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A multicriteria model for the assessment of rural development plans in Greece

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ABSTRACT

In the last decades rural communities face the problems of ageing of population, high share of elder farmers and imbalanced distribution of farmers across age classes. The Rural Development Plans (RDPs) of Common Agricultural Policy (CAP) in European Union (EU) are the policy instruments that affect agriculture and the people living in rural areas. The RDP measure "Setting up Young Farmers" aims to fight the demographic problems of these areas. This study is an attempt to highlight the role and the impacts of RDPs and especially of the "Setting up Young Farmers" measure in the prefecture of Thessaloniki in Greece. To this end, a multicriteria mathematical programming model was implemented. This methodology was chosen using the Knowledge Brokerage Approach in the context of the LIAISE project, which proposes a set of support modules that are linked to the impact assessment process with a final goal to support future policies and design. The results showed that the "Setting up young farmers" measure achieved its goals to transfer land to young, trained farmers, to offset the set-up costs faced by young people when establishing themselves in farming.

Introduction

In the last decades many new issues have emerged in rural communities such as ageing of population in rural areas, liveliness of rural areas, residential use of farms, unfavourable age structure, the high share of elder farmers and the imbalanced distribution of farmers across age classes. Ageing of population in European Union (EU) rural areas raise the issue of "greying" society in connection to the liveliness of rural areas and the residential use of farms (Nikolov et al., 2012). According to European Commission (EC/COM, 2010) "the vitality and potential of many rural areas remain closely linked to the presence of a competitive and dynamic farming sector, which is attractive to young farmers". In order to correct all these age imbalances EU gives many opportunities for its member states by support measures co-funded under the Common Agricultural Policy (CAP). The CAP is the main policy instrument that affects agriculture and the economy of rural areas of the EU. CAP is structured in two complementary pillars, with annual direct payments and market measures making up the first and multi-annual rural development measures the second pillar (EC/COM, 2010). The Rural development Plans (RDP) aim at promoting competitiveness, the sustainable management of natural resources, and the balanced development of rural areas by more specific and targeted measures (EC, 2005). RDPs give to the member states the flexibility to address the issues of most concern within their respective territory with co-financing (EC/COM, 2010). Every member state applies a National Rural Development Plan (NRDP) which must be based on EU Strategic Guidelines (EC, 2005). The most important measure of RDP that targets young farmers, is "Setting up young farmers" (measure 112). The Setting up of young farmers' measure has been included in NRDPs in the majority of Member States in the last two programming periods 2000–2006 and 2007–2013.

The Setting up Young Farmers measure supports the entry of young persons into the agriculture sector and aims to fight the demographic problems of rural areas (EC, 2005). This measure provides for a one-off grant to be paid to trained farmers between the ages of 18 and 40 who have been set-up in farming for the first time (Department of agriculture fisheries and food of Ireland, 2009). Many EU Member States also have a different age limit as opposed to the 40 years in Greece (Ministry of Agriculture and Food, 2007).

A traditional argument connected to RDP measures is the issue of maintaining economically vital rural communities, particularly in rural areas where alternative income opportunities were limited. However, a full range of new issues has emerged. Farm size and its change over time are the main aspect of farm structure that the literature connects to "setting up young farmers" measure. Land markets become important in this perspective as farmland acquisition and entry-exit from the market determine changes in farm structure intended as physical size (Ahearn et al., 2005). The Setting

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Table 1
LIAISE IA support modules used in "Setting up Young Farmers" study.

Support modules	Phases	Setting Up Young Farmers
1) Test case formulation and scheduling	Formulation Phase	Applicable
2) Identification of test case team and target groups		Applicable
3) Policy storylines	Scoping and planning phase	Not applicable
4) Identifying impact areas and scales		Partly applicable
5) IA scoping and planning		Not applicable
6) Tools selection and technical specification	Instrumental phase	Applicable
7) Indicators, data requirements and sources		Applicable
8) Tool implementation: analysing impacts	Conceptual learning phase	Not applicable
9) Reflection and evaluation		

Source. Modules for IA support (LIAISE, 2011).

up Young Farmers measure aims to renew the age composition of the rural population and to improve the structure of their farms (Aggelopoulos and Arabatzis, 2010). It has also indirect impacts by supporting rural employment and maintaining the social fabric of rural areas. RDPs also affect the rural economy and by promoting diversification to enable local actors to unlock their potential and to optimise the use of additional local resources (Manos et al., 2013). Finally, there are many impacts in the structural diversity of the farming systems, by improving the conditions for small farms and developing local markets, because in Europe, heterogeneous farm structures and production systems contribute to the attractiveness and identity of rural regions (EC/COM, 2010). According to Bartolini and Viaggi (2013) structural change provides the possibility of increasing the competitiveness and efficiency of the farm households.

