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Agricultural Entrepreneurship in the European Union: Contributions for a Sustainable Development

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Abstract: Entrepreneurship is sometimes seen as a glimmer of hope which may bring about some contribution towards improving economic dynamics and performance, specifically in the creation of employment by young people, in general, with further educational training, greater flexibility and who are better prepared for working with new technologies. However, entrepreneurship in the agricultural sector is, in certain circumstances, viewed as being something incompatible or, at least, difficult to implement. More scientific studies in these fields could provide interesting contributions on the road to highlighting new ideas inside the farming sector. In this framework, the objective of this study is to explore the entrepreneurship dimensions within the European Union agriculture towards a more sustainable sector. In fact, without an economic dimension in farm management, its sustainability in the medium and long run may be compromised, increasing the abandonment of farming, namely in more disadvantaged regions. For this, the literature which is available on the platform Web of Science relating to the following three topics was initially analysed: entrepreneurship, agriculture, and the European Union. This literature was clustered through the VOSviewer software, an interesting tool for performing bibliometric analysis. Secondly, statistical information related to European Union agricultural entrepreneurship considering empirical approaches was also explored. The analysis carried out shows that the realities across European Union countries are, in fact, different, where the instruments from the common agricultural policies, for example, may play a crucial role in promoting more farming entrepreneurship in a more sustainable way.

Keywords: VOSviewer software; bibliometric analysis; statistical analysis; agricultural innovation

1. Introduction

Bringing about new ideas is a fundamental approach in every sector. This is particularly important in agriculture, considering its specificities and lower capacity to sometimes create innovation, and in less favoured contexts of the European Union, such as in rural areas, frequently suffering from a lack in dynamics. In some European Union countries, such as Portugal, many things have already been done in this manner, namely with European financial funds, but there is still much to do. This is primarily due to the fact that for many years, the European agricultural policies within the framework of the Common Agricultural Policy (CAP) are or were socially unjust (favouring larger farms) and economically inefficient (conditioning farmers to opt for the most subsidised productions) in some member-states. On the other hand, the European agricultural strategies could be more directed towards promoting agricultural entrepreneurship and leadership. This is a typical problem which stems from having common policy instruments for a set of countries and regions with great differences amongst them. In any case, these frameworks have limited the potential for the development of farms which are located in certain regions [1].

The consequences of this are the vast differences in the levels of development across farms from different European countries and sometimes across farms from diverse regions within the same member-state. Another question, in addition or in parallel to the economic performance, refers to the discussion about the social and environmental contributions of the farms, namely in less affluent regions, where the agricultural sector, specifically family farming, provides a decisive contribution towards balanced development. However, it would be interesting if the model of this family farming inside the European Union were to be rethought, as some of this agriculture is practiced by older farmers or by farmers who, with their current levels of income, will probably decide in the near future to abandon this sector and the regions in which they live [1].

In this way, it is fundamental to bring about new approaches and sometimes to look at things from a different perspective in order to renew/refresh the agricultural sector, specifically in regions with a greater risk of abandonment. Innovation and entrepreneurship should play an important part here, not only in the agro-food sector, but namely in the production sector (agrarian sectors). It is specifically important to attract younger generations as well as the most qualified professionals.

Considering this context, this study aims to highlight the main insights available in the scientific literature related with agricultural entrepreneurship in the European Union. To deeper explore these insights, the literature review was complemented with bibliometric analysis. Data and empirical analyses were also performed to better explore the actual realities in these domains. These approaches made it possible to find a set of proposals to improve the sustainability of farms in the European Union regions.

Further Explanation of the Research Approach

This subsection aims to clarify the following aspects: What is the main contribution of the paper? How does the existing literature miss the role of entrepreneurship? Does the EU sufficiently support this problem in its policies? How exactly is entrepreneurship defined and measured?

This research intends to bring more insights for the understanding of agricultural entrepreneurship, specifically, for the context of the European Union. There are interesting contributions about these topics, as highlighted in the literature review, but there is still enormous potential to be explored, because agricultural entrepreneurship is a topic that does not attract as much attention from the several stakeholders as in some other sectors. In fact, it is important to further explore the scientific literature available on the Web of Science platform. It is also important to analyse the statistical information available for some fields considered by the literature as relevant to agricultural entrepreneurship, such as, for example, those related to women and young people. In turn, it is relevant to show how these variables influence agricultural performance in the European Union, namely, for instance, to eventually propose policy adjustments.

Following these motivations, the bibliometric analysis was considered, namely, to highlight the main insights of the scientific literature and to support the organization of the literature review. The information obtained with the bibliometric analysis and literature review was considered to identify the main variables related to these domains to be explored through data analysis and econometric approaches.

The concept of agricultural entrepreneurship was considered in all its dimensions. In fact, agricultural entrepreneurship is important for more competitive farms, to strengthen their position in the market, but also for more familiar farms, to improve their socioeconomic and environmental contributions. In practice, entrepreneurship presupposes innovation and new ideas for any stage, from production to final consumption.

2. Material and Methods

The study proposed here aimed to identify the main gaps in the scientific literature related to these topics under analysis and to identify the main factors that influence agricultural entrepreneurship within the European Union. With these objectives, the intention was namely to provide further

insight into the design or redesigning of new strategic plans that will promote entrepreneurship in the agricultural sector whilst taking advantage of the available resources, specifically from agroforestry land. In this way, the scientific literature relative to the subjects analysed was explored through bibliometric analysis and literature survey, so as to highlight how entrepreneurship may be further developed inside the agricultural framework. The bibliometric analysis is an interesting approach, specifically, to support the organization of this research. Subsequently, statistical information was examined through descriptive (data analysis) and empirical (regressions based on the Cobb-Douglas model) analyses, namely in order to stress the impacts from entrepreneurship variables on social and economic dimensions. The Cobb–Douglas model (production function) allows us to analyse relationships between several production factors and the output and has its relevance within this study. This approach was followed so as to interconnect the literature survey about agricultural entrepreneurship in the European Union with the empirical reality verified in the several member-states mirrored by variables related with these topics and available in the main statistical databases (namely Eurostat). It was considered important to present these interrelationships and the selection of the chosen variables already took into account the insights from the literature analysis (where, for example, the role of women and younger people in farm management was stressed, as well as, for instance, the sustainability of farms).

