Towards sustainability in European agricultural firms

Abstract

There has been an undeniable and remarkable performance of the global food system over the last fifty years. During this period, total food supply has increased almost threefold, whereas population has only done so in a twofold ratio, along with very significant shifts in diet related to economic development. European agricultural activity plays an important role in European and world food security through the agricultural production, supply and international trade. The main aim of this paper was analyses the agricultural sustainability of the twenty-nine Member States of the European Union in terms of economics, environmental, social and political activity. Information and data comes from FADN database from the European Commission related to the year 2013, because is the last information available. The methodology includes the min-max approach based on the four components of sustainability, namely, economic, social, environmental and politics. We include the new component of politics in the sustainability because European agricultural are high subsidised and these subsidies have impacts on European agricultural sustainability. All the referred components of sustainability were based on various indicators in each component based on the literature. The min-max approach was employed to normalise the selected indicators expressed in variety dimensions for their need to be put on a common basis according to Vitunskiene & Dabkiene, (2016). Multivariate methods, namely Component Principal Analysis was used to estimate weights for the selected indicators to construct sub-indices and then the sub-indices were aggregated into the farm relative sustainability index according to Vitunskiene & Dabkiene, (2016), but adjusted to the present goals. After, cluster analysis was used to form homogeneous groups of European countries according the agricultural sustainability indices. The results confirm three groups of European countries, namely, the North and Central countries; the New Member States and the Mediterranean counties. The results confirm that European agriculture firms and respective countries had a medium sustainability. The main conclusion highlines confirms the importance of the sustainability as a tool to better adjust agricultural policies among the European Member States and the need of to take into account the social, environmental, political and competitiveness of the agricultural sector in each cluster of countries and respective agricultural firms.

Keywords: European Member States; economics; environmental; political; social; sustainability.

1. Introduction

Agricultural activity plays an important role in the 29 Member States of the European Union (EU) in terms of economics, environmental, social and political activity. This sector provides

not only agricultural goods and services to feed the local population but have direct and indirect impacts on European and world economic sector by the exports and imports, as well as, in other sectors by the multiplier effect, namely, on the agroindustry's. But the agricultural activity has, at the same time, impacts at the social level for the local population on European countries and at a worldwide level, namely, by the creation of direct and indirect jobs and the maintenance of population living in rural areas. At the environmental level the contribute of the agriculture cannot be neglected in preservation of the habitats and biodiversity that allow the development of of-farms activities with add values for livehoods and the creation of jobs.

More specifically, this paper aims to:

a) To analyze the total sustainability of the farms from European Member States as a way to promote innovation and social change among all the European agricultural firms;

b) To analyze the competitiveness of EU MS farms;

c) To analyze the social sustainability of EU MS farms;

d) To analyze the environmental sustainability of EU MS farms;

e) To analyze the political sustainability of EU MS farms

f) To compare the results of total sustainability of farms among countries in order to better define CAP policies and support from EU.

This paper making a threefold contribution in the literature:

1) This paper gives insights to stakeholders and to public decision-makers about the way forward in the promotion of the rural development and also promoting the agricultural sustainability.

2) Introduce at the first time another new and very increasing, important and innovator indicator of sustainability, namely, the political dimension, as a new concept of sustainability in the literature.

3) Gives insights to the scientific community to more accurate measures for sustainability of farms and for sectorial activities with the necessary adjust in order to promote the agricultural and sectorial sustainability.

2. Literature Review

The economic indicators from firms in general and agricultural firms are common since the neoclassical theory. On the other hand, sustainability indicators are also common in life sciences and environmental sciences (Gómez-Limón, & Sanchez-Fernandez, 2010). But evaluation of European sustainability firms was never analysed. The seminar work from Vitunskiene & Dabkiene, (2016) assessing the farm relative sustainability on Lithuanian agricultural firms. Based on that work economic, social and environmental indicators was constructed. But the political indicators of firms wasn't never used. According to Dos Santos (2013) agricultural European firms are high subsidized.