Assessment of the Rural Development Plan regionally will help in re-addressing the CAP in the wider framework of EU policy objectives. In this context, this paper focusing on assessing the impacts of "Setting up Young Farmers" RDP measure at regional scale. The study was carried out in the prefecture of Thessaloniki in Greece and is an important pilot process enabling the regional authorities to design, develop and implement IA for their regional policies. The research tries to measure the impacts of "setting up young farmers" measure ex-post. This research is part of a suite of cases studies which was developed under the LIAISE network of excellence (Linking Impact Assessment Instruments to Sustainable Expertise).

The paper is organised as follows. In the following section, the "Setting up Young Farmers" RDP measure is presented. The methodology approach which includes Knowledge Brokerage Approach and MCDA model is provided in 'Results' section. The last two sections contain the results of the analysis and some concluding remarks.

Methodology approach

Knowledge Brokerage Approach (Kba)

LIAISE network of excellence developed a coherent suite of case studies of different jurisdictions and policy fields. For this reason the methodology of Knowledge Brokerage Approach was selected. According to Canadian Health Services Research Foundation (2003) Knowledge brokerage (KB) is about knowing what knowledge exists, who owns that knowledge, and how that knowledge can be best exchanged among stakeholders and decision-makers. Knowledge brokering has gained increasing importance among all the strategies proposed in the scientific literature to increase knowledge utilisation during the last decade (Ziam et al., 2009). In order to ensure consistency across case studies, LIAISE proposed a set of support modules (SMs), which are linked to the impact assessment process with final goal to support future policies and design. The IA Support Modules have a dual role: (1) they provide a research infrastructure in the form of temporary Support Modules during the implementation of case studies, and (2) they help structure future interaction processes between researchers and policy-makers, for example, helping facilitate use of long-term IA Toolbox developed by LIAISE WP4. The modules also provide a framework for assessing the most appropriate KB strategy to use. They also include the crucial aspect of evaluation of the KB approach – how KB worked, what factors influenced it and how effective it was (Ward et al., 2009). The Support module approach fitted quite well with this study. In this research a set of support modules based on an improved understanding of long-term socio-economic mechanisms of change in rural areas, were applied. The focus was on the interface between "Setting up Young Farmers" RDP measure in rural economy, adopting prefecture as the reference agent in the connection between policy and socio-economic change. The state of the art about the study policy impacts intersects some specific issues dealt with setting up young farmers RDP measure. This research focused on economic, social and environmental impacts (Table 1).

The selection of the appropriate tools for this study was made according to the specific needs of policy makers (after interviews), the LIASE toolbox and the availability of data and tools already used for similar studies. A special attention was also given on impact scales and impact areas. The main tools selected were Simple tools and Multicriteria Decision Analysis:

- Simple tools. Tools that can give answers when estimating impacts in a simple way e.g. indicators linked to surveys and questionnaires in order to reflect young farmers' perceptions of rural areas where they live. In this context Economic, Environmental and Social Indicators were measured in order to assess the impacts of the measure (Table 2).
- MCDA model. An MCDA model combines different criteria to a utility function under a set of constraints concerning different categories of land, labour, available capital, etc. The

Table 2
Economic, environmental and social indicators that are used.

Economic impact	Environmental impact	Social impact
Farm income (Family farm income) (€)	Fertilizers use (kg/ha)	Labour use (h/ha)
Farm income (Gross added value) (€)	Water use (m^3/ha)	Annual work unit (AWU)
Gross revenue (€/ha)		
Variable cost (€/ha)		
Gross margin (€/ha)		

Table 3
Formulation of Pay off matrix.

Objectives attributes	$f_1(X)$	$f_2(X)$	...	$f_n(X)$
$f_1(X)$	f_1^*	f_{12}	...	f_{1n}
$f_2(X)$	f_{21}	f_2^*	...	f_{2n}
...	...	...	...	...
$f_n(X)$	f_{n1}	f_{n2}	...	f_n^*

implementation of an MCDA model optimises the Young Farmers farm plan in the Prefecture of Thessaloniki taking into account the available resources (land, labour, capital). The MCDA methodology was implemented for the 2007–2013 programming period. The MCDA model was solved by Weighted Goal Programming (Amador et al., 1998; Sumpsi et al., 1997)

Methodology – weighting goal programming for policy analysis

In order to analyse how “Setting up Young Farmers” measure may influence farm production decisions we extend (Amador et al., 1998; Sumpsi et al., 1997, 1993) methodologies for the analysis and simulation of agricultural systems based upon multicriteria techniques. This methodology has been successfully implemented on real agricultural systems (Bartolini et al., 2007a,b; Berbel and Rodriguez, 1998; Gomez-Limon et al., 2002; Gomez-Limon and Riesgo, 2004; Manos et al., 2011, 2006, 2010).

