



Mediterranean University of Reggio Calabria
Department of AGRARIA

Research Doctorate Agricultural, Food and Forestry Science
XXXII cycle

ASSESSING THE EFFECTIVENESS OF
RURAL DEVELOPMENT POLICIES
IN SOUTHERN ITALY USING
DATA ENVELOPMENT ANALYSIS

Coordinator: Prof. Marco POIANA

Tutor: Prof. Giuseppe ZIMBALATTI

Co-tutor: Dr. Anna Irene DE LUCA

Ph.D. Thesis of:
Claudio DI GIROLAMO

ACADEMIC YEARS 2016/2019

TABLE OF CONTENTS

ABSTRACT	3
RIASSUNTO	5
KEYWORDS	6
1. INTRODUCTION	7
2. RURAL DEVELOPMENT POLICIES UNDER THE COMMON AGRICULTURAL POLICY (CAP)	9
2.1. CAP history and evolution of the “second pillar” for rural development	9
3. THE RURAL DEVELOPMENT POLICY IN ITALY	35
3.1. Introduction	35
3.2. National Regional Development Plan (NRDP).....	35
4. THE FRAMEWORK OF RURAL DEVELOPMENT PROGRAMME (RDP) FUNDING IN CALABRIA	50
4.1. The Rural Development Programme of Calabrian Region for 2014-2020 programming period	50
4.2. Distribution of public funding under the Rural Development Programme of Calabria Region	59
4.3. Measure 4.1.1- Investments in agricultural holdings	64
5. THE ASSESSMENT OF FARM’ EFFICIENCY USING DATA ENVELOPMENT ANALYSIS (DEA)	72
5.1. The DEA-methodology: theoretical background	72
5.2. Basic frontier models’ implementation	75
5.3. State of the art on DEA approaches in agricultural field	77
6. MATERIALS AND METHODS	81
6.1. Experimental design: sampling and data gathering.....	81
6.2. DEA model as applied to the case study	89
6.3. Results and Discussion	89
7. CONCLUSIONS AND FUTURE PERSPECTIVES	97
REFERENCES	99
SITOGRAPHY	103
TABLES INDEX	104
FIGURES INDEX	104

ABSTRACT

The present doctoral thesis aims at analyzing the effectiveness of the Community spending on the European Agricultural Fund for Rural Development (hereinafter EAFRD) by the Calabria region (South Italy) during the current programming period, using the Data Envelopment Analysis (DEA) model. In particular, the research focused on funded investments associated to the measures aimed at restructuring and developing the physical potential and promoting innovation, in order to monitor the effects of the improvement on farm profitability over time and, overall, on regional agricultural sector. After a description of rural development policies under the Common Agricultural Policy (CAP), in order to clarify the reference context of analysis from which the research work has his starting point, a focused analysis of rural development policy in Italy is provided. Therefore, a deepening of the state of the art on Italian Rural Development Programs (RDPs) for the period 2014-2020, especially in terms of financial allocation and progress of budget is carried out, as well as an analysis of the RDP in Calabria Region with a focus on the implementation of Measure 4.1.1 Investments in agricultural holdings. In order to analyse the performance of this specific context of public funding, in terms of investment granted and realized by beneficiary farms, the theoretical and methodological aspects of Data Envelopment Analysis (DEA) were exposed and extensively scrutinized. DEA is a non-parametric linear-programming-based method that, actually, represents the most widely used procedure in estimating the technical efficiency of decision-making units (DMUs), which convert multiple inputs into multiple outputs. Technical efficiency consists in the ability of a DMU to maximize outputs given the same level of inputs and technology or to minimize inputs given a same level of outputs. In this sense, technical efficiency analysis can be oriented towards two different way: increasing output (output-oriented approach) or reducing input (input-oriented approach). DEA allows the construction of a “best practice” frontier on which the efficient DMUs are located and that are used to measure the relative efficiency of remaining inefficient units in terms of their distance from the frontier. From the literature review carried out in this doctoral thesis, it was highlighted as several studies in olive sector dealing with the computation of technical efficiency by employed DEA models that were used to examine the economic efficiency of olive-growing farms and provide information for a better assignment of European agricultural subsidies. Frequently, the results showed that the assignment of subsidies

should be made in terms of farm efficiency results since the efficiency of farms would be under-estimated by an overall measurement. Moreover, the major of results indicated that efficiency is positively related to the size of the farm and, then, large farms are more likely to improve their techniques, and that the inefficiency is caused by the fact that the farms do not use minimum input or do not raise the maximum output from the actual inputs. For the case study of the thesis, the application of DEA model, on 50 olive farms data benefit from RDP funding, is conducted by explained the experimental design, the sampling and data gathering, as well as data elaboration and results. The objective was to analyses the technical efficiency and scale efficiency of beneficiary farms in using public funding provided under the Measure 4.1.1 Investments in agricultural holdings. The evaluation of farm performances was carried out by comparing it with the best managerial practices observed on a Pareto-efficient frontier and, then, by applying input and output oriented DEA models. The choice to use both models was due to the interest in determining the returns to scale of the farms under study and estimating their scale efficiency. In particular, the input-oriented approach help to explain the major ability of producers to control inputs rather than output levels, while output-oriented approach is especially linked to the objective of rural policies in increasing farming productivity, in terms of economic results in gross saleable production. The outcomes highlighted the most relevant potentiality, advantages and limits offered by the research work and methodological implementation proposed.