Based on FADN database (2017) data and Vitunskiene & Dabkiene, (2016) we construct the social, economic, social and introduce a new political indicator of sustainability according to the tables 1; 2; 3 and 4.

Table 1. Economic indicators of the agricultural activity

Variable	Indicator
X_1	Labour productivity: farm gross value added per 1 annual work unit (EUR/AWU)
X_2	Capital productivity: Cash-flow (at constant prices) to capital
X_3	Land productivity: farm gross value added (at constant price) per 1 ha of UAA (EUR/ha)
X_4	Solvency: ratio farm total assets to total liabilities
X_5	Farm income: family Farm income per 1 family work unit (EUR/FWU)
X_6	Fixed capital formation: investment in long term assets per 1 ha of UAA (EUR/ha)
X_7	Farm diversification: ratio of revenue forms the other gainful activities to total revenue (%)

Note: ha- hectare; AWU – Annual work unit; UAA – Utilized agricultural area; % - per cent.
Source: Vitunskiene & Dabkiene, (2016) adjusted.

Table 2. Social indicators of the agricultural activity

Variable	Indicator
W_1	Family work: ratio of hours worked by family members to total hours worked on farm (%)
W_2	Jobs on farm: total annual hours worked converted into full-time equivalents (FTE)
W_3	Innovation and cycle agricultural life: Net Investment/UAA (%)

W_4	Family Farm Income / FWU
W_5	Job creation (Total AWU/UAA) (%)

Note: ha- hectare; AWU – Annual work unit; UAA – Utilized agricultural area; % - per cent.

Source: Vitunskiene & Dabkiene, (2016) adjusted.

Table 3. Environmental indicators of the agricultural activity

Variable	Indicator
Z_1	Use of chemical fertilizers: amount of chemical fertilizers per ha of UAA (Kg/ha UAA)
Z_2	Energy intensity: ratio of cost of electricity, equipment, heating, transport fuel and oil to farm gross value added
Z_3	Meadows and pastures: share of meadows and pastures (per cent of UAA)
Z_4	Livestock density: livestock units per 1 hectare of UAA (LSUs/ha)
Z_5	Environment-friendly: Total agricultural area out of production/UAA (%)

Note: ha- hectare; AWU – Annual work unit; UAA – Utilized agricultural area; % - per cent.

Source: Vitunskiene & Dabkiene, (2016) adjusted.

Table 4. Political indicators of the agricultural activity

Variable	Indicator
P_1	Total dependency of farms from subsidies: Total subsidies/Farm net income (%)
P_2	Dependency of crops subsidies: / subsidies on crops/Farm net income (%)
P_3	Dependency on livestock subsidies: subsidies on livestock/ Farm net income (%)
P_4	Dependency on dairying subsidies: subsidies on dairying/farm net income (%)
P_5	Dependency on environmental subsidies: subsidies on environmental measures/Farm net income (%)

Source: Authors, 2017.

3. Methodology

Data comes from FADN database (2016), but reporting to the year of 2013, because was the last one available. The main methods include multivariate methods, namely Component Principal Analysis was used to estimate weights for the selected indicators to construct sub-indices and then the sub-indices were aggregated into the farm relative sustainability index according to Vitunskiene & Dabkiene, (2016), but adjusted to the present goals. After, Cluster analysis was used to form homogeneous groups of European farms of countries, according to the agricultural sustainability indices by Dos Santos (2016); Miličić et al., (2017); Silva et al., (2015) and Silva, & Marote, (2013).

4. Results

The main results of the cluster analysis of farms of EU MS outline confirm the existence of three clusters based on economics; social; environmental and political indicators, namely:

Table 4 – Clusters of countries of farms sustainability

Cluster	**Countries**
I	Czech Republic; Estonia; Hungary; Italy; Poland; Portugal; Romania and Slovenia
II	Bulgaria; Cyprus; Greece; Spain; Croatia; Lithuania; Malta, Austria, and Sweden
III	Belgium; Denmark; Germany; France; Ireland; Luxembourg; Latvia; Netherlands; Finland and United Kingdom.

Source: Results of authors, 2018.