Specifically, a Multicriteria Decision Model (MCDM) is used in order to achieve better policy-making procedures and the simulation of the most realistic decision process. The MCDM model was chosen because of the variety of criteria taken into account by farmers when they plan their crop plans, broadening in this way the traditional assumption of profit maximisation. It also assembles the multifunctionality of agriculture involving variables related with economic, social and environmental aspects.

The utility MCDM approach in comparison with other approaches such as linear programming, cost benefit analysis, etc. can achieve optimum farm resource allocations (land, labour, capital, water, etc.) that imply the simultaneous optimisation of several conflicting criteria, such as the maximisation of gross margin, the minimisation of fertilizers, the minimisation of labour used, etc. We employ this methodology to estimate a surrogate utility function in order to simulate farmers’ decision-making processes, broadening in this way the traditional profit-maximising assumption. This surrogate utility function is then used to estimate the value of decoupled payments in crop production. Briefly, the methodology can be summarised as follows:

1. Establish a tentative set of objectives that may be supposed to be most important for farmers. Questionnaires and descriptive research are sufficient for this purpose.
2. Determine the pay-off matrix of the above set of objectives.
3. Using this matrix estimate a set of weights that optimally reflect farmers’ preferences.

The first step in our analysis thus consists of defining a tentative set of objectives $f_1(X)\cdots f_i(X)\cdots f_n(X)$ which seeks to represent the real objectives of the farmers (e.g. profit maximisation, minimisation of fertilizers, total labour minimisation, etc.). Once these objectives have been defined, the second step is the calculation of the pay-off matrix, which has the following formulation (Table 3):

The elements of the matrix need to be calculated by optimising one objective in each row. Thus, *fij* is the value of the *i* attribute when the *j*-th objective is optimised. Once the pay-off matrix has been obtained, we can try to solve the following system of *q* (number of objectives) equations:

and

$$\sum_{j=1}^{q} w_j f_{ij} = f_i, \quad i = 1, 2, \ldots q; \quad \text{and} \quad \sum_{j=1}^{q} w_j = 1, \tag{1}$$

where *wj* are the weights attached of each objective that reproduce the actual behaviour of the farmer, *fij* are the elements of pay-off matrix and *fi* is the value achieved for the *i*-th objective according to the observed crop distribution.

Normally, the above system does not result in a set of w and it is therefore necessary to search for the best possible solution by minimising the sum of deviational variables that find the closest set of weights. For this purpose a weighted goal programme with percentage deviational variables can be formulated (Romero, 1991). This solution will be obtained by resolving the following LP Model:

$$Min \sum_{i=1}^{q} \frac{n_i + p_i}{f_i} \tag{2}$$

subject to:

$$\sum_{j=1}^{q} w_j f_{ij} + n_i - p_i = f_i, \quad i = 1, 2, \ldots, q, \quad \text{and} \quad \sum_{j=1}^{q} w_j = 1$$

where *pi* is the positive deviational variable (i.e. the measurement of the over-achievement of the *i*-th objective respect to a given target), and *ni* is a negative deviational variable that measures the difference between real value and model solution for the *i*-th objective).

In some cases certain objectives are closely correlated, which means that maximising one objective implies the simultaneous achievement of the rest. In such cases it may be advisable to be very selective regarding the number of objectives modelled, avoiding those that are closely related (in agricultural production, for example, sales are closely related to gross margin). The pay-off matrix shows the degree of conflict among criteria, and in the hypothetical case that all objectives are closely related (maximisation of an objective implies almost optimal values for the rest); we conclude that there is no need to represent the multicriteria problem.

Data requirements

The modelling approach suggested requires data collection from the specific prefecture. A sample of young farmers who have participated in the “Setting up Young Farmers” measure during 2007–2010 from the Prefecture of Thessaloniki in Greece was chosen. Secondary data also used gathered from the Region of Central Macedonia and from the Department of Agriculture and Veterinary of Thessaloniki Prefecture. Data were collected for crops, yields, prices, subsidies, income and variable costs (seeds, fertilisers, chemicals, machinery, labour and other costs (e.g. cost of water)), gross margin and fertiliser use.