RIASSUNTO

La presente tesi di dottorato mira ad analizzare l'efficacia della spesa comunitaria per il Fondo europeo agricolo per lo sviluppo rurale (di seguito FEASR) da parte della regione Calabria (Sud Italia) durante l'attuale periodo di programmazione, utilizzando il modello Data Envelopment Analysis (DEA). In particolare, la ricerca si è concentrata su investimenti finanziati associati alle misure volte a ristrutturare e sviluppare il potenziale fisico e promuovere l'innovazione, al fine di monitorare gli effetti del miglioramento sulla redditività delle aziende agricole nel tempo e, nel complesso, sul settore agricolo regionale. Dopo una descrizione delle politiche di sviluppo rurale nell'ambito della politica agricola comune (PAC), al fine di chiarire il contesto di riferimento dell'analisi da cui il lavoro di ricerca ha il suo punto di partenza, viene fornita un'analisi mirata della politica di sviluppo rurale in Italia. Pertanto, viene effettuato un approfondimento dello stato dell'arte dei programmi di sviluppo rurale (PSR) italiani per il periodo 2014-2020, in particolare in termini di dotazione e avanzamento finanziario, nonché un'analisi del PSR nella regione Calabria con particolare attenzione all'attuazione della misura 4.1.1. Investimenti nelle aziende agricole. Al fine di analizzare le prestazioni di questo specifico contesto di finanziamento pubblico, in termini di investimenti concessi ad aziende agricole beneficiarie, gli aspetti teorici e metodologici del modello Data Envelopment Analysis (DEA) sono stati esposti e ampiamente esaminati. DEA è un metodo non parametrico basato sulla programmazione lineare che, in realtà, rappresenta la procedura più ampiamente utilizzata per stimare l'efficienza tecnica delle unità decisionali (DMU), che convertono più input in più output. L'efficienza tecnica consiste nella capacità di una DMU di massimizzare gli output con lo stesso livello di input e tecnologia o di minimizzare gli input con lo stesso livello di output. In questo senso, l'analisi dell'efficienza tecnica può essere orientata verso due metodi diversi: aumentare la produzione (output-oriented approach) o ridurre l'input (input-oriented approach). La DEA consente la costruzione di una frontiera delle "best practice" su cui si trovano le DMU efficienti e che sono utilizzate per misurare l'efficienza relativa delle unità inefficienti rimanenti in termini di distanza dalla frontiera. Dalla revisione della letteratura condotta in questa tesi di dottorato, è stato messo in evidenza come diversi studi nel settore olivicolo si occupano del calcolo dell'efficienza tecnica da parte dei modelli DEA impiegati e che sono stati utilizzati per esaminare l'efficienza economica

delle aziende olivicole e fornire informazioni per una migliore assegnazione di finanziamenti agricoli europei. Spesso, i risultati hanno mostrato che l'assegnazione dei finanziamenti dovrebbe essere fatta in termini di risultati di efficienza delle aziende agricole poiché l'efficienza delle aziende agricole sarebbe sottovalutata da una misurazione complessiva. Inoltre, la maggior parte dei risultati hanno indicato che l'efficienza è correlata positivamente alle dimensioni dell'azienda agricola e, quindi, le grandi aziende agricole hanno maggiori probabilità di migliorare le loro tecniche e che l'inefficienza è causata dal fatto che le aziende agricole non utilizzano un minimo livello di input o non ottengono il massimo livello di output. Per il caso di studio della tesi, l'applicazione del modello DEA, è stata effettuata su 50 DMU relative alle aziende olivicole beneficiarie del finanziamento del PSR, ed è condotta spiegando la progettazione sperimentale, il campionamento e la raccolta dei dati, nonché l'elaborazione e i risultati dei dati. L'obiettivo è analizzare l'efficienza tecnica e ridimensionare l'efficienza delle aziende agricole beneficiarie nell'utilizzare i finanziamenti pubblici previsti dalla misura 4.1.1 Investimenti nelle aziende agricole. La valutazione delle prestazioni dell'azienda agricola è stata effettuata confrontandola con le migliori pratiche manageriali osservate su una frontiera Pareto-efficiente e, quindi, applicando modelli DEA orientati all'input e all'output. La scelta di utilizzare entrambi i modelli è dovuta all'interesse nel determinare i ritorni di scala delle aziende agricole analizzate e stimarne l'efficienza. In particolare, l'approccio orientato all'input aiuta a spiegare la maggiore capacità dei produttori di controllare gli input piuttosto che i livelli di output, mentre l'approccio orientato all'output è in particolare legato all'obiettivo delle politiche rurali di aumentare la produttività agricola, in termini di risultati economici in produzione lorda vendibile. I risultati hanno messo in luce le potenzialità, i vantaggi e i limiti più rilevanti offerti dal lavoro di ricerca e dall'implementazione metodologica proposta.

KEYWORDS

Common Agricultural Policy, Rural Development Programs, olive farms, Calabria Region, Data Envelopment Analysis (DEA).

1. INTRODUCTION

The present doctoral thesis aims to analyze the Rural Development Policy implemented in Calabria Region in terms of farms efficiency using Data Envelopment Analysis (DEA) in order to provide a useful tool for the monitoring of the public expenditure not only in financial terms but also in terms of quality of the expense. In particular, it is analyzed the ability of regional administration to address financial resources of European Agricultural Fund for Rural Development (EAFRD), to support farms' investments finalized to increase added value of agro-food chains. The research work was focused on the analysis of the material investments for restructuring and developing physical capital and promoting innovation in Calabria farms, in order to monitor the effects on the improvement of profitability over time and, overall, of the regional agricultural system.

The thesis is articulated into seven chapters, including the introduction; the second chapter deepens the European rural development policies from the years 1957 to today, starting from the evolution of agricultural policies by retracing the main historical steps and ending with a technical focus on the last two community programs period 2007/2013 and 2014/2020. Finally, the chapter makes a comparison between the political choices made by the 28 Member States in terms of the overall financial endowment of the programs and for measures, in order to highlight also priority diversities between states.