The results show the existence of three clusters that generically include, respectively: 1) Cluster I include mainly the New Member States (NMS); 2) Cluster II includes mainly the Mediterranean countries; and; (3) Cluster III includes mainly the Central European countries, which have mostly been in the genesis from European Union and are beneficiaries of the policies the from the beginning from Common Agricultural Policy (CAP).

Table 5 – Results of Cluster of farms sustainability indicators

Variable	Economic Indicators/ Cluster

Cluster	I	II	III
X_1	117560	111061	398211
X_2	0,5	0,5	0,3
X_3	8207	13076	17092
X_4	321	440	77
X_5	109780	81794	328271
X_6	223682	51930	393520
X_7	8717	13921	14534
Variable	Social Indicators/ Cluster I	Social Indicators/ Cluster II	Social Indicators/ Cluster III
W_1	537	611	675
W_2	1574	665	468
W_3	22554	-61989	216707
W_4	109781	81795	328272
W_5	59	106	29
Variable	Environmental indicators/ Cluster I	Environmental indicators/ Cluster II	Environmental indicators/ Cluster III
Z_1	93232	115492	146775
Z_2	2,8	2,2	3
Z_3	45,6	37,5	22,1
Z_4	0	0	0,2
Z_5	0,7	0,4	0,5
Variable	Political indicators Cluster I	Political indicators/ Cluster II	Political indicators/ Cluster III
P_1	591	384	582
P_2	9	14	11

P_3	25	18	52
P_4	22	0,5	6,2
P_5	0,8	2,9	7,5

Source: Results of authors, 2018.

The results of economic indicators highline confirm that Central European countries (Cluster III) presents a high value of productivity of labour; capital; financial indicators; income and investment in fixed capital. On the opposite way the farm diversification id high in the Mediterranean countries due the climatic and soil conditions that allows different and unique agricultural systems, namely as occurs with “montado” or cork production with pastures and animal production.

About the social indicators of the agricultural activity among the Clusters, the results confirm the important social impacts of all these tree clusters on this indicator, mainly with the high contribute of the agricultural firms from cluster I and cluster III, from the NMS and Central European agricultural firms on jobs creation on farm; innovation and rural development. These results confirm the important contribute of family farms for the preservation of the rural development and sustainability and are according to Salvioni et al., (2014) and Dos Santos (2013).

About the environmental indicators the results mainly confirm that the Mediterranean agricultural systems are, in general, more environmental friendly with low inputs in fertilizers chemicals; low energy intensity consumption; highest areas on pastures and more extensive livestock systems. These results highline confirm the need of financial support from CAP policies to conduct the maintenance of the environmental European systems and farms and your preservation.

The results of political indicators from the firms of the all the clusters confirm that the dependency of farms from subsidies presents the highest value for the Central European countries, namely the total dependency of farms from subsidies, dairying and environmental financial support measures from CAP.

Conclusion

The main results confirm that farms from European Central countries are more competitive with more economic efficiency and have high financial support from CAP measures. On the opposite way, Mediterranean agricultural firms have the highest value and contribute on environmental and rural development and preservation. In general all the European agricultural firms from EU the family farms represent an important contribute for jobs creation and the maintenance of the rural live.

With the exception of crop subsidies, Mediterranean agricultural firms present the lowest values of support from CAP policies. That means the need of more attention from public decision makers about the Mediterranean agricultural farms and countries.

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Annex 1- Results from Countries Economics; social, environmental and political indicators of the agricultural activity

Country (3	X1	X2	X3	X4	X5	X6	X7	W1	W2	W3	W4	W5	Z1	Z2	Z3	Z4	Z5	P1	P2	P3	P4	P5
(BEL) Belgi	43308,94	.06	2380,384	3,799797	36853,98	30520,13	2001,5	77,94118	16,11111	30054,92	36853,98	4,001569	18758,34	0,220705	0,608082	0,026719	0,006497317	29,027647	0,146346444	4,19413026	0	0,005672343
(BGR) Bulg	7925,34	.07	632,3825	4,799847	3834,96	7666,087	753,37	47,71784	63,09444	10401,48	3834,96	6,365557	10552,03	0,237282	2,060222	0,002396	0,017466115	52,32899706	0,954678976	2,496852707	0,0472094	0
(CYP) Cypr	10411,81	.06	1936,271	20,40356	9745,39	1501	1626,66	75,75758	5,672222	-20937,9	9745,39	14,91525	17593,22	0,322304	7,00565	0,004139	0,022431989	34,89333914	0	1,842983602	0	0,07255841
(CZE) Czec	20550,24	.03	756,8493	4,495051	18900,21	43802,99	812,77	23,14335	9,727778	12255,56	18900,21	2,866479	10678,75	0,416514	0,930739	0,007501	0,015896181	69,99899105	0,114347212	1,367121813	3,952545907	0,000840788
(DAN) Den	92135,26	.02	2102,093	1,706113	73378,08	90666,67	1519,43	46,02273	15,25	30612,68	73378,08	1,797202	13274,79	0,240953	4,60533	0,044813	0,136411206	22,57738751	0,020320572	0,15394373	0	0
(DEU) Ger	43624,98	.05	1478,594	4,843721	35474,22	39848,84	1256,96	57,07965	104,9	20746,91	35474,22	2,542182	16116,99	0,30585	1,192351	0,018131	0,021236442	36,05450466	0,156365815	-0,22033365	3,097870785	0,175657701
(ELL) Gree	11818,51	.12	1669,011	307,0563	11615,05	762,5	1654,65	81,48148	187,4056	-30122,3	11615,05	11,00917	15382,26	0,188359	5,708461	0,00231	0,022223104	52,02008316	4,863889543	0,690358516	0,007844983	0,070604848
(ESP) Spai	21393,85	.09	799,4628	38,78327	21246,63	2254,902	873,8	74,45255	313,0389	-2800,98	21246,63	3,345543	8852,259	0,17695	8,962149	0,008813	0,138223508	32,84514543	2,601392872	2,260002731	0,26628431	0,092175338
(EST) Esto	16618,69	.03	374,7718	3,039132	13676,1	46711,63	455,6	41,95122	4,227778	16774,01	13676,1	1,496897	8909,091	0,440331	14,93246	0,008902	0,450501059	79,20879121	0	1,852014652	0,005860806	0
(FRA) Fran	30939,02	.09	1119,516	2,526298	22406,89	21785,82	1279,88	69,11765	166,0111	-3272,79	22406,89	2,360019	17328,78	0,240289	1,931976	0,021545	0,050492071	47,43376829	1,796757612	4,346381969	0,351126928	0,210359826
(HRV) Croa	4262,83	.03	764,9268	35,64296	3031	1126,087	930,33	87,5	44,96667	-15003,2	3031	11,71229	13704,65	0,217442	2,482495	0,002867	0,011770671	54,98343105	3,84909508	5,480499618	0	1,593168493
(HUN) Hun	19414,61	.09	759,9754	5,989144	22853,65	13921,88	918,91	40,50633	57,13889	5326,355	22853,65	3,243021	11001,64	0,307325	2,237274	0,004963	0,03132472	56,32183908	1,839731692	3,396177265	3,933444043	0,240956009
(IRE) Irelai	23338,4	.02	736,5987	39,21682	19463,98	11604,5	260,48	93,27731	48,05556	8432,64	19463,98	2,403555	14623,31	0,246237	0,242375	0,022862	0,004731787	71,840219	0	1,21024385	0	0,327774376
(ITA) Italy	22772,64	.06	2164,903	131,5632	23527,49	3446,392	2417,7	75,1938	382,2444	-23833	23527,49	7,583774	14556,14	0,15446	5,291005	0,005591	0,032295685	23,77327715	0,60146799	0,292238684	0,37719179	0,020388745
(LTU) Lithu	8692,99	.08	464,4902	6,525926	8771,59	8354,61	517,46	80,57143	33,82778	9153,45	8771,59	3,604531	10315,14	0,271429	4,963955	0,003372	0,064198189	62,83930332	0	2,398948406	0,151166612	0,072297075
(LUX) Luxe	37723,67	.01	1539,469	4,179444	31894,19	71287,07	541,44	80,76923	0,888889	55234,02	31894,19	2,195416	12867,31	0,237616	0,084439	0,027822	0,001741333	68,46400466	0	-0,02477412	2,387059166	0,091809968
(LVA) Latvi	8181,26	0	377,9997	3,183257	6375,18	14081,82	510,24	63,15789	13,71111	13828,34	6375,18	3,02504	8423,795	0,484607	7,468519	0,005032	0,126100631	79,21325294	0,087806591	11,64900779	0,292688638	3,845928701
(MLT) Mal	9429,16	.05	6012,313	24,40825	8325,01	1732,258	6645,02	86,71329	1,566667	-18432,8	8325,01	53,35821	28246,27	0,355117	3,358209	0,004703	0,002786792	22,2403682	1,774181575	0	0	0
(NED) Net	56804,54	.02	5737,63	2,947403	48900,89	50248,61	5647,86	52,74725	27,51111	49563,91	48900,89	7,487658	21758,09	0,31259	0,521119	0,023244	0,003219821	11,7625414	0,030340785	-0,95089312	0,074238091	0,010974327
(OST) Aust	20980,28	.05	1456,588	8,832821	19164,52	17599,24	660,97	92,25352	50,42778	15985,94	19164,52	4,34118	6631	0,245713	1,375726	0,007636	0,013957427	62,14031793	1,499094507	2,629284325	1,019518412	0,147561875
(POL) Pola	7017,18	.06	887,0282	16,62882	6510,63	2969,388	865,19	86,47059	408,5778	-2206,27	6510,63	9,037746	15124,93	0,26335	1,48857	0,003079	0,007418378	50,08400538	0,823252688	0,428427419	1,990927419	0
(POR) Port	10320,6	.1	771,7647	37,52538	10987,97	4338,095	794,33	78,75	54,35556	6125,237	10987,97	6,072106	5620,493	0,170338	19,62049	0,004644	0,168709454	44,68240005	3,051628951	8,93648001	0,351877692	0,254807984
(ROU) Ron	5551,85	.14	842,7184	65,50438	4303,98	600	769,86	89,07563	631,0833	-6332,25	4303,98	12,83711	7669,903	0,160522	0,539374	0,001745	0,001690491	28,83593869	0,03035362	0,94096221	0,273182577	0,258005767
(SUO) Finl	24666,05	.04	955,4843	3,750499	17745,64	27942,11	870,24	76,6129	21,38889	3628,487	17745,64	2,148674	12860,86	0,501333	2,876451	0,01102	0,06757692	163,7394506	8,687151748	30,99156049	0	2,847925967
(SVE) Swe	37126,53	.04	797,4515	2,935465	15225,24	28532,74	920,44	76,87075	15,49444	5753,222	15225,24	1,446423	10846,21	0,447356	2,971564	0,020499	0,096640928	72,46660567	0,029277219	3,021043001	0	1,015553522
(SVK) Slov	11504,71	-.01	444,0394	6,4944	5248,47	101249,5	620,42	7,112069	2,061111	2872,729	5248,47	2,526912	9102,874	0,457949	0,602683	0,006303	0,013352375	94,11907913	2,478838423	2,516292542	0,041199531	0,011236236
(SVN) Slov	3809,53	.02	1204,924	50,13486	3772,21	6642,748	1062,48	94,92754	24,11111	11571,97	3772,21	13,06818	10568,18	0,380384	0	0,004261	0	143,8870875	0,114438299	4,749189395	11,02422277	0
(UKJ) Unite	37489,3	.03	664,624	10,5141	35778,77	35534,96	646,45	58,57143	53,65556	7878,29	35778,77	1,276673	10762,96	0,229218	2,601982	0,025308	0,086647043	51,86764238	0,001272669	0,377982819	0,013999364	0,001272669

Source: Authors Results, 2018.

* H I E R A R C H I C A L C L U S T E R A N A L Y S I S *

Dendrogram using Ward Method