Multicriteria model definition

We define a system via a mathematical simplification of the relevant variables and their relationships in order to understand the effect of any modifications of the initial conditions that characterise the system. Every system has variables that control the processes involved and that belong to the decision-making process as ‘decision variables’. The crop plan selected will determine changes in certain attributes of the system. Attributes are relevant functions deduced from the decision variables, but there are attributes that are not relevant to the decision makers. Attributes to which decision makers assign a desired direction of improvement are considered objective functions. In this report we will analyse not only the farmers' objectives but also attributes that are relevant to policy makers.

Variables

Each farmer has a set of variables *Xi* (crops), as described in the previous section. These are the decision variables that can assume any value belonging to the feasible set.

Objectives

This model will optimise at the same time different criteria as profit maximisation, fertilizer minimisation, etc. At the preliminary stage, three objectives must be regarded as belonging to the farmer's decision-making process.

Profit maximisation

Farmers wish to maximise profits, but calculation of profit requires the computation of some relatively difficult factors such as depreciation. Therefore, for convenience it is assumed that gross margin (GM) is a good estimator of profit, and maximisation of profit is equivalent in the short run to maximisation of gross margin.

The objective function included in the model is defined as follows:

$$MaxGM = \sum GM_i \times X_i \quad (3)$$

where GM is the total gross margin, is crop *i* and *GMi* is the gross margin of crop *i*.

Fertilizer minimisation

Fertilizer minimisation is a public objective. For this reason it is not considered in the decision process by farmers. The most obvious indicators are those related to the consumption of water and use of pesticides that are directly related to the pollution of water resources and appear more directly quantifiable at farm level. They are, nevertheless, not obviously subject to aggregation at higher level and their effects on the environment can be evaluated only after some elaboration of prediction models based on diffusion functions.

Fertilizer minimisation is the main form for calculating the surpluses of nitrogen potentially dangerous for the environment. It would also be the main indicator of the impact of farming on the environment as groundwater quality is concerned.

In this way, all nitrogen reaching the cultivated soil is included as input. Similar indicators can be designed for other nutrients, such as phosphorus and potassium. For this reason, fertilizer is computed as the sum of fertilizers used for all crops (TF), and its objective function will be as follows:

$$MinTF = \sum F_i \times X_i \quad (4)$$

Table 4
Objectives and constraints of the proposed MCDM model.

Objectives	Constraints
Profit maximisation	CAP single farm payments
$MaxGM = \sum GM_i \times X_i$	CAP production rights
	CAP crop rotations
Fertilizer minimisation	Land total
$MinTF = \sum F_i \times X_i$	Land irrigated
	Market constraints
Labour minimisation	Capital
$MinTL = \sum TL_i \times X_i$	Variable costs
	Total labour

Minimisation of labour inputs

The minimisation of labour implies not only a reduction of input cost, but also an increase of leisure time and reduction of administration and management processes. The farmers usually show an aversion to hiring labour. An explanation of this behaviour is that this parameter is connected with the complexity of crops because the hired labour adds a degree of complexity to family farming.

For this reason, labour is calculated as the sum of labour for all farm activities (TL), therefore the objective function will be:

$$MinTL = \sum TL_i \times X_i \quad (5)$$

No other objectives are proposed in advance. We will assume that at the preliminary stage the three objectives mentioned above are enough to explain farmers' behaviour.

Constraints

In order to analyse CAP's impacts we used several constraints resulted from the implementation of the CAP. The chosen constraints are the following:

- Total cultivation area. The sum of total available land for all crops (*Xi*) must add up to 100. This constraint is only introduced in order to obtain the outcome of the model as percentages
- CAP rights. The sum of production rights (*PRi*) for crops (*Xi*) according to CAP regulations should be minus-equal to the total production rights of the area (TPR)

Table 5
Economic, environmental and social indicators (existent BP, future BP and real).

Indicators	Existent business plan	Future business plan	Increase/decrease % (existent-future)	Real (2010)	Increase/decrease % (existent-real)
Economic					
Farm income (family farm income) (€)	30,277.9	44,031.2	45.42%	48,536.8	60.30%
Farm income (gross added value) (€)	19,336.9	30,276.5	56.57%	33,374.6	72.60%
Gross revenue (€/ha)	1352.3	1458.5	7.85%	1462.5	8.20%
Variable cost (€/ha)	970.1	1094.1	12.78%	1053.2	8.60%
Gross margin (€/ha)	300.0	363.5	21.16%	400.7	33.70%
Environmental					
Fertilisers use (kg/ha)	509.2	520.7	2.26%	521.0	2.40%
Water use (m^3/ha)	3203.2	4076.1	27.25%	3409.8	6.50%
Social					
Labour use (h/ha)	149.0	173.3	16.26%	164.7	10.70%
Annual work unit (AWU)	1.56	2.07	32.69%	1.97	26.30%

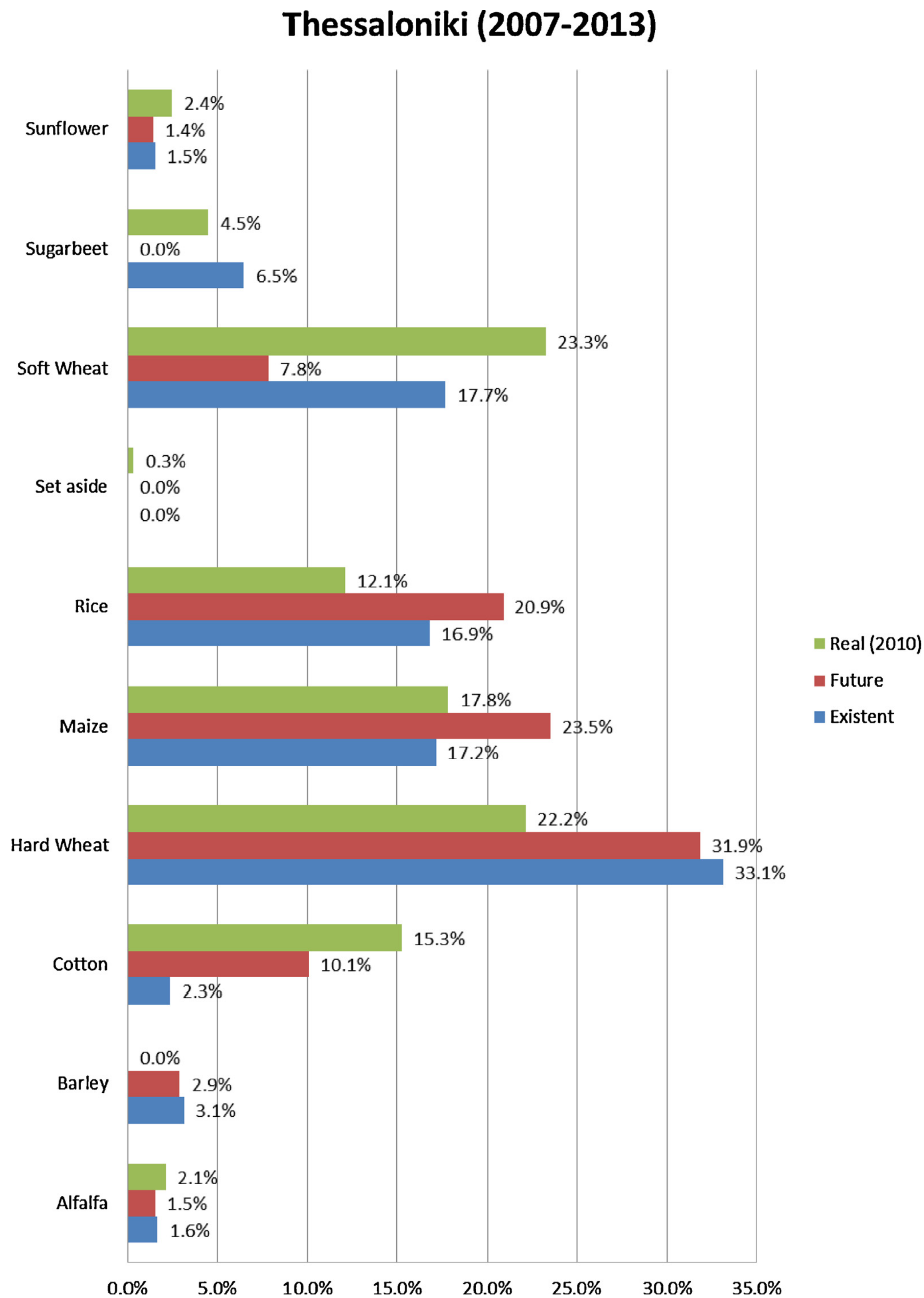

Fig. 1. Existent BP, future BP and real crop plan (2010) of the average farm of the prefecture of Thessaloniki in the second programming period (2007–2013).

- CAP quotas. The sum of quotas (*QPi*) for all crops (Xi) according to CAP regulations should be minus-equal to the total quotas of the area (TQP)
- Market and other constraints (they were defined according to market limitations and on the basis of the maximum historical cultivation during the planning period) (Table 4)

Results

From 2000 to 2012 there were two programming periods where the Setting up Young Farmers measure was implemented in Greece. The first was from 2000 to 2006 and the second is the programming period 2007–2013. In the first programming period there were 4 calls for participating in the measure (2001, 2002, 2003 and 2005). On the contrary in the second programming period there was only one call in 2009. The sample of the case study was people who have participated in “Setting up Young Farmers” measure from year 2000 to 2009 from the Prefecture of Thessaloniki. The analysis was made in two parts. The first part includes the analysis of the farm plans and the main technical and economic characteristics of the farmers, according to their business plans submitted with their application, in comparison with the real situation in 2010. This part of analysis

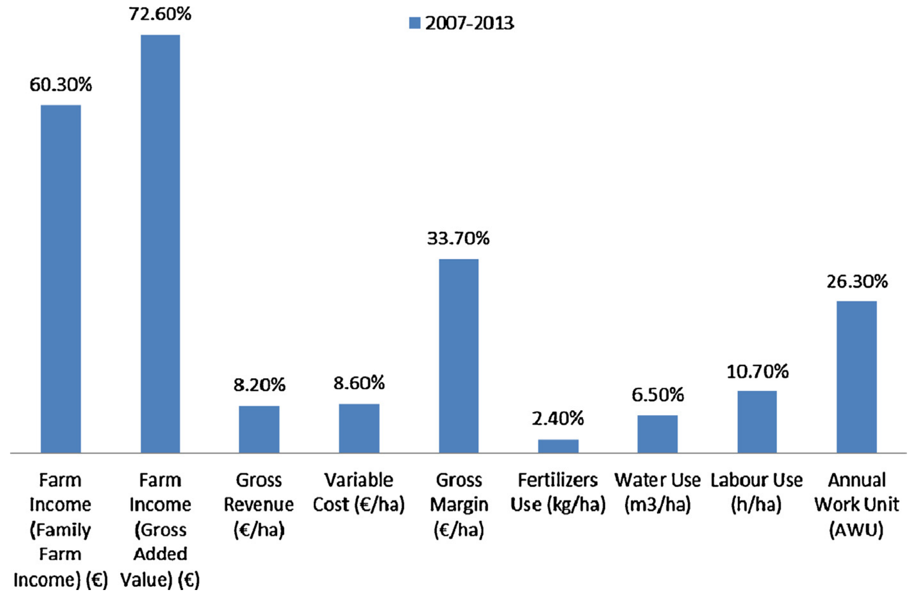

Fig. 2. Economic environmental and social indicators (existent BP 2007–2013 vs real 2010).

was made using simple tools such as descriptive statistics and estimation of the main economic, social and environmental indicators. The second part of the analysis includes the implementation of an MCDA model. The farm plan is optimised for 2007–2013. In continuation we compare the values of the chosen indicators between the farm plans (1) submitted with their application, (2) the real (existent) situation in 2010, and (3) the optimum achieved by the MCDA model.

In the following figure we can see the existent, the future business plan and the real crop plan (2010) of the average farm of the prefecture of Thessaloniki in the second programming period (2007–2013). As we can observe, there is an increase in the young farmers future business plan for the cultivated area of maize which will participate with 23.5% in the future plan when participate with 17.2% in the existent crop plan, for the cultivated area of rice which will participate with 20.9% when participate with 16.9% in the existent crop plan and for the cultivated area of cotton which will participate with 10.1% in the future plan when participate with 2.3% in the existent plan. Moreover, we can also observe that there is a decrease in other cultivations of the existent crop plan. Specifically, the cultivation of soft wheat will decrease from 17.7 to 7.8% in the future plan with 23.3% in the real plan and the cultivation of hard wheat from 33.1 to 31.9% in the future plan with 22.2% in the real plan. In addition, the cultivated area of barley will decrease from 3.1 to 2.9% and the cultivated area of alfalfa will decrease from 1.6 to 1.5% with 2.1% in the real plan. There is also a minor decrease for the cultivated area of sunflower in the future plan. Finally, the cultivation of sugarbeets will be abandoned in the future plan with 4.5% in the real crop plan. Finally, the average farm has set aside 0.3% of the total cultivated area in the real crop plan (Fig. 1).

The next table shows the economic, environmental and social indicators for the existent future and real plan of the average farm of the prefecture of Thessaloniki in the second programming period (2007–2013). As regards the family farm income, we can observe that there is an increase 45.42% from the existent to future plan when the amount of family farm income in real crop plan is 48,536.8 €. Also, the gross added value presents increase 56.57%, the gross margin has increase 21.16% the gross revenue has increase 7.85% and the variable cost increased 12.78% from existent to future business plan. Moreover, the environmental indicator which calculates the fertilizers use presents increase (2.26%) and the indicator which calculates the water use presents increase (27.25%). Finally, the indicator which calculates the labour use presents increase 16.26% and the indicator which calculates the annual work unit increased 32.69% (Table 5).

As regards the family farm income we can observe that in real crop plan (2010) there is an increase 60.3% in comparison to the existent business plan. Also, the gross added value presents increase 72.6% and also the gross margin has increased 33.7%. The environmental indicators show a negative impact as fertilizers use increased 2.4% and water use increased 6.5%. Finally, the indicator which calculates the labour use presents increase 10.7% when the indicator which calculates the annual work unit increased 26.3%. From these results we can conclude that we have positive economic impact from the "Setting Up Young Farmers" measure and as regards the environmental indicators, we can observe that there is a negative environmental impact both in fertilizers and water use which are increased. Finally, we can observe that there is positive social impact due to increase in labour use and increase in annual work unit. The following figure presents the economic, environmental and social impact of "Setting up Young Farmers" to the prefecture of Thessaloniki (Fig. 2).

Results of MCDA model

Finally, the results of the model for the study region, suggest the reduction of three cultivations. We observe that there is a decrease of 13.7% in the cultivated area of maize, 7.9% in the cultivated area of hard wheat, and 4.4% in the cultivated area of cotton. On the contrary, there is an increase of 32.6% in the cultivated area of sunflower, 24% in the area of rice, 16% in the area of sugarbeets, and 99.9% of alfalfa. The participation of set aside in the optimal production plan increases, as compared with the existent production plan, by 199.9% of the total cultivated area of study region (Table 6).

The results show that the real situation in 2010 was very close to the optimum situation achieved by the MCDA model. As presented in Table 7, the Farm family income achieved by the MCDA model is 1.7% higher than the real one. The Gross Added value achieved by the MCDA model is also 1.4% higher than the real one. As regards the other economic indicators, Gross revenue is 2.5% higher, variable cost is 2.9% higher and gross margin is 1.5% higher. As regards the environmental indicators show 2.69% decrease in MCDA plans for the fertilizers use and 8.01% increase for the water use. Finally,

Table 6
Existent and optimum production plan.

	Existent production plan	MCDA model	
		Mod. values	% deviation
GM (€)	40,072	40,691	1.5%
FER (kg)	52,103	50,651	−2.8%
TL (hours)	16,465	17,311	5.1%
Rice	12.11	15.0	24.0%
Hard Wheat	22.16	20.4	−7.9%
Sunflower	2.45	3.2	32.6%
Soft Wheat	23.26	21.0	−9.7%
Maize	17.84	15.4	−13.7%
Sugarbeets	4.49	5.2	16.0%
Cotton	15.29	14.6	−4.4%
Alfalfa	2.09	4.2	99.9%
SA	0.31	0.9	199.9%
Total	100.0	100.0	

Table 7
Economic, environmental and social indicators (real vs optimum plans).

Indicators	Real (2010)	MCDA	Increase/ decrease %
Economic			
Farm income (family farm income) (€)	48,537	49,377	1.7%
Farm income (gross added value) (€)	33,375	33,849	1.4%
Gross revenue (€/ha)	1454	1491	2.5%
Variable cost (€/ha)	1053	1084	2.9%
Gross margin (€/ha)	401	407	1.5%
Environmental			
Fertilisers use (kg/ha)	521	507	−2.69%
Water use (m^3/ha)	3410	3683	8.01%
Social			
Labour use (h/ha)	165	173	5.1%
Annual work unit (AWU)	1.97	2.06	4.5%

social indicators show 5.1% increase in MCDA plan for Labour use and 4.5% increase for the Annual Work Unit (Fig. 3).

Green arrow in Table 8 shows positive impact and red arrow negative impact. From the above table we can conclude that the MCDA model achieved increase in all economic indicators (family farm income, gross added value, gross revenue, variable cost and gross margin). As regards the environmental indicators there is a decrease in fertilisers use and increase in water use. Finally, an

Table 8
Economic, social and environmental impact of "Setting up young farmers" measure (MCDA optimum vs real 2010).

Plan	Economic impact	Environmental impact	Social impact
MCDA	↑	↓ ↑	↑
2007–2013	↑	↓	↑

increase in social indicators such as labour use and annual work unit is presented.

Conclusions

The "Setting up young farmers" measure was implemented in prefecture of Thessaloniki in Greece for two programming periods. The first period was on 2000–2006 and the second on 2007–2013. In this study an assessment of the impacts of the "Setting up young farmers" measure was made by measuring the main economic social and environmental indicators. The selected economic indicators were: farm income, gross revenue, variable costs and gross margin; the environmental indicators were: water use and fertilizers use; and the social indicators were: labour use and annual work units. The analysis was made in two parts. The first part included an analysis of the farm plans and the main technical and economic characteristics of the farmers. This analysis was made according to their business plans which were submitted with their application to the programme, in comparison with the real situation in 2010 only for the second programming period. This analysis was made with the use of simple tools such as descriptive statistics and calculation of the main economic, social and environmental indicators. The second part of the analysis included Multicriteria Decision Analysis. With the use of MCDA the farm plans of the prefecture of Thessaloniki were optimised only for the second programming period. With this methodology we compared the results of the main chosen indicators for the farmers' business plans which were submitted with their application to the programme, with the real situation in 2010 and with the optimum situation according to MCDA.

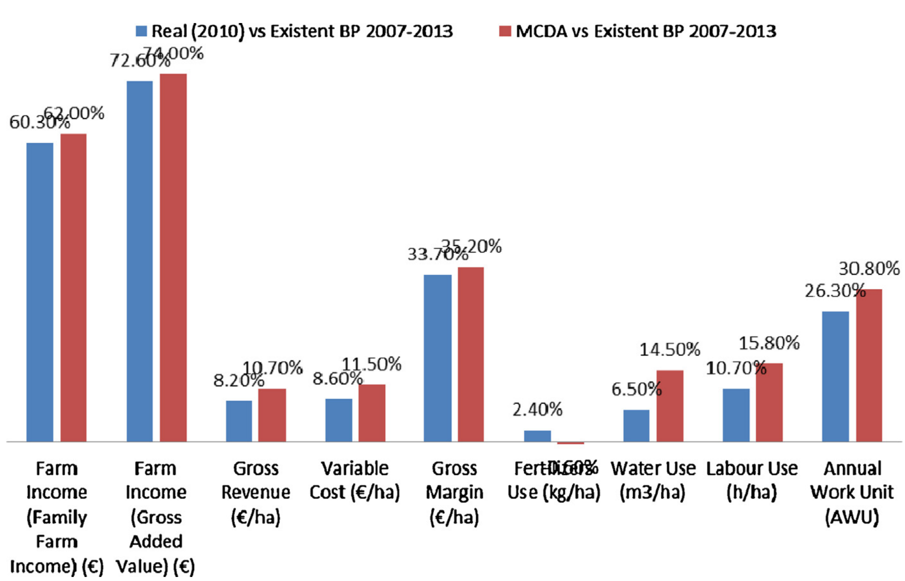

Fig. 3. Economic environmental and social indicators.

As main conclusion we can indicate that the "Setting up young farmers" RDP measure achieved its goals to transfer land to young, trained farmers, to offset the set-up costs faced by young people when establishing themselves in farming and to provide assistance for the investments required on such holdings. As regards the economic impact this measure achieved to increase the farm income of the young farmers. On the other hand the economic impact in the second programming period was higher than the one which was predicted in the farmers' business plans. On the other hand, the environmental impact was negative because of the fertilizers and water use increase. One of the main aims of the Setting up Young Farmers measure was to increase the AWU for the young farmers. From the results we can conclude that this goal was achieved. From the comparison of the results we can conclude that the increase of the AWU is connected with the increase of the farm income as we can see from the results in the prefectures of Thessaloniki in the second programming period. As regards the MCDA model analysis we can indicate that achieved better economic and social results for the young farmers and achieved to reduce fertilizers use in comparison to the results of the second programming period. The study showed that impact assessment of RDP measures is critical in order to sustain effective programmes. Future research in setting up young farmers should focus on the comparison of the implementation of the 'Setting up young farmers' measure between EU countries and in empirical research on the effectiveness of the 'Setting up young farmers' measure in comparison with other RDP or CAP measures that affecting young farmers.

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