The third chapter is dedicated to state of the art of the rural development policy in Italy in the current community programme period, with a focus of the state of the art at regional level, both in terms of overall financial endowment and in terms of financial allocation by measure in the different Italian regions, always with the aim of highlighting the different characteristics between the territories.

The fourth chapter is dedicated to rural development policies implemented in the Calabria Region starting from a financial comparison of the last two programming dates 2007/2013 and 2014/2020 and ending with an analysis of the current programming.

The fifth chapter is devoted to the scientific methodology applied, with particular reference to the choice of the DEA input/output oriented methodology and providing a brief literature review on DEA application in agro-food sector.

The sixth chapter is dedicated to the case study, both to the method of collecting the reference data and their statistical commentary, and to the processing of the data with

the reference scientific methodology. In particular, within the measure 4.1.1 - Investments in agricultural holdings (art. 17 Reg. EU 1305/2013) pursuant to PSR Calabria 2014/2020, data on farms' investments were gathered through database provided by the Agency of the Calabria Region for Agricultural Provisions (ARCEA) within National Agricultural Information System (SIAN). Data collected are based on the declarations of beneficiaries for funding applications by means of business plan arrangement. Data were used in order to analyse the performance of public funding by comparing the farms' situation ex-ante and ex-post investment. Starting from a population of 429 beneficiaries for the entire measure 4.1.1 applied in Calabrian territory, the case study focused on the olive sector, due to his high significance level in regional area, for which a preliminary sample of 102 farms was selected, representing in economic terms 14.68% of the total budget foreseen by the funding announcement. A further selection was necessary in order to obtain a homogeneous population of data and in order to avoid that other production chains, present in the multi-functional farms, could have a negative impact on the economic results.

The seventh chapter is dedicated to the description of results obtained and their discussion, while the last chapter provide reflections in terms of conclusion and future perspectives.

2. RURAL DEVELOPMENT POLICIES UNDER THE COMMON AGRICULTURAL POLICY (CAP)

2.1. CAP history and evolution of the “second pillar” for rural development

The history of the Common Agricultural Policy (CAP) begins with the policies implemented since the mid-twentieth century (Frascarelli, 2017). The fundamental objective of European countries, in those years, was focused on satisfying food needs due to the precarious political situation linked to the exit from the Second World War and to workforce preferences, in monetary terms, for the industrial sector and services rather than agriculture.

It is for this reason that in 1957, with the Treaties of Rome, that instituted the European Economic Community (EEC), six European countries¹ chose to set an economic rather than a political objective with regards to the agricultural sector based on quantitative results.

In the article 38 of the EEC, the field of action of the CAP is clearly defined; specifying that “the common market includes agriculture and trade in agricultural products” and that the functioning and development “must be accompanied by the establishment of a common agricultural policy of the Member States”.

The objectives set forth in Article 39 of the EEC, which were carried over in their entirety in the subsequent Treaty on the Functioning of the European Union (TFEU), were: to increase agricultural productivity by focusing on technical progress thereby ensuring the rational development of agricultural production, as well as the improvement of production factors in particular labour. Thus, ensuring a fair standard of living for the farming community, thanks in particular to the increase in individual income of those working in agriculture. Additionally, to stabilize the markets; guarantee the security of supplies, and to ensure reasonable prices for deliveries to consumers.

All while taking into consideration the particular nature of the subjective agricultural activity of each agricultural region. Recognizing the need to gradually make the appropriate adjustments, and above all that the agricultural sector represents a sector intimately connected to the whole economy in each Member State of the Community.

To achieve these objectives, three years after the signing of the Treaty, the CAP based its interventions on the internal and external markets of the Common Market Organizations (CMOs), through internal market interventions regarding price support

¹ The so-called inner six: Italy, France, Germany West, Belgium, Netherlands e Luxembourg.

and refunds of import and export levies for the external market. Herein, the guidelines for intervention in the agricultural sector were represented by:

- 1) The singularity of the markets for each product; to be achieved progressively through the reconciliation of national prices and the simultaneous elimination of any tariff and non-tariff obstacles to intra-community trade;
- 2) The community preference; such that the competitiveness of community producers is not threatened by imports from third countries;
- 3) The financial solidarity, guaranteed by the European Agricultural Guidance and Guarantee Fund (EAGGF); already provided for in Article 40 of the Treaty, but established, subsequently, in 1962 with Regulation n. 25, concerning the financing of the CAP.

The positive effects of this policy were rapid. In a decade, production increased, as expected, and life in rural areas improved, on the other hand there were the negative effects due to the excessive exploitation of natural resources with negatively important consequences on the environment (among all, excess of livestock waste and water pollution) and the incentive of intensive rural areas to the detriment of the extensive ones.

From the outset it is clear that the CAP assigned a priority role to the policy of agricultural markets and prices, turning a great deal of attention to sectoral and corporate matters. Indeed, although the need to set up a specific policy for the structures was set out in the EEC, it will take some time before such interventions will be recognized as having a significant position within European agriculture policies.

In 1960, the Mansholt Plan specified the main lines of action, having been drawn up at the Stresa Conference a few years earlier, in which the overwhelming interest in price and market policy is evident, rather than towards structural policy, justified also by urgencies related to the historical-political context of the time.

With the establishment in 1962 of the EAGGF, referred to above, there was the intent to create a single fund for the financing of all the initiatives envisioned by the CAP; it is subdivided into the Guarantee section, for financing and support of prices and agricultural markets, and in the Guidance section, for structural interventions (Official Journal No. 030 of 04/20/1962).

In the seventies, the negative effects of agricultural policies overcame the positive effects, as the excessive push to produce by farmers, due above all to the intervention

price to support domestic markets, led to imbalances within the Community between both products and regions (De Stefano, 1985).

In the macroeconomic context, this situation led to international trade tensions in the subsequent decade due to incompatibility with the objectives of progressive trade liberalization as well as a heavy burden on the community budget, which was affected by the CAP for about 70% of its financial resources. This led to the first production restrictions (for example, in 1984 milk quotas were introduced) and the price interventions were guaranteed only for a certain amount of production.

Subsequently, the guarantee limits were introduced, quotas for other agricultural sectors besides milk as well as financial stabilizers, for the reduction of prices in subsequent years as a “sanction” with respect to production surplus, thereby introducing the principle of co-responsibility of the farmers.

The CAP represented the largest source of expenditure of the Community budget, as well as the first and main instrument over the years for the promotion of the European integration process (Gulisano, 1995a).

In 1964, with the approval by the European Council of Regulation n. 17 of the Council of February 5th, concerning the conditions of the competition of the EAGGF (Official Journal No. 034 of 02.27.1964) the first initiative, valid until 1972, of an autonomous nature was realized regarding the price policies, in favor of the European structural policy. In fact, this regulation was aimed at modernizing farms and processing plants (Fanfani, 1990). In particular, the regulation provided for contributions equal to 25% of the quota required by the individual projects that had to be presented directly to the European Community with the agreement of the Member States concerned.

Initially, therefore, the structural policies were conceived as interventions of a punctual type, financed on the basis of spontaneous requests and not falling within the ambit of defined programs, or as funding for individual projects, qualified as “public projects, semi-public and private”, totally or partially destined for the improvement of agricultural structures (Gulisano, 1995b).

In 1972, subsequently to the Mansholt Plan, which approves what was stated in the Memorandum on the agriculture reform of 1969 with a structural policy imprint, the negative effects induced by the policy adopted were acknowledged and the need to give structural policy a more incisive character in the actions of modernization of the agricultural plants and improvement of the living conditions of the operators of the

sector was supported. To these negative effects was added the unresolved problem of farmers' income, always much lower than that of those employed in non-agricultural sectors. From this, the insertion in the Memorandum of some proposals that exhorted the modernization of the agricultural sector through its adaptation to the organization and the industrial type production, through the qualification of manpower and the removal of that in excess, the increase in company size, the reduction of cultivated areas, as well as of farm specialization and concentration (Dono, 1999).

In order to achieve the objectives described above, in 1972 the Directives n. 159, n. 160 and n. 161 were approved, respectively, for “the modernization of agricultural holdings with the aim of closing the existing the gap on agricultural income compared to non-agricultural sectors”, “the encouraging the abandonment of agricultural activity through early retirement and land transfer”, and “the socio-economic information, and professional qualification with the creation of training centers for farmers”.

Unfortunately, these same directives did not produce the expected effects (Fanfani, 1990) due to the excessive uniformity of the application of the directives in all the areas of the Community, which led to an increase in the disparities between territories, and to the limited financial resources available (5% compared to the guarantee section of the EAGGF).

Finally, there were also institutional problems that some countries have had to face in order to make the planned measures operational. With reference to this last factor, the case of Italy is emblematic, which, despite the evident interest and the urgency and necessity of applying these measures, has implemented the directives with delay, and has also undergone a real block of the system due to the transfer, in 1972, of competences in agriculture to the Regions (Gulisano, 1995a).

In 1975, with the intention of the Community to compensate for the disparities between the territories, previously reported as the main cause of the failure of the Guidelines in favor of the structural policies of 1972, the Directive n. 268 “On mountain agriculture and certain disadvantaged areas” was issued.

Compared to the previous directives that had promoted modernization of the farm, however, removed from the territorial, economic and social context of the area to which it belongs, the new directive was aimed at analyzing the specific features of the territory, introducing for the first time the idea of a “disadvantaged area”. This last term is understood as a territory in which, for the promotion of agricultural development, it is

necessary to take into account limiting factors, e.g.: the scarce supply of resources, disadvantages due to altitude, slope, scarce fertility of the soil, as well as to a low productivity in general (Fanfani, 1990).

In the same year, the European Fund for Regional Development (EFRD) was established which had, through actions of regional interest, had, and still has, the purpose, of reducing the socio-economic gap between European territories (Council Regulation No. 724, of March 18, 1975, establishing a European Regional Development Fund Official Journal L 73 of 21.3.1975).

In 1985, the European Commission, in the Green Book on “Perspectives of Community Agricultural Policy” (EEC Commission, 1985) proposed a new strategy based on structural actions, linked to precise regional and territorial planning. In addition, the document, in its final part entitled “Agriculture in society”, indicates the road to rural development, later legitimized as the second pillar of the CAP, considering new and important issues that had been overlooked until then (such as the role of agricultural activity in socio-economic context of rural areas, the importance of the territory, the environment and services). The Green Book and the subsequent 1988 document on “The Future of the Rural World” (EEC Commission, 1988) redefined European agricultural structural policy and suggested a new look, mainly due to a reduction in price and market policy (De Luca and Gulisano, 2009).

In fact, the intentions of the Mansholt Plan were aimed at identifying a development policy in a global and inter-sectoral sense but, on the other hand, they did not specify the role of regional institutions and how the tools and methodologies of intervention had to be interpreted at the local level (Fanfani, 1990).

The excessive expenses borne by the Guarantee section of the EAGGF worsened more and more with the enlargement of the EEC which in 1973 saw the entry of Great Britain, Ireland, and Denmark, in 1981 of Greece and in 1985 of Spain and Portugal making it necessary to reform the CAP.