3. Bibliometric Analysis of the Literature Available on the Web of Science

In this section, the literature was first analysed through the VOSviewer software (Nees Jan van Eck and Ludo Waltman, Leiden, The Netherlands) [2], considering the scientific studies available on the platform Web of Science [3] and through the University of Burgos (Spain), where we stayed for a week on an Erasmus+ mission. On this scientific platform, 89 studies were found (including 76 articles, 20 meetings and 3 books) in a search performed at the end of May 2018 that included the topics: entrepreneurship; agriculture; European Union. After this initial analysis, in a subsequent sub-section, scientific studies through a literature review will be further explored. It is worth stressing that this kind of analysis for the agricultural sector follows studies such as, for example, that developed by Martinho [4], where the bibliometric analysis is an interesting tool with relevant outcomes.

3.1. Literature Analysis through the VOSviewer

Considering a minimum number of occurrences in all documents of a term of 5, the VOSviewer software selected the 70 terms presented in Table 1 with the respective number of occurrences and relevance score. This minimum number was chosen as after several simulations this was the value which possessed a greater relevance for the main terms. The relevance score indicates the terms which were more demonstrative of the topics analysed [2]. It is worth stressing that despite the importance of the agricultural policies for the questions related to farming entrepreneurship, as stressed before, it seems that the literature gave them little relevance, as shown in the bibliometric analysis performed through the VOSviewer software (in Table 1 the term "policy" appears with a low relevance of 0.51). These aspects related to agricultural policy will be explored at the end of this study, considering the findings obtained from the bibliometric and statistical analyses.

To improve the interpretation of the map, the following terms of relevance below 1.00 were excluded, with the exception of terms related to countries (Spain and Greece) and the European Union. The selection of terms such as rural development and sustainability was maintained. The map with all the terms is presented in Figure 1, where it is possible to identify 4 groups.

The terms considered by the software for each group are presented in Table 2. By analysing Tables 1 and 2 and Figure 1, it is possible to observe that in group 1 the terms for the European Union are those with a greater number of occurrences (11) and women is the term with the most relevance (1.51). For group 2, the term combination presents a higher occurrence and the term mean has greater relevance. In group 3, the term the Netherlands has greater occurrence and the term multifunctional

agriculture shows higher relevance. Finally, for group 4, the terms sustainability and difference are those with greater occurrence and relevance, respectively.

On the other hand, it is important to stress the proximity (relatedness) of terms such as: European Union, rural development and, for example, Greece in group 1; combination, place, attitude, industry and, for example, Spain for group 2; the Netherlands, transition, multifunctional agriculture and, for example, management for group 3.

Table 1. Number of occurrences and respective relevance of each term.

Term	Occurrences	Relevance
multifunctional agriculture	5	5.31
mean	5	3.23
transition	6	2.50
attitude	6	2.40
view	6	2.09
possibility	7	1.63
woman	7	1.51
management	8	1.48
difference	7	1.37
crisis	7	1.32
Netherlands	15	1.32
case	7	1.28
significance	6	1.20
industry	8	1.20
case study	9	1.19
combination	9	1.17
world	5	1.15
sample	10	1.15
improvement	8	1.12
cost	5	1.12
place	9	1.10
basis	7	1.09
economic performance	5	1.07
initiative	9	1.05
addition	6	0.99
success	11	0.99
experience	9	0.97
adoption	6	0.96
literature	10	0.94
ability	5	0.93
effect	10	0.92
recent year	5	0.92
situation	11	0.89
response	6	0.89
framework	14	0.88
issue	8	0.85
challenge	9	0.83
diversification	9	0.82
author	7	0.80
year	7	0.79
extent	7	0.77
Spain	8	0.77
outcome	8	0.74
relationship	12	0.72
value	12	0.72
agricultural sector	13	0.67
term	9	0.66
risk	9	0.66
Greece	8	0.60
company	8	0.60
order	9	0.60
country	8	0.58
demand	12	0.57
service	13	0.57
performance	9	0.56
element	6	0.52
policy	13	0.51
society	8	0.50
person	8	0.50
impact	11	0.49
product	11	0.49
way	9	0.48
article	12	0.47
rural area	18	0.47
end	5	0.46
European Union	11	0.44
rural development	10	0.44
sustainability	14	0.43
quality	14	0.30
information	10	0.27

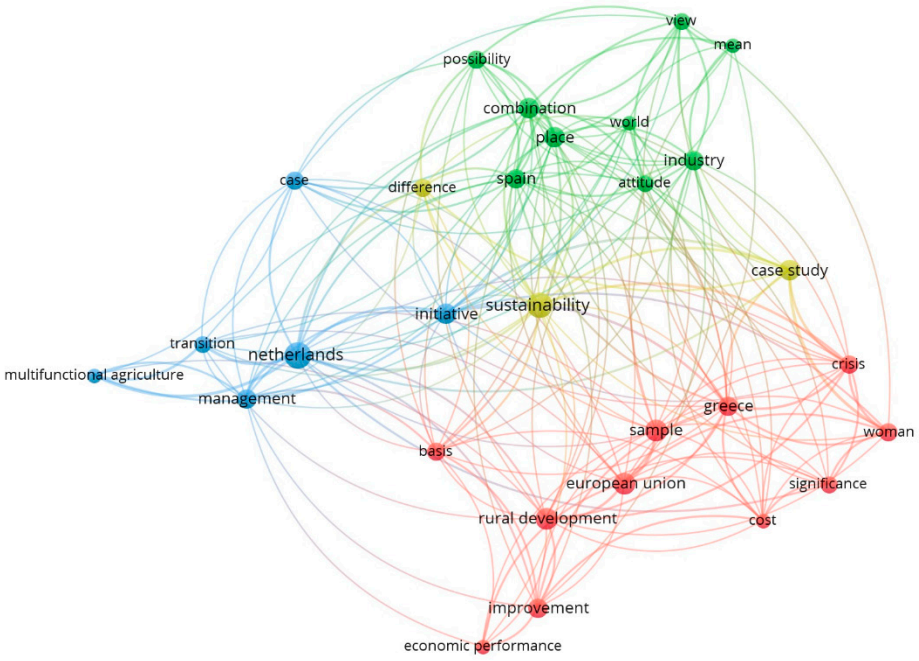

Figure 1. Map containing all the terms.

Table 2. Terms included in each group.

Groups	Terms
Group 1 (11 terms)	basis cost crisis economic performance European Union Greece improvement rural development sample significance woman
Group 2 (9 terms)	attitude combination industry mean place possibility Spain view world
Group 3 (6 terms)	case initiative management multifunctional agriculture Netherlands transition
Group 4 (3 terms)	case study difference sustainability

3.2. Literature Review

In this subsection for the literature analysis, several scientific documents related to agricultural entrepreneurship were grouped considering the terms previously identified for the four clusters presented in the previous subsection, namely in Table 2.

3.2.1. The European Union and Agricultural Entrepreneurship

The agricultural context in the European Union is, indeed, complex, considering the diversity of realities between countries and regions; however, these frameworks are sometimes considered as benchmarks for other countries [5] because there are relevant examples. In turn, some contexts of agricultural development in Europe were also influenced in some parts of history by other global realities, specifically the American one [6] in globalized trade. These scenarios have their implications in the dynamics of entrepreneurship in the agricultural sector, characterized by their specific particularities within several economic activities [7]. Specifically regarding entrepreneurship amongst women, it is necessary to highlight its importance as a specific field with many potentialities, namely in female empowerment and in the promotion of local resources, activities and endogenous productions [8–10].

In a new paradigm of rural development in the European Union, the various forms of European support for the creation of small businesses provide interesting contributions towards entrepreneurship in rural regions [11]; however, some barriers, namely administrative ones, continue to complicate the process [12]. The perception of the numerous stakeholders concerning entrepreneurship can also condition its implementation [13]. Due to the European Union's support, specifically for multifunctional agriculture and market globalization, there has been a rise in entrepreneurial attitudes amongst European farmers [14], or this has at least had an influence on farm organization and farmers' perspectives [15]. In addition, investments in research and education (specifically educational training) from the several agricultural stakeholders have helped to promote innovation and entrepreneurship in the farming sector and this increases the performance in agriculture [16–19].

3.2.2. Some Concepts Associated with Farming Entrepreneurship

The attitude and perspectives of the several stakeholders (sometimes the entrepreneurship is seen as something distant, for others and that can disturb the status quo) are determinant for effective faming entrepreneurship and benchmarking may play an interesting role here [20], because it allows farmers to see other realities where entrepreneurial practices are implemented with success. In any case, the economic impact of innovation and entrepreneurship initiatives is not yet totally clear in some sectors and regions [21]. Nevertheless, professional skills and technological/entrepreneurial/developmental competences are fundamental for the promotion for entrepreneurship and innovation [22,23], namely in rural areas where job availability is limited [24]. Self-confidence and good planning for businesses and investments are crucial for success in entrepreneurship [25]. Social capital (social networks, participation in agricultural institutions and access to information) also has its importance [26]. Information, communication and technology (ICT) may be a useful way to promote and increase farming and rural entrepreneurship [27]; however, there is still some work to be done in these fields, namely to overcome several constraints that complicate their utilization by farmers and other agricultural stakeholders [28]. The same happens with other new technologies, such as with nanotechnology [29,30].

The local cultural and historical contexts condition the decisions of famers and this has an influence on the way the several activities are developed [31]. On the other hand, a social perspective of farmers and constructive personal characteristics can positively influence agricultural entrepreneurship [32]. In any case, the organization of employment and working conditions has its influence on the business and entrepreneurship dynamic [33]. Gender is another factor with an influence on entrepreneurship characteristics and motivation [34–36], as well as the age of the farmers in question [37]. The social

construct concerning the relationships between the rural and urban areas [38], sometimes influences the dynamics developed within the several frameworks.

In the context of crisis, agricultural entrepreneurship is, in general, an alternative way to reduce unemployment through self-employment [39,40].

3.2.3. Multifunctional Farming and Agricultural Entrepreneurship

There are several activities complementary to agricultural production that can be developed in rural areas [41], some even from within the farms, such as agro-tourism [42], organic farming [43,44] and direct marketing [45], where, for example, multifunctional agriculture may be an option, from a perspective of farmers, producers and entrepreneurs [46]. Nonetheless, the multifunctional agricultural and innovative activities in farms are not free from criticism in some European contexts [47]. Aquaculture in some specific contexts may bring contributions to this multifunctionality; however, some constraints should be carefully analysed and solved [48]. In this multifunctional role of farms, bioenergy production may be a good example, in favourable contexts [49–51], as well as heating entrepreneurship in rural Finland [52]. Another question is the multiple businesses of the farm owners [53,54] that may promote the adoption of innovative and entrepreneurial options. In turn, the agricultural sector is fundamental for industrial performance [55], namely for the industries closely related to agriculture.

Agricultural entrepreneurship is often related to the diversification of activities in farms, where networking is crucial to promote changes within businesses [56–58] and to promote exchanges in experience [59]. However, this networking between the several agricultural and rural stakeholders is not always symmetric and does not provide benefits for everyone [60]. Trust, engagement and reciprocity amongst the several agents are important for success [61] and for creating environmental entrepreneurship [62], as well as the concerns for ethics [63].

In any case, the multifunctional land organization needs interdisciplinary approaches involving the several stakeholders [64] with the same objectives [65]. However, sometimes the transition from family farming to entrepreneurial management is associated with more stress for farmers, where agricultural policies are one of the causes of stress [66–68].

3.2.4. Agricultural Sustainability and Entrepreneurship

The relationships between farming sustainability and agricultural entrepreneurship sometimes depend on the form in which the sector is organized [69]. The sustainability of farms is a concern in several countries, namely in those with more environmental problems [70]. A balanced and sustainable relationship between farms and their surrounding context is the main goal for several agricultural stakeholders [71]. Entrepreneurship may bring about interesting contributions to a balanced relationship among the economic, social and environmental dimensions [72,73]. For entrepreneurial and sustainable farms, institutions play a crucial role, namely the cooperatives [74] and the universities for technological transfer [75], as well as the rural policies [76,77]. Social entrepreneurship in rural regions [78] and social farming [79–81] are interesting perspectives for farming and rural sustainability. The solution of social and environmental problems are the main goals for several farmers [82], or, at least, they should be [83], namely those who practice agriculture in disadvantaged regions and receive subsidies to stay there. Another example of agricultural contributions towards sustainability is urban agriculture, as a form of food production, occupation for unemployed persons and for the creation of skills in a process of lifelong learning [84], where there are economic, social and environmental concerns [85].

The farmers who remain in the less affluent regions and smaller farms, some with low profitability, have determinant importance for regional sustainability [86]. The current world contexts call for virtuous circles in sustainable landscape management [87] and for new forms of dealing with these new realities [88], where agroforestry has its place [89]. Innovation in farms brings about important insights for sustainability and animal welfare [90,91]. The aversion to change and to implementing new approaches is one important barrier against improving overall sustainability [92,93].

4. Data Analysis for Agricultural Entrepreneurship in the European Union

This section is aimed at complementing the analysis carried out before for the bibliometric approach. The data available in the Eurostat [94] will be analysed considering data which are more related with agricultural entrepreneurship in European Union regions (NUTS 2) and for 2016 (one observation by region), namely (Figure 2): the number of farms; the utilized agricultural area (hectare); the standard output (euro); the directly employed labour (annual working unit); and the number of farms whose household consumes more than 50% of the final production. These variables are important to understand the current and potential context around European agricultural entrepreneurship. On the other hand, these variables are important to perform the regressions with the Cobb–Douglas model (where the output is regressed, namely, in function of the labour and capital inputs). The standard output was considered as a dependent variable and the utilized agricultural area and the number of farms (as proxies for the capital) and labour were used as independent variables. Having said that, the database used does not present data for Italian regions in all variables considered and for some regions relative to the number of farms whose household consumes more than 50% of the final production.

Considering the relevance outlined by the literature towards the influence of aspects related to gender and age in agricultural entrepreneurship, the number of farms managed by males and females and by different age groups will also be analysed (Figure 3). In fact, as referred to before, gender is an important factor with an influence upon entrepreneurship characteristics and motivation [34–36], as well as the age of farmers [37].

To better understand the distribution of the values from the different variables across the European Union regions, shapefiles were considered obtained from the Eurostat [95] and worked upon with the QGIS [96] and with the GeoDa [97]. Several maps were created considering the GeoDa percentile methodologies. In these maps, the dark blue is for the percentile with lower values and the dark red is for the percentile with higher values. To improve the presentation of the figures, the overseas regions (Guadeloupe, Guyane, La Réunion, Mayotte and Martinique) were removed from the maps.

Figure 2 shows that the regions of Sud-Vest Oltenia, Sud-Muntenia and Nord-Est (all from Romania) are those with greater numbers of farms. It is also worth stressing that regions from Portugal, Spain and others from the nearby countries of Romania (Greece, Croatia, Hungary, Poland and Lithuania) have relatively high values for the number of farms. This context reflects, in some cases, the small size of the farms. It is on these smaller farms that innovation and entrepreneurship may play a relevant role.

On the other hand, the regions with a greater utilized agricultural area are located in Spain (Andalucía, Castilla-la Mancha and Castilla y León). Other regions, for example, from Spain, Portugal, France, Ireland, the United Kingdom and Romania have a relatively high agricultural area. In some of these regions, the large number of hectares is a consequence of the high number of farms, although with a low average area.

Relatively to the standard output, Andalúcia (Spain), Bretagne and Pays de la Loire (France) are the regions with better performance. However, when we look at the productivity of area (standard output by hectare), the higher values go to the Dutch regions. The Dutch farming sector is always a specific context, considering its land particularities that allow other kinds of agricultural organization. Concerning labour productivity, the higher values appear in regions from the United Kingdom and Denmark. This structure emphasizes farm performance in northern European regions.

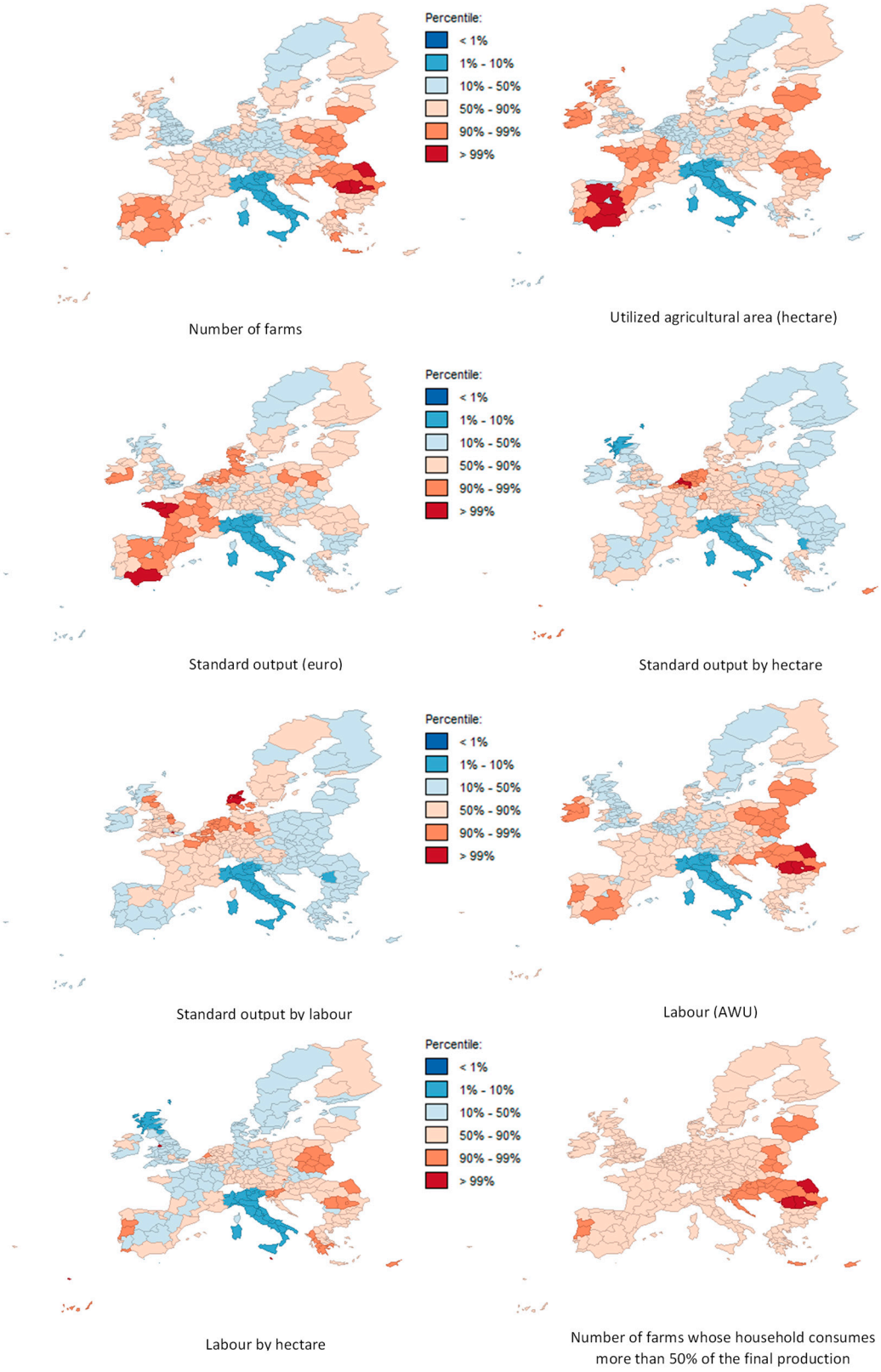

Figure 2. Some further variables associated with agricultural entrepreneurship in the EU.

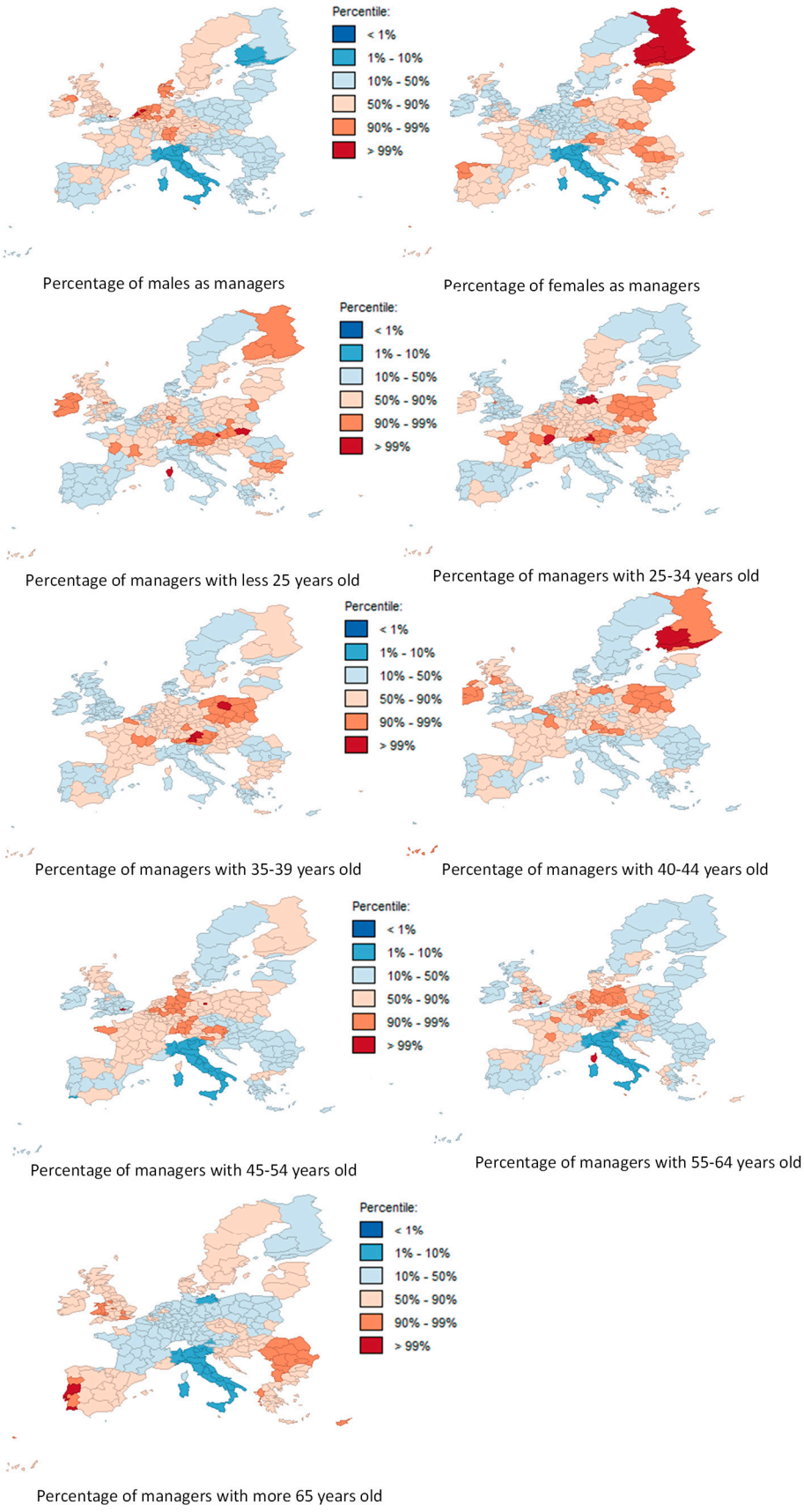

Figure 3. Number of farms disaggregated by gender and age of the managers.

The values for the labour force employed directly by the agricultural sector have a similar distribution as those verified and described by the number of farms, showing that a high number of farms, in some circumstances, is synonymous with small size and little mechanization. The Romanian regions with a higher number of farms and agricultural workers are, also, the same as those with a greater number of farms whose household consumes more than 50% of the final production. Malta, Madeira (Portugal) and Merseyside (the United Kingdom) seem to be the regions with a higher amount of labour per hectare. Other regions from Portugal (Norte, Centro and Algarve) present, also, relatively high values for labour by area. These high labour values per hectare are good from a social point of view, but they, also, show that there is work to be done to make the social and economic dimensions more compatible. In fact, some of these farms are located in mountainous or disadvantaged areas, managed from the perspective of the family, but, even here, measures can be taken for more adjusted management, claiming for agricultural innovation and entrepreneurship. In any case, the social and environmental contributions of these farms are unquestionable and clearly justify the financial support available in the European Union for these contexts. However, these subsidies could be more linked to more innovative and entrepreneurial management, maintaining the social and environmental role of this agriculture. Without this innovative approach for farms located in disadvantaged regions, the consequence, in the medium and long term, will be abandonment.

Regions from the countries of the southern European Union (Portugal, Spain, France and Greece) and from the countries of central and Eastern Europe seem to be those with more area, number of farms, labour and, in some cases, standard output. However, when the area and labour productivities are analysed, the greater performance is verified in regions from the northern countries (the Netherlands and Denmark).

Disaggregating the number of farms by gender and age of the managers, Figure 3 shows that Dutch farms are mostly managed by men and the Finnish agricultural units are managed by women. Women also play a relevant role in farm management in some regions of Germany, Poland, Austria, Romania, Latvia, Lithuania and in the north of Portugal and Spain. Considering the importance of women for more entrepreneurial management, their role should be rethought in the European Union, including from a policy perspective.

Younger managers (less than 25 years old) appear in farms of regions from Slovakia, as well as from France, Austria, Bulgaria, Poland, Finland and Ireland. Germany, Austria and France are the countries with regions where there are more managers aged 25–34 years old. It is also worth stressing that regions from Poland have a relevant number of farms managed by people between the ages of 25 and 34 years old. Regions from Austria and Poland are those with more farms managed by farmers in the 35–39 age group. The farms with managers between 40 and 44 years old appear more in Finnish regions and with 45–64 years old in regions from the central European countries (around France, Germany and the United Kingdom, for example). The greater number of farms with the oldest managers (more than 65 years old) appears in the Portuguese regions, as well as in regions from Romania, Bulgaria, Greece and the United Kingdom. Also, taking into account the role of young people in the agricultural sector, the several CAP instruments should be redesigned to be more effective in bringing youngers to the farms, namely, in countries where this context is more problematic.

5. Results for Cross-Section Regressions

Considering the data available in the Eurostat database (all variables in logarithms), the standard output (euros) was regressed, through cross-section regression for 2016 and across the European Union regions (NUTS 2), in function of the labour directly employed (AWU), the utilized agricultural area (hectare) and number of farms (Equation 1), taking into account the Cobb and Douglas [98] model as a base. The utilized agricultural area and the number of farms were considered as proxies for the capital.

The number of farms has the advantage of being considered by the database disaggregated by genders and ages, two important questions referred to by the literature.

$$so_j = \alpha_0 + \alpha_1 labour_j + \alpha_2 uaa_j + \alpha_3 nf_j + \varepsilon \quad (1)$$

where *so* is the logarithm of standard output, *labour* is the logarithm of labour directly employed, *uaa* is the logarithm of utilized agricultural area, *nf* is the logarithm of number of farms and *j* the European Union regions.

5.1. Stressing the Cobb-Douglas Model Adequacy for Agriculture

It is important to highlight that the variables selection took into account the original Cobb–Douglas model, the literature review carried out before and to avoid problems of multicollinearity. The Cobb–Douglas model, with proper adjustments, was considered in analyses for the agricultural sector by several authors, namely for efficiency surveys with data envelopment analysis [99] or through stochastic frontier [100].

Specifically for agriculture in the European Union and with the most diverse approaches (including efficiency analysis), several studies considered the Cobb–Douglas model from the theory of production and taking into account different databases with micro- or macroeconomic statistical information. For example, Aggelopoulos et al. [101] explored data related to production factors and output from 80 Greek pig farms through the Cobb–Douglas developments. These authors highlighted the relevance of the results obtained with the Cobb–Douglas production function and the adequacy of this approach for the agricultural sector. The relevance of the model in terms of economic and agronomic dimensions was also stressed by Gornott and Wechsung [102]. Bille et al. [103] considered microeconomic data from the Italian Farm Accountancy Data Network and used variables such as area and labour as inputs.. Galdeano-Gomez et al. [104] used financial data from 56 Spanish farming-marketing cooperatives to analyse the externalities from sustainability on agricultural productivity, considering as a base the Cobb–Douglas model. Martinho [1] considered the Cobb–Douglas developments to analyse the common agricultural policy impacts on the dynamics of the Portuguese agricultural sector. Utnik-Banas et al. [105] analysed the technical efficiency from some Polish broiler production farms, taking into account as a base the Cobb–Douglas model and considering as inputs, for example, several costs, labour and fixed capital. In fact, in these models, namely when regression approaches are considered, it is important to limit the number of variables to avoid statistical problems, specifically multicollinearity. Typically, inputs which are taken into account are those such as labour and capital (or proxies for it) and other variables for extended versions.

5.2. Regressions and Results Analysis

Several regressions were made through the cross-sectional methodologies, considering the Stata [106] procedures, some with the number of farms disaggregated by gender and age groups for management. The results are presented in Table 3. The labour and the utilized agricultural area are control variables from the Cobb–Douglas model and the variables related to the number of farms disaggregated by gender and age groups for the management are decision variables, considering the previous literature analysis and to capture the age and gender effects on the agricultural output.

Table 3 reveals that this is, indeed, explained positively by the number of agricultural workers and the area, whilst negatively by number of farms, showing that, in general, the regions with more farms have smaller scale economies and less output. To analyse the eventual problems of multicollinearity among the independent variables, the results were compared, for example, for models 1 and 2, which seems to suggest an absence of this statistical infraction. On the other hand, considering the Breusch–Pagan test for heteroscedasticity and the Ramsey RESET test, the more statistically consistent models are those with the number of farms disaggregated by age groups, specifically for younger managers.

Table 3. Cross-section results based on the production function model (standard output logarithm as dependent variable).

Variables	Model1	Model2	Model2 (Corrected)	Model3	Model3 (Corrected)	Model4	Model4 (Corrected)	Model5	Model6	Model7	Model8	Model9	Model9 (Corrected)	Model10	Model10 (Corrected)	Model11	Model11 (Corrected)
Constant	13.660 * (40.300)	10.040 * (28.570)	8.276 * (19.680)	10.222 * (27.430)	8.866 * (19.770)	9.243 * (28.530)	8.305 * (24.260)	9.632 * (17.590)	9.929 * (19.410)	9.306 * (17.130)	9.996 * (21.620)	10.062 * (24.540)	8.558 * (18.650)	9.673 * (24.220)	8.315 * (19.750)	9.850 * (28.580)	9.065 * (25.100)
Logarithm of labour	0.702 * (20.020)	0.708 * (7.880)	0.785 * (10.000)	0.480 * (5.440)	0.616 * (7.670)	0.759 * (12.430)	0.776 * (13.480)	0.540 * (8.140)	0.476 * (5.930)	0.689 * (7.120)	0.550 * (6.460)	0.404 * (4.440)	0.596 * (8.120)	0.609 * (6.500)	0.691 * (9.840)	0.598 * (9.540)	0.580 * (10.310)
Logarithm of utilized agricultural area		0.601 * (13.160)	0.549 * (12.560)	0.611 * (12.720)	0.576 * (12.470)	0.554 * (14.000)	0.494 * (12.730)	0.563 * (11.140)	0.598 * (12.750)	0.600 * (11.920)	0.588 * (12.800)	0.614 * (12.610)	0.557 * (12.040)	0.612 * (12.990)	0.524 * (11.800)	0.576 * (13.160)	0.515 * (11.900)
Logarithm of number of farms		−0.439 * (−6.250)	−0.026 * (−8.530)														
Logarithm of farms managed by men				−0.244 * (−3.470)	−0.020 * (−5.940)												
Logarithm of farms managed by women						−0.421 * (−11.590)	−0.026 * (−12.850)										
Logarithm of farms managed by persons aged less than 25 years old								−0.371 * (−8.180)									
Logarithm of farms managed by persons aged between 25 and 34 years old									−0.270 * (−4.500)								
Logarithm of farms managed by persons aged between 35 and 39 years old										−0.481 * (−6.620)							
Logarithm of farms managed by persons aged between 40 and 44 years old											−0.341 * (−5.110)						
Logarithm of farms managed by persons aged between 45 and 54 years old												−0.171 * (−2.310)	−0.001 * (−6.350)				
Logarithm of farms managed by persons aged between 55 and 64 years old														−0.362 * (−4.760)	−0.002 *(−8.400)		
Logarithm of farms managed by persons aged over 65 years old																−0.327 * (−8.250)	−0.001 * (−9.440)
Breusch–Pagan test for heteroscedasticity	0.270 [0.604]	6.720 * [0.009]	0.970 [0.323]	10.040 * [0.001]	2.870 [0.090]	7.330 * [0.006]	2.550 [0.110]	1.000 [0.317]	2.280 [0.131]	0.060 [0.805]	1.260 [0.261]	7.320 * [0.006]	0.010 [0.904]	11.190 * [0.000]	1.180 [0.276]	12.620 * [0.000]	3.560 [0.059]
Ramsey RESET test using powers of the fitted values	18.460 * [0.000]	4.920 * [0.002]	0.630 [0.594]	5.690 * [0.000]	1.870 [0.135]	1.670 [0.174]	0.730 [0.532]	0.960 [0.411]	1.100 [0.347]	2.070 [0.105]	1.090 [0.353]	6.930 * [0.000]	1.110 [0.344]	5.050 * [0.002]	0.160 [0.925]	4.060 * [0.007]	0.550 [0.649]
VIF (Variance Inflation Factor)	1.000	8.420	6.920	7.520	6.510	4.950	4.620	3.150	5.070	6.440	6.230	7.530	5.280	8.750	5.460	4.400	3.700
Number of observations	250	250	250	250	250	249	249	220	243	212	245	249	249	250	250	249	249

Note: *, statistically significant at 5% or less. Model 2 (Corrected), this model was corrected by changing the number of farms to the number of farms squared. Model 3 (Corrected), this model was corrected by changing the number of farms managed by men to the number of farms managed by men squared. Model 4 (Corrected), this model was corrected by changing the number of farms managed by women to the number of farms managed by women squared. Model 9 (Corrected), this model was corrected by changing the number of farms managed by persons aged between 45 and 54 years old to the number of farms managed by persons aged between 45 and 54 years old cubed. Model 10 (Corrected), this model was corrected by changing the number of farms managed by persons aged between 55 and 64 years old to the number of farms managed by persons aged between 55 and 64 years old cubed. Model 11 (Corrected), this model was corrected by changing the number of farms managed by persons aged over 65 to the number of farms managed by persons aged over 65 cubed.

In any case, the Variance Inflation Factor (test for multicollinearity) was run and, in fact, the results suggest the absence of collinearity (all the results are below 10). On the other hand, to solve the problems related with heteroscedasticity and with omitted variables, several alternatives have been tried, namely through the translog model; however, in the simulations performed, the results are not statistically significant. In this way, it was opted to transform, in the models with problems for the Breusch–Pagan and Ramsey RESET tests, the variable related to the number of farms. In the beginning, for each model with heteroscedasticity and with the omitted variable problems, the variables from the translog model were simulated and some of the best statistical results were those where the respective number of farms variable was squared. However, this transformation was not enough for the models with statistical problems and related to farms managed by older farmers. In these cases, the respective number of farms variable was cubed. With these transformations, it was possible to confirm the impact from the several variables in the standard output and to compare results between models.

Model 6, for farms with managers from 25 to 34 years of age, this seems to be where (amongst the younger generations) the number of farms influences the standard output less negatively (−0.270). These findings suggest that the problems related to the number of farms (and probably related with the scale economies of the farms and their performance) may be better solved when the farmers are younger people, with an age ranging from 25 to 34 years. For balanced rural development and for farm sustainability, where the questions related to the economic dimension may not be the only determinant aspect in farm management, it will be important to attract younger, more qualified, innovative people and with more entrepreneurial capacities. In fact, innovation and entrepreneurial skills allow for a deeper exploitation of the multifunctionality of farms, promoting both social and environmental dimensions, with interesting returns for the farmer, as referred to before in the literature review.

In turn, farms which are managed by women influence the agricultural output more negatively than those managed by men. This shows that there still remains a long way to go across the whole of the European Union agricultural sector towards improving the role of women in farms, namely promoting more empowerment in resolving historical and sociological contexts.

Finally, amongst the older farmers (more than 45 years old), the farms managed by people between 55 and 64 were those with more negative impacts on the agricultural performance. The experience accumulated by the older farmers is important for agricultural dynamics; however, sometimes age is an impediment for innovation and entrepreneurship.

6. Discussions

This study was designed and planned with the aim of analysing entrepreneurship in the European Union agricultural sector, exploring the literature available on the Web of Science platform and related to the three topics: entrepreneurship, agriculture, and the European Union. This literature was further explored with bibliometric approaches through the VOSviewer software. These topics were also explored statistically, considering empirical methodologies.

The literature review shows that some terms such as gender, age, multifunctional agriculture, sustainability and rural development, for example, are important expressions when they are analysed as topics related with agricultural entrepreneurship in the European Union. These are relevant insights because the role of women and young people may, indeed, make a difference on European Union farms. These aspects may, in certain circumstances, be obvious findings, but have not been yet fully addressed by the several stakeholders, namely policymakers. In fact, women have an increasing role in society and, consequently, in farm management. Younger people have more training and inclination to use new technologies, namely those related to information and communications technology. If we want to do things differently and with greater return, then multifunctional agriculture and innovation are interesting approaches. In all these contexts, we cannot forget sustainability and a balanced development, where we unite economics, the environment and social aspects. On the other hand, countries such as The Netherlands are, also, important terms in this kind of analysis. In these frameworks related to agricultural entrepreneurship, the environments across the European

Union countries are really quite diverse, where the common agricultural policy may have a more effective influence in reducing asymmetries. Indeed, the bibliometric analysis, namely the information presented in Table 1, reveals that the questions related to agricultural policies are frequently referred to in the literature relative to agricultural entrepreneurship in the European Union (the term "policy" has an occurrence of 13, a number which resides amongst the higher values), but with a relatively low relevance (0.51). Considering these findings, it will be important that the several stakeholders, namely policymakers, design policy instruments which have a greater impact on agricultural entrepreneurship in the different European member-states, so as to increase the relevance of the interrelationships between agricultural policies and entrepreneurship.

The data analysis shows that European Union countries from the southern and eastern regions have a greater number of farms, more utilized agricultural area and more labour, and, in consequence, in some contexts, have smaller farms and with fewer technological resources. These contexts require more adjusted strategies that promote more entrepreneurial management, because the social and environmental dimensions of these farms are important, but should be balanced with the economic dimension. However, it is those farms from the north which have higher labour and area productivities. Maybe, in some cases, these farms could be considered benchmarks for the remaining European sector. In turn, regions from Finland, for example, have more women and younger people as managers. The regions from Portugal are those where the managers are older (more than 65 years old). Indeed, these questions should be addressed in the design of agricultural policies, namely in further promoting the importance of women and younger people in farm management and improving farming productivities in certain member-states. Low productivities may be an obstacle for creating more added value and consequently to bring about more qualified, innovative and entrepreneurial people.

The results obtained with the cross-section regressions, considering a model based on a Cobb–Douglas production function, reveal that the standard output is positively influenced by the agricultural workers and the area, whilst it is negatively influenced by the number of farms. Again, these considerations may be considered obvious, but they continue to deserve special attention from policymakers, because of the productivity weaknesses. In turn, improvements are needed in the output of small farms. Entrepreneurial approaches may here bring relevant contributions. In addition, the results confirm the importance of the age groups on the farms' performance. Another question to be taken into account by the policymakers is to clearly distinguish between agricultural economic entrepreneurship, agricultural social entrepreneurship and agricultural environmental entrepreneurship. It will be important, also, to define the sectors and regions where each one of these agricultural entrepreneurships is more likely. In fact, the literature shows that relative to agricultural entrepreneurship, economic aspects are determinant, but so too are sustainability and multifunctionality dimensions for integrated rural development. Empowerment for female farmers and bringing together farmers' experience and innovation will be another big challenge.

7. Conclusions

As a final remark, it is worth stressing that entrepreneurship dynamics in the agricultural sector are influenced by its particularities and often follow a pattern different to those verified in other economic sectors, such as industry. For example, a great number of firms in industry are often seen as a sign of good dynamics, whereas in the agricultural sector a high number of farms negatively influence the regional standard output (because a greater number of farms is, frequently, synonymous with lower scale economies and lower dynamics).

Thinking about the agricultural and rural policies, this study has brought to light some interesting contributions to the discussion about these topics, namely when highlighting the importance of more effective strategies that promote the several dimensions of agricultural entrepreneurship (economic, social and environmental) within the European Union. This is, in fact, a gap in the CAP instruments that could be redesigned to deeper address these dimensions. In the present version of the CAP strategies, the environmental dimensions, for instance, are clearly addressed, but innovation and

entrepreneurship could be more specific. For example, something like the "Greening" instrument of the first pillar could be created for farming entrepreneurship. There are already incentives to attract young farmers (in the first and second pillars of the CAP), but they could be redesigned to be more effective, namely, to maintain these farmers for longer periods in the sector. Another aspect in which the agricultural policies could be rethought is regarding the role of the women in the sector and their empowerment.

On the other hand, the importance of younger generations and women for agricultural entrepreneurship has also been stressed. However, it will be important to compare these results, in future studies, with those that may be obtained with other topics and other variables. For example, analysing the relationships between agricultural entrepreneurship and the activities of R&D or further analysing the interrelationship between agricultural entrepreneurship and agricultural, agro-environmental, and rural policies in the European Union, may provide interesting future contributions. Agricultural entrepreneurship has great potential to be explored. The consideration of other variables, some without information in the main statistical databases, but which may be obtained through the implementation, for example, of surveys in representative farms, will allow for a deeper examination of the technical orientation and business model for farms. Considering analysis by European Union country and other approaches in order to build the variables (ordinal variables, for example) could be another interesting suggestion for future research.

In any case, to address these and other approaches in future studies related with agricultural entrepreneurship, for example, some recent reviews such as those performed by Fitz-Koch et al. [107], Wuepper and Lybbert [108] and Dias et al. [109] are suggested. Other studies, such as the following, may also bring about further interesting insights: Morris et al. [110] and Dias and Franco [111].

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