing cycles, namely, the financing of National Program for Rural Development (PNDR) 2007–2013 and PNDR 2014–2020.

Considering the categories, it has been found that both crop areas and cereal production tend to maximize in the peak years, while some elements such as Total tuberous and root plants (ha) and Dried legumes and protein crops for grain production (including seeds and mixtures of cereals and legumes) (ha) tend to reduce their productive weights in peak years.

Another analyzed component, namely, the uncultivated land, tends to decrease in weight during the period of maximum productivity. The data analysis revealed that the best performance was recorded in 2020, when uncultivated land was reduced by about 1000 ha, compared to the previous year, registering a total reduction of 50% compared to the year 2010 (the year of the beginning of the analysis).

Considering the statistical data provided by the Ministry of Agriculture and Rural Development (Dynamics of Operators and Areas in Organic Agriculture 2010–2020, n.d.), the following working hypotheses were considered:

H1—the number of operators in organic farming increases as productivity increases. This hypothesis is confirmed in other studies [9,24,27,28], which emphasizes that organic production will develop especially when investors will find proper niche for their products.

H2—the number of operators in organic farming in Romania tends to decrease as the agricultural area with organic cereals increases. This hypothesis considers that cereals are not high-price crops, and since most organic farm facilities adopt strategies focused on the production of cereals, it can be due to lack of demand among consumers, for other valuable organic crops. Thus, since the rate of return decreases, the number of investors and organic farm owners records a downward trend. This hypothesis is revealed, partially, in previous research studies [9,27].

H3—high-yield crops optimize, in a short productive horizon, the number of operators in organic farming, while low-yield crops tend to disturb the balance of the market and supply. This 3rd hypothesis results as a consequence of the 2nd hypothesis. Thus, if consumer feedback related to organics agricultural products is positive, the number of operators from this economic field will register an intensive increase. This hypothesis is also mentioned, in previous studies, as being probable [18,20–22].

For the analysis and validation of working hypotheses, an econometric model was developed in order to quantify the dynamics of organic farming operators (OperatorsAE), in relation to independent variables such as Uncultivated, FreshVegetablesAE, RootsAE, OtherCropsAE, CropsAE, GrasslandsAE, IndustrialCropsAE, Perman, and GreenCropsAE, Perman.
The model uses the least squares method to determine the multiple linear regression function.

\[
\text{Operators}_{AE} = a \times \text{Uncultivated} + b \times \text{FreshVegetables}_{AE} + c \\
\times \text{Roots}_{AE} + d \times \text{OtherCrops}_{AE} + e \times \text{Crops}_{AE} + f \\
\times \text{Grasslands}_{AE} + g \times \text{IndustrialCrops}_{AE} + h \\
\times \text{PermanentCrops}_{AE} + i \times \text{Cereals}_{AE} + j \\
\times \text{GreenPlants}_{AE}
\] (1)

where the following are defined:

dependent variable of the model—Operators\(AE\);
\(a\)–\(j\)—correlation coefficients;
model regressors—Uncultivated, FreshVegetables\(AE\), Roots\(AE\), OtherCrops\(AE\), Crops\(AE\), Grasslands\(AE\), IndustrialCrops\(AE\), PermanentCrops\(AE\), Cereals\(AE\), GreenPlants\(AE\).

The results of the model were tested, based on the collected information from the statistical yearbooks, for the indicators considered in the models’ design, evaluated in the period 2010–2020. After testing the Enter method, all variables were accepted for modeling. No variables were excluded, and the validity of the database was determined (see Table 1).

<table>
<thead>
<tr>
<th>Variables Entered/Removed</th>
<th>Variables Entered</th>
<th>Variables Removed</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Uncultivated, FreshVegetables(AE), Roots(AE), OtherCrops(AE), Crops(AE), Grasslands(AE), IndustrialCrops(AE), PermanentCrops(AE), Cereals(AE), GreenPlants(AE)(^b)</td>
<td></td>
<td>Enter</td>
</tr>
</tbody>
</table>

\(^a\) Dependent Variable: Operators\(AE\), \(^b\) All requested variables entered. Source: Authors’ calculations using SPSS v 25.

The model summary shows that the level of the determination coefficient \(R^2\) is 1, revealing that the model is 100% representative for the studied phenomenon. This means that the number of operators in organic farming depends by the structure of agricultural production, cultivated or uncultivated areas and the consumers’ preference in the productive area for organic products (see Table 2).

<table>
<thead>
<tr>
<th>Model</th>
<th>(R)</th>
<th>(R^2) Square</th>
<th>Adjusted (R^2) Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.000(^a)</td>
<td>1.000</td>
<td>1.000</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>df1</th>
<th>df2</th>
<th>Change Statistics</th>
</tr>
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<tr>
<td>1</td>
<td>10</td>
<td>Sig. F Change</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Durbin-Watson</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.740</td>
</tr>
</tbody>
</table>

Source: Authors’ calculations using SPSS v 25 \(^a\). Predictors: (Constant), Uncultivated, FreshVegetables\(AE\), Roots\(AE\), OtherCrops\(AE\), Crops\(AE\), Grasslands\(AE\), IndustrialCrops\(AE\), PermanentCrops\(AE\), Cereals\(AE\), GreenPlants\(AE\)\(^b\). Dependent Variable: Operators\(AE\).

Table 2 shows that the model is validated by the Unilateral Critical Probability Test. The null hypothesis is rejected and the alternative hypothesis is accepted, which validates the modeling result.
The table of coefficients, generated for the multiple linear regression function, allows the establishment of the regression coefficients’ value and the concrete definition of the function, as follows:

\[
\text{OperatorsAE} = 0.478 \times \text{Uncultivated} - 2.568 \times \text{FreshVegetablesAE} + 12.254 \times \text{RootsAE} - 0.105 \times \text{OtherCropsAE} + 0.244 \times \text{CropsAE} + 5.373 \times \text{GrasslandsAE} + 3.154 \times \text{IndustrialCropsAE} + 0.40 \times \text{PermanentCropsAE} - 0.237 \times \text{CerealsAE} - 0.902 \times \text{GreenPlantsAE} - 9671.783
\] (2)

The definition of the regression function allowed the estimation of the volume of operators possible to activate on the organic farming market in Romania in the range represented by the minimum threshold of 3.155 operators and the maximum threshold of 15.544 operators, with an average of 10.757 operators and a standard deviation of 3.565 operators/year.

3. Results

The results of the model made it possible to test the Pearson correlations of the dependent variable with the regressors, in order to determine the impact that the categories of regressor variables could have, individually, on the variation of the dependent variable of the model (see Table 3).

Table 3. Pearson correlations.

<table>
<thead>
<tr>
<th>Correlations</th>
<th>OperatorsAE</th>
</tr>
</thead>
<tbody>
<tr>
<td>OperatorsAE</td>
<td>1.000</td>
</tr>
<tr>
<td>CerealsAE</td>
<td>0.328</td>
</tr>
<tr>
<td>CropsAE</td>
<td>-0.571</td>
</tr>
<tr>
<td>RootsAE</td>
<td>0.455</td>
</tr>
<tr>
<td>IndustrialCropsAE</td>
<td>-0.233</td>
</tr>
<tr>
<td>GreenPlantsAE</td>
<td>-0.128</td>
</tr>
<tr>
<td>OtherCropsAE</td>
<td>-0.392</td>
</tr>
<tr>
<td>FreshVegetablesAE</td>
<td>0.393</td>
</tr>
<tr>
<td>PermanentCropsAE</td>
<td>0.018</td>
</tr>
<tr>
<td>GrasslandsAE</td>
<td>0.545</td>
</tr>
<tr>
<td>Uncultivated</td>
<td>-0.093</td>
</tr>
</tbody>
</table>

Source: Authors’ calculations.

Table 3 shows that the production of cereals per ha (CerealsAE) is directly correlated with the number of economic operators. The increase with one operator in the number of operators influences the increase in production by 32.8 kg for one ha of cultivated organic cereals.

In the same way, the total production of tuberous and root plants (ha) (RootsAE) presents a direct correlation, proportional to the number of economic operators, as can be seen in Figure 4. This figure shows that the number of operators is maximized for productions over 500 ha, the Pearson correlation coefficient being 0.455.
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Figure 4. Pareto diagram of the evolution of the dependent variable OperatorsAE in relation to the RootsAE variable. Source: Elaborated by the authors.

The analysis of Figure 4 reveals that there is a great disparity in production structure, in relation to the number of agricultural producers. Thus, if in 2010, with a number of 3155 producers, cultivated areas larger than 500 ha, then in 2020, 10,210 farmers cultivated areas larger than 380 ha. There is a decline in the production of organic roots, an aspect which reveals a weak capacity to take advantage of opportunities and a lack of connection with the agricultural market, since it is known that recent research emphasizes the adoption of natural substances from the roots (celery, beets, etc.) in the meat industry, instead of synthetic food additives. Thus, Figure 4 results emphasizes that in Romania, users and producers do not benefit from direct distribution chains, revealing a fragmented supply chain, a major barrier in terms of increasing productivity and economic efficiency of organic agriculture.

Regarding the production of Permanent crops orchards, vines, fruit bushes, nuts, etc. (ha) (PermanentCropsAE), we can appreciate that this indicator also subscribes to productivity, with a direct impact on the dynamics of the economic agents number, although the level of Pearson correlation is low (see Figure 5).

Figure 5 reveals that permanent crops do not benefit from an economic predictability based on the supply–demand ratio, and that in general, the crisis years (2019–2020) generated a change in production parameters due to the intensification of domestic demand and exports of unprocessed raw materials, combined with the lack of storage capacity and the price volatility marked by numerous cracks in the Sibiu stock exchange. It is noted that the period 2012–2018 was the most stable period for permanent crops, in which production forecasts could be made, especially due to rural development programs supported by European and national funds that revitalized the branch.

Other productive elements directly correlated with the dynamics of the operators’ number are: the production of fresh vegetables (including melons) and strawberries (ha) (FreshVegetablesAE) and the production of permanent crops pastures and grasslands (ha) (GrasslandsAE), which leads to the identification of the real market interest for these four categories of organic products. This aspect validates hypothesis H1, which is that the number of operators in organic farming as an attribute of productivity shows a dynamic directly proportional to the increase in the production of Tuberous and root plants (ha), and an increase in production for permanent crops pastures and grasslands (ha), for fresh vegetables...
(including melons) and strawberries (ha), respectively, with these elements representing performance maximizers in organic farming and a pivot of medium term development.

Figure 5. Pareto diagram of the evolution of the dependent variable OperatorsAE in relation to the variable PermanentCropsAE. Source: Elaborated by the authors.

Table 3 reveals that the production of dried legumes and protein crops for the production of grains (including seeds and mixtures of cereals and legumes) (ha) (CropsAE); industrial crops (ha) (IndustrialCropsAE); other arable crops (ha) (OtherCropsAE); green harvested plants (ha) (GreenPlantsAE) vary indirectly in relation to the dynamics of the number of operators from the organic farming.

This diagram refers to dried vegetables and protein crops for the production of grain (including seeds and mixtures of cereals and vegetables). These categories are subject to the same lack of economic predictability, being in relation to the punctual agricultural interest marked by shifting the demand for conventional products to the preference related to organic products. Romanian decision makers adopted a strategy of ending a series of economic programs despite their success, since funding problems arose. However, some programs were restarted after 2–3 years The above mentioned aspect are highlighted in Figure 6.

Therefore, the H3 hypothesis is confirmed: high-yield crops optimize, in a short productive horizon, the number of operators in organic farming, while low-yield crops tend to disrupt market balance and supply. The sustainability of organic farming in Romania is far from being achieved, as the interest of the producer or consumer is not protected by active measures. There are many elements of improperly applied agricultural policy, which do not allow efficiencies to be achieved in the branch, or achieved occasionally at the level of companies or associations.

It can also be seen from Table 3 that the dynamics of economic operators in organic farming varies inversely with the dynamics of uncultivated land (ha) (Uncultivated), which validates hypothesis H2: the number of organic farmers in Romania tends to decrease proportionally to how much agricultural area organic grain is growing. This reveals that land fragmentation is an impediment for organic farming and business associations can be a solution for viable organic farming in Romania.
However, some programs were restarted after 2–3 years. The above mentioned aspect are highlighted in Figure 6.

Figure 6. Pareto diagram of the evolution of the dependent variable OperatorsAE in relation to the variable CropsAE. Source: Elaborated by the authors.

4. Discussion

The European Green Deal Pact [42] targets the transition to organic farming in the context of climate change and environmental degradation. Organic farming is a viable alternative for population health status, since it has multiple benefits due to non-genetically modified products and by increasing the level of good quality nutrients in the food basket of the population.

Thus, in stages, through the Green Deal Pact, until 2050 [43], it is assumed that a complete reduction in greenhouse gas emissions, an economic growth model disconnected from the consumption of primary resources and the social and economic cohesion of all EU member states will be achieved.

Organic farming contributes to the Green Deal objectives in terms of healthy and affordable food consumption, but also has a negative contribution on another strategic objective (fresh air, clean water, healthy soil and biodiversity); thus, strategies to eliminate some risks associated with organic agriculture are required (see Figure 7).

The risks highlighted in Figure 7 are related to the Green Deal objective for the protection of biodiversity, environment and soil because both greenhouse gas emissions and biodiversity, as a result of these emissions, are affected by the increased intake of nitrites used in organic agriculture by recycling manure.

The present research proposes the integration of these risks in a digital monitoring instrument connected to the CAP, which allows the modification of the CAP in accordance with the signals emitted by digital instruments, which allows the elimination or minimization of risks, as can be seen from the above leak.

The proposed model makes a connection between the index of organic production by product categories and the number of agricultural operators active in organic agriculture in Romania. The case of Romania is specific, determined by the relatively large number of operators in the context of land fragmentation (low profitability of agricultural holdings) and a relative adversity to customized forms of association, based on experience in the centralized economy (1950–1989) [44]. This case is analyzed in relation to the objectives of the Green Deal, in the sense of transforming the “granary of Europe” into a region with inefficient agricultural exploitation and in the geopolitical context represented by the reduction in Ukraine’s production capacity (Figure 7).
The risks and opportunities offered by organic farming in the context of the Green Deal and CAP. Source: Elaborated by the authors.

The result of interest is the validation of hypothesis H3 of the research, which reveals that high-yield crops optimize, during a short productive horizon, the number of operators in organic farming, while low-yield crops tend to unbalance the market. This result motivates the need, emphasized also by the European authorities, to increase the social impact and adherence related to the consumption of organic products through education and promotion, an aspect which, unlike the rest of developed European countries, in Romania is diminished by the value of the average daily basket. Therefore, financial allocations in favor of the consumption of organic products must be adopted. In 2022, the minimum basket level for a decent monthly living should be 542 euros [45]. Instead, in Romania, about 1.5 million Romanians work on the minimum wage, which is lower than the value of the minimum consumption basket calculated for 2022 [45].

In these conditions, it can be appreciated that, at least for emerging countries such as Romania, the objectives of the Green Deal are difficult to achieve from the perspective of social and economic cohesion, as well as from the perspective of switching to organic food consumption. Almost a particular example can be found in the Romanian rural area, where there is recorded a subsistence consumption of organic food provided from households farming facilities, for their own consumption. On the other hand, other peculiarities such as time shortage and low culture surface dominated in the urban environment, where the consumption of organic products is limited both in terms of purchasing power and of consumption habits. However, integrated agriculture production systems such as roof-top aquaponics systems can represent a future direction which can be developed in the context of limited agriculture land area.

The novelty of present research consists of identifying the production predispositions of the economic operators which act in Romania, considered a state with great agricultural potential that could contribute to the increase in food security, highlighting the fact that the number of organic farmers in Romania tends to decrease, while the agricultural area with organic cereals is increasing (hypothesis H2 of the research).

The whole research can be categorized as an answer to the many questions related to the present and, especially, to the future of organic farming in Romania, and beyond:
Can organic farming successfully replace traditional agriculture in order to ensure food security in Europe? Can organic farming become economically efficient? Can a state that was previously classified as the “granary of Europe” become a successful exponent of organic farming? Can the risks associated with the implementation of organic farming be efficiently limited?

The results of the research show that organic farming may represent the future beneficial alternative for the health of the population, but this aspect needs to be supported by a good education of the population in favor of the consumption of organic food, as well as support measures from the state.

The economic efficiency of organic farming depends on I-E ratios, knowing that higher consumption rates reduce the real costs of exploitation, but also through the specific measures taken by the EU through strategic development programs that contain allocations of funds for development of agriculture. In the context of the current global economic crisis, the galloping inflation in Romania is an impediment in the development of the production and consumption of organic products. At this moment, it is difficult to anticipate the time horizon in which Romania will become an important agricultural producer in Europe in terms of organic products. The digital tools proposed by us in this research can be an efficient means of combating in order to reduce the risks related to the development of organic agriculture.

Proposals to improve this unfavorable climate, both economically and productively, target a better collaboration of operators from the perspective of Green Deal and the establishment of digital monitoring tools with an effect on increasing economic efficiency, which in turn could be a source of motivation for the operators in the Romanian organic agriculture in order to improve the operational status, to increase the production capacity, to reduce the land fragmentation and to approach some European objectives such as those proposed by the Green Deal.

5. Conclusions

The present research highlights the interest in organic farming in the current context of sustainable development policies and the limiting of the impact of agricultural exploitation on the environment. The following objectives are achieved in the research:

- Identification of the main components with productive contribution in organic farming, in Romania;
- The analysis of the above mentioned components dynamics and the developing of Pareto diagrams of positive and negative productivity;
- The quantification of the regression model of ecological productivity in the period 2010–2020, a model whose replicability can be extended to other states;
- Results dissemination in the form of productivity clusters;
- The evaluation of the changes in agricultural policy captured by modeling and designing strategic directions for the organic farming development in Romania.

The research reveals that the dynamics of agricultural operators is directly dependent on the branches for which there is commercial interest related to the demand for goods and inversely dependent on the branches for which commercial interest is low, monitoring at least two changes in development strategy financed by centralized EU sustainable development programs.

At the same time, the transition from extensive development to intensive development through ecological practices, which is a basic component of current sustainable agricultural development policies, was highlighted. The strategy of limiting land fragmentation in agriculture as a successful element of sustainable development was incorporated.

The impact of the research is significant, emphasized by the clusters delimitation with high and medium productive yield, which orients the economic attractiveness for the operators from ecological agriculture, but also by identifying a statistical tool for evaluating the changes in these clusters over time.
The proposed model is useful for economic operators and decision makers in the field of agricultural strategy to establish future directions for the development of branches. The limits of the study are represented by the relatively small number of variables and the average study period of 10 years, with the authors aiming to develop the research to increase its impact by considering several variables and expanding the forecast horizon in a future paper.


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**References**

1. Siepmann, L.; Nicholas, K.A. German Winegrowers’ Motives and Barriers to Convert to Organic Farming. *Sustainability* 2018, 10, 4215. [CrossRef]
4. Petrescu, A.G.; Onciocu, I.; Petrescu, M. Perception of Organic Food Consumption in Romania. *Foods* 2017, 6, 42. [CrossRef]
14. Smoluk-Sikorska, J.; Malinowski, M. An Attempt to Apply Canonical Analysis to Investigate the Dependencies between the Level of Organic Farming Development in Poland and the Chosen Environmental Determinants. *Energies* 2021, 14, 8390. [CrossRef]