In 1985, with Regulation n. 797 of the Council of March 12th, concerning the improvement of the efficiency of agricultural structures (Official Journal no. L 093 of 30/03/1985), the three Directives of 1972 are replaced. Interventions aimed at the “Improvement of the efficiency of agricultural structures” were been identified, through an extension of the types of farms admitted to financing (especially the farms with the lowest income) and a simplification of procedures through the direct application by the

Member States, with wide margins of adaptability to local realities. In particular, article 19 of the same regulation, provided for specific regional rules that constituted an important novelty as they re-evaluated the role of local autonomies in the planning of interventions aimed at overcoming structural and infrastructural disadvantages at the regional level. Furthermore, there were measures in favor of protecting the environment, through the adoption of eco-compatible farming practices and the possibility of funding for farmers who refrained from intensifying production in ecologically sensitive areas. Actually, the important innovations foreseen by the regulation have not had equally important results on the economic resources designated for structural policies which instead of doubling, as in the intended by the Commission, have increased by only 30%, thus remaining completely inadequate to the real needs of the rural European territories (Dono, 1999).

Also in 1985, with the enactment of Regulation n. 2088 of the Council of 23 July 1985 relating to the Integrated Mediterranean Programs (IMPs) (Official Journal No. L 197 of 07/27/1985), attention was paid to the most disadvantaged areas of the Mediterranean area (France, Italy, Greece) which have represented at European level the first example of structural, integrated and territorial intervention (Fanfani, 1990).

The ideological novelty on which this instrument is based consisted of considering forms of support and development of agriculture integrated with the activities connected to it, as well as industrial sectors, crafts, services, tourism and, natural resources. As Fanfani (1990) points out, “the Integrated Mediterranean Programs represent [...] the first global European project of structural intervention at territorial level, which simultaneously acts on all economic sectors susceptible to development at the local level”.

The aim was to delineate in this way a territorial planning, at regional and sub-regional level, which exceeded the logic of sectoral interventions in agriculture and which made more use of the financial involvement not only of the EAGGF Guidance, but also of the others European Structural Funds, such as the European Social Fund (ESF), the ERDF and contributions from the European Investment Bank (EIB). Still, with regards to the IMPs, it seems important to highlight how and why the application of these programs in Italy has had many difficulties (De Luca and Gulisano, 2009).

Ultimately, the delays that occurred in the Italian implementation of the IMPs led, at the end of 1991, to a total of only 42% of approved appropriations, compared to 70% in France and 81% in Greece (Dono, 1999).

Between 1987 and 1989, the Regulations n. 1760/87, n. 1094/88, n. 1096/88, n. 768/89, concerning “agricultural structures and the adaptation of agriculture to the market situation, as well as rural area maintenance” encouraged the conversion of surplus agricultural production toward non-agricultural sectors, the reduction of the crops experiencing excessive production and supporting some disadvantaged areas, in order to maintain social balances and protect the environment. It introduced the practice of the setting aside of arable land thereby excluding it from production with a practice better known as ‘set-aside’ and “the encouragement of early cessation of agricultural activity” known also as early retirement. In addition, these Regulations provided for “the integration of income for particular types of entrepreneurs with difficulty adapting to new quantitative control measures and the redirection of production”.

These Regulations, on the one hand, represented a laudable attempt to create a functional link between structural interventions and the problems facing agricultural markets; on the other hand, they were totally lacking in originality and above all they did not follow a common strategy; in fact “the various measures give the impression of following the method of subsequent adaptations and therefore not organic nor functional for long-term planning [...] cannot yet be considered as real structural measures but, as in the case of the ‘set-aside’ practice, they should rather be traced back to forms of income support or social safety nets aimed at making a transition phase less drastic” (Gulisano, 1995).

The 80s’, among other things, were affected by various political events that required further changes to the CAP. They saw the start of the Uruguay Round (1986) within the General Agreement on Tariffs and Trade (GATT), the fall of the Berlin Wall (1989), the creation of the Single European Act (SEA) on the free market and laid the groundwork for the establishment of the World Trade Organization (WTO).

With the signing of the Single European Act (SEA) in February of 1986 (Official Journal no. L 169 of 29 June 1987), the first major revision of the 1957 Treaty of Rome was realized. The Act set an objective of establishing a single market in the European Community by December 31st, 1992 and codified European Political Cooperation, the forerunner of the European Union’s Common Foreign and Security Policy. With this,

two important lines of action of the European Union are given: the reform of the Structural Funds, and the rural development policy. Moreover, the affirmation of the principle of economic and social cohesion recognized by the SEA itself is of fundamental importance to a real Community policy that in 1994 will see the establishment of a special financing instrument, complementary to the other structural funds.

Regarding the policy of rural development, the Commission identified particularly problematic areas within its territory. The first concerns the rural areas close to the large urban agglomerations and the main communication routes, characterized by conflicts in land use, land degradation, and maintenance of ecological balances for which, the actions to be taken must be aimed at land protection, the environment and the restructuring of rural spaces. The second concerns traditionally agricultural areas characterized by small-sized farms and low agricultural incomes, with problems of population exodus, especially regarding young people, for which the actions to be undertaken concerned the development of alternative and economically profitable activities even outside the sector agriculture and to focus on actions regarding niche productions and environmental protection actions. The third concerned rural areas characterized by the phenomenon of “marginalization” present in areas that are difficult to reach, which leads to problems of depopulation.

The greatest difficulties are connected to the accentuated lack of infrastructures that does not allow the diversification of productive activities, so that the community intervention must be aimed at maintaining that existing minimum of rural production, as a guarantee to avoid serious phenomena of environmental degradation, through actions concerning the strengthening of direct income support, the promotion of extensive production methods functional to obtaining quality products, the promotion of interventions in the forestry sector and in the creation of the conditions for development of tourism through the territories (Gulisano, 1995a).

On June 24th 1988, Regulation n. 2052 of the Council was introduced concerning the missions of the Structural Funds, their effectiveness and the coordination of their interventions and those of the European Investment Bank and the other existing financial instruments (Official Journal No. L 185 of 07/15/1988). Four fundamental principles are set for the implementation of structural measures. The “concentration” of the interventions at a territorial level provided for promotion of development and

structural adjustment in the regions which had experienced delay; the conversion of regions seriously affected by industrial decline; the facilitation of actions geared toward the adaptation of workers to industrial change to fight long-term unemployment and the evolution of production systems; the adaptation of production structures in agriculture and forestry to further the development of rural areas.

The “concertation” being understood as a partnership between the European Commission and the national and regional administrations in the planning phases (preparation, financing, surveillance, and evaluation). These were “complementary” with respect to strategies and initiatives implemented at local, national and regional levels and the “better management of the funds”, with the doubling of the ERDF, ESF and EAGGF-Guidance appropriations.

From this moment on, we are witnessing a clear superseding of the logic behind the funding of individual projects, moving on to an approach based on integrated multi-year programs.

The 90’ years represented the beginning of a true re-styling of the CAP with the drafting of the 1992 MacSharry Reform, but the attention of government institutions was still focused on preserving agricultural incomes. The innovations that led to this reform provided for economic compensation, with respect to the reduction of price intervention. This was no longer linked to the quantities produced but rather to the maintenance of the cultivated area and the heads of cattle raised with the obligation of leaving a part of the agricultural land that constituted the farm untouched or reserved (so-called ‘set-aside’). The accompanying measures (so-called because they were added to the reform of some CMOs) focused on the use of natural resources, the respect for the environment (Reg. CEE n. 2078/92), and on the interest in local specialties or the denominations of origin (Reg. CEE n. 2081/92 relating to Protected Denominations of Origin (PDOs) and Protected Geographical Indications (PGIs) and n. 2082/92 relating to “Specific Attestations”) and to organic production foods (Reg. CEE n. 2092/91). Additionally, a Community aid scheme was added for forestry measures in the agricultural sector (Reg. CEE n. 2080/92), and finally, for early retirement in agriculture (Reg. CEE n. 2079/92).

The attention of the provision toward the problems of regional development is highlighted by the considerable increase in funding. Funding went from just over 8 billion European currency units (ecus) at the end of the eighties to over 20 billion ecus

in 1999; the overall financing of the Structural Funds for the period 1994-1999 exceeds 141 billion ecus, concentrated largely (over 68%) in the regions included in Objective 1 (Gulisano, 1995).

Still, another weak point was the lack of attention that the Regions had shown towards the intermediate evaluation and monitoring phases of the programs, essential in providing information on the progress made in pursuing the objectives and in providing indications on any modifications to be made.

It should be emphasized that the so-called “Community Initiative Programs” are launched by the European Community within the 1989-1993 programming period. Within these programs was the LEADER program (Liaisons Entre Actions de Développement de l'Économie Rurale - Link between Actions for the Development of the Rural Economy) which operates in favor of European rural areas, proposing a development method that assists, encourages and encourages the active participation of local operators in the future of their territory.

At the end of the '90s, following the eastward expansion of the markets and the significant weight of the CAP on the entire Community Budget, a change was strictly necessary. Moreover, this change happened in light of the World Trade Organization (WTO) negotiations. These changes were in part thanks to the issuing of the “Agenda 2000” Reform. This new Reform, on the one hand, retraced the steps already outlined with the previous policy, and on the other hand, introduced very important innovations. First of all, it introduced the Rural Development Policy as a specific CAP budget which has been subdivided into the 1st and 2nd pillars we know today (EAGF and EAFRD funds).

With specific reference to rural development, Regulation n. 1257/99 on “Support for rural development by the EAGGF” establishes four fundamental principles for rural development. These include:

The multifunctionality in agriculture such as its multi-purpose role beyond the simple production of foodstuffs and implies the recognition and incentive of the range of services offered by farmers;

Multisectoral and integrated set-up of the rural economy in order to diversify activities, create new sources of income and employment, and protect the rural heritage;

The flexibility of aid for rural development, based on subsidiarity and in favor of decentralization, consultation at regional and local levels and partnerships;

Transparency in the development and management of programs, starting from a simplified and more accessible regulations.

These principles are necessary to achieve the three objectives of the program: strengthening the agricultural and forestry sector; improving the competitiveness of rural areas; environmental protection and rural heritage.

To achieve the three objectives set out above, seven intervention measures have been established: Investments in agricultural holdings; Human resources; Less favored areas and areas with environmental constraints; Agro-environmental measures; Processing and marketing of agricultural products; Forestry; Various measures for the development of rural areas as a whole.

However, it cannot be denied that Agenda 2000, albeit with great limitations, laid the foundations for transforming rural development policies into what is now defined as the true “second pillar of the CAP”, through the progressive balance between structural expenditure and agricultural expenditure and the unification of rural development measures in a single legal framework (De Filippis and Storti, 2001).

The trend of the CAP was that from now on the second pillar would increasingly take on the role of a policy for the development of rural areas, with multi-year planning. This was done by focusing on three support axes: the structural modernization of agriculture (competitiveness), the production of public goods and environmental externalities (sustainability), the diversification of the economy of rural areas (diversification), to which was later added the fourth axis dedicated to LEADER programming.

The introduction of the principle of Multifunctionality of the Agenda 2000 Reform within the Rural Development Policy was fundamentally important. The absolute aim of this principle was the enhancement of rural territories both through interventions dedicated to the recovery of rural buildings for tourism purposes (farm holidays, educational farms) and the valorization of direct sales (Henke, 2004). The farmer was considered a producer of both private goods for the market and public goods and services.

All forms of direct payments guaranteed by the CAP - from those of the first pillar to allowances for disadvantaged areas, to agro-environmental payments - were based on the principle of compensation for lost income. In the case of first pillar payments, they represent compensation for the loss of price-guaranteed support. In the case of agro-environmental payments, they serve as reimbursement for the higher production costs

and in the case of compensatory allowances, they compensate for the loss of income due to the difficulties of company management in disadvantaged areas. In 2003, Commissioner Franz Fischler proposed a substantial reform of the CAP linked to the need to better justify the public expenditures in the agricultural sector. The main issues were the support the income of farmers and to give added value in terms of quality food, environmental protection, and animal welfare, preservation of landscapes and cultural heritage, and finally, in terms of greater balance and social justice (Frascarelli, 2017).

One of the innovations introduced by this Reform with regard to the financing of rural development was the directive on the so-called “modulation”, or the transfer of a 5% share of the resources provided for the Single Payment Scheme (SPS). In practical terms, based on the provisions of the Fishler Reform, each company receives an annual payment equal to the average of the direct payments it received in the reference period (arable crops and meats 2000-2002), regardless of what it produces, as long as the areas used every year to assert the rights to the SPS are not intended for the production of fruit and vegetables and permanent crops, or are left uncultivated (in this case provided that the surfaces are kept in good agricultural conditions). After the June 2003 Reform, direct payments for olive oil, tobacco, cotton, sugar and some of the banana payments were also decoupled and included in the SPS. The land used to produce these products became eligible to claim the rights to the SPS (Anania, 2007).

Member States were given the opportunity to choose to distribute aid through the application of averages on the historical production values of individual farms (as was the case in Italy) or to determine at regional levels (so-called regionalization) equal amounts for everyone. In this way, support is shifted from products to producers, in order to remove market distortions, caused by the old political approach, and to protect the income of farmers who become free to move towards the needs of consumers and the market (Frascarelli, 2017).

Decoupling has offered advantages (better orientation of agriculture to the market, income stabilization, remuneration based on environmental obligations) and disadvantages (land rent, support for historical producers, undifferentiated support). It was analyzed in-depth by several agricultural economists (Moro and Sckokai, 2013; Bartolini and Viaggi, 2013; De Filippis et al., 2003).

For Italian agriculture, the effects of decoupling were significant (Frascarelli, 2005). In 2007, The Common Organization of the Markets (CMO) laid the framework for the

market measures provided for under the CAP. Following a series of reforms, 21 separate CMOs were codified in 2007 into a single CMO, covering all agricultural products. Reforms to the CAP have also made the policy progressively more market-oriented and scaled-down the role of intervention tools, which are now regarded as safety nets to be used only in the event of a crisis. Cereal crops (maize, durum wheat) as well as industrial crops (oil, tobacco and) that benefited from high coupled support in the previous CAP, have seen a considerable decrease in the land dedicated to them. Even the durum wheat crops decreased by 700,000 hectares from 2005 to 2007. The cereal crops that had a low coupled support (soft wheat, barley, minor cereals) kept the farmland invested. The reform of the CMO particularly with regards to beet, tomato and citrus fruit from industrial farming, has led to a sharp decrease in their relative productions, with consequent supply difficulties for the respective processing industries. Another fundamental principle of the Fischler Reform was the introduction of the conditions which require the payment of the union premiums with the respect to the Obligatory Management Criteria (OMC) and the Good Agronomic and Environmental Conditions (GAEC) of the farm. These last refer to a set of European Union (EU) standards (described in Annex III of Council Regulation (EC) No 73/2009) defined at the national or regional level, aiming at more sustainable agriculture. This principle has created some confusion in its application in the demarcation of aid between Pillar I and II. Requiring specification that the measures in favor of the agricultural land or animals provided for under the Second Pillar respect additional commitments and obligations with respect to the so-called baseline which is represented by the conditions.

Within the “new” Rural Development Policy (RDP), two separate universes are identified. One focused on structural interventions such as NON-IACS measures or those not subject to the Integrated Administration and Control Systems (IACS) established by Regulation (EC) n. 1290/2005. The other, which focused on IACS measures interventions on agricultural land and animals was considered by some authors as the territorial approach of the CAP.

The increasingly stringent requirements regarding quality, environment, and animal welfare forced farmers to make major structural adjustments and withstand strong production constraints (e.g. the Nitrates Directive and the obligation of buffer strips along watercourses) (Frascarelli, 2017).

Regarding RDP, the reference legislation is represented by Regulation (EC) n. 1698/2005 of the Council, of September 20, 2005. More precisely, it regulated the support for rural development by the European Agricultural Fund for Rural Development (EAFRD), subsequently modified with Regulation (EC) n. 65/2011 of the Commission of 27 January 2011, for the 2007/2013 program. Thus, setting the objectives listed below, grouping the measures (38) into priority axes (4), and considering the technical assistance measure for the program's regional rural development.

The first axis of the RDP 2007/2013 had the objective of increasing the competitiveness of the agricultural and forestry sectors by supporting restructuring, development, and innovation. In order to achieve this result, the community programming made 13 structural measures (NOT IACS) available to the Member States. These were divided into three macro-areas. The first concerning the promotion of knowledge and the development of human potential. The second concerning restructuring and development of physical capital with the promotion of innovation. Finally, the improvement of the quality of production and agricultural products.

The measures designed with the aim of strengthening human capital were aimed, specifically, at training and information actions. These included the dissemination of scientific knowledge and innovative practices, aimed at workers in the agricultural, food and forestry sectors (Mes. 111). With this measure confirmed, as in previous regulations, it was necessary to raise the cultural level of agricultural entrepreneurs in order to qualify their daily work and implement the insertion of young farmers (Mes. 112). This measure, together with the measure relating to the early retirement of farmers and agricultural workers (Mes. 113), was to aid in a generational turnover on farms given the needs of Member States to keep young people in agriculture and consequently mitigate the phenomenon of land abandonment. Further measures were introduced, promoting the use of consultancy services by agricultural entrepreneurs and holders of forest areas (Mes. 114) and to promote the creation of consultancy businesses, services for replacements, assistance for farm management, as well as forestry consultancy services (Mes. 115). The measures sought to promote investment in human capital, encouraging the use of specialized consulting provided by public bodies or private professionals for farms.

The measures aimed to strengthen the physical capital were aimed at the modernization of farms. Represented as one of the most important both in terms of resources allocated and in terms of financeable interventions (Mes. 121). It covers the modernization and/or construction of farm buildings that can be used for business purposes, to the purchase of machines and tools, to real land improvements. These are understood as interventions on agricultural land such as new plantations, farm road conditions and other types of interventions, to interventions on the innovation of irrigation systems or the installation of renewable energy plants. Applying to purchases relating to technological innovation aimed at increasing the economic value of forests (Mes. 122), the intent was to modernize forestry companies in terms of investments on structures such as roads, farm buildings useful for business purposes and others; increasing the added value of agricultural and forestry products. The next measure aimed at the modernization of agro-industrial companies (Mes. 123), and targeting both the structural point of view as well as that of technological innovation. It encouraged cooperation for the development of new products, processes, and technologies in the agricultural and food sectors, as well as in the forestry sector. In order to improve and develop infrastructures in parallel with the development and adaptation of agriculture and forestry (Mes. 124). Another measure (Mes. 125), was mainly dedicated to cooperation between companies and public and private research. Restoration of agricultural production, potentially damaged by natural disasters and the introduction of adequate prevention measures was dedicated exclusively to public entities in order to favor collective infrastructural interventions (Mes.126).

The measures, projected with the scope of improving the quality of production and agricultural products, were aimed at supporting farmers to comply with strict standards based on Community legislation. In order to support farmers who participate in food quality systems, another measure (Mes. 132) financed the cost of quality certifications that companies claimed to produce products with a recognized brand. Aimed at supporting producer associations for information and promotion activities concerning products that fall under food quality systems (Mes. 133), this measure was dedicated to financing the cost of product advertising.

The second axis of the RDP 2007/2013 had the objective of enhancing the environment and natural spaces by supporting the management of the territory. In particular, for the achievement of this result, the Community programming created 13 measures divided

into two macro-areas, concerning the promotion of sustainable use of agricultural land and the promotion of sustainable use of forest areas available to the Member States.

The measures, designed with the goal of promoting sustainable use of agricultural land, represent the measures that in fact have additional commitments with respect to the conditions projected as a baseline for the measures of the 1st Pillar of the CAP. In particular, these provided for compensation in favor of farmers in mountain areas (Mes. 211), with this measure, based on the area, a premium was given to agricultural areas usable by the farms that had their land located in the mountainous areas as identified in the various territorial delineations identified at the level regional. Another measure, pertaining to allowances for farmers in areas with natural handicaps, other than mountain areas (Mes. 212), the action was taken as in the previous measure but financing farms with land located in disadvantaged areas, different from the mountainous areas, as identified at regional level. The measure regarding the compensation provided for landfalling into Natura 2000 areas and land referred to in directive 2000/60/EC; of agro-environmental payments (Mes. 214), was created to cover both surface areas and structural interventions. This included various types of actions. Action 1, for example, financed the farms that submitted to the integrated production regulations issued at regional level. Action 2, aimed at farms that subjected themselves to organic production regulations, or to third-party certifying bodies to certify organic cultivation Action 4, referred to the genetic conservation of local livestock breeds in danger of extinction. Action 6, introduced in 2011 with the above regulation concerning the new challenges of the CAP, was dedicated to structural investments for the conservation of the regional genetic heritage that can be activated by public and private research bodies. Relating to animal welfare payments (Mes. 215), this measure was dedicated to livestock farms that undertook investment in equipment that improved animal welfare both in semi-intensive and extensive farming. Support for non-productive investments (Mes. 216) of a structural type, this measure provided for investments aimed at safeguarding the landscape, such as the stone terraces. The measures aimed at promoting the sustainable use of forest surfaces, in particular included the afforestation of agricultural land (Mes. 221) and the afforestation of non-agricultural land (Mes. 223). These types of measures mixed structural and surface, particularly for the duration of the commitments (15 years). They provided for the occupation of agricultural areas without the financing of afforestation works with the

payment of a premium for the whole duration of the commitment. With these measures, it is necessary to specify in order to understand the complexity of implementation that the commitments made between the beneficiary and the granting administrations concern the period between at least two community programs. The first concerns the planting of agroforestry systems on agricultural land with Natura 2000 payments, i.e. forest-environmental payments. The latter is linked to the restoration of forestry potential and preventive measures (Mes. 226) and to support non-productive investments (Mes. 227). Both structural measures are dedicated to the financing of both private companies and public bodies.

The measures of the second axis, with particular reference to the measures that provided for an acreage/head payment, represented the measures of greater financial commitment and greater expenditure. For the simplicity of implementation, they are very similar to the methods designed for the measures of the First Pillar of the CAP. The administrative investigation phase was automated for the most part thanks to the aforementioned IMCS. To be precise, this system allows the computerized recognition of both the personal and financial data of the beneficiary and of the territorial data deriving from the photo-interpretation activity.

The third axis of the RDP 2007/2013 had the objective of improving the quality of life in rural areas and promoting the diversification of economic activities. To achieve this result, which is identified with the principle of multi-functionality in agriculture, the Community programming has made available five measures to the Member States which are divided into two macro-areas, concerning the diversification of the rural economy and the improvement of the quality of life in rural areas.

The measures, designed with the aim of promoting the diversification of the rural economy, provided, in particular, for diversification into non-agricultural activities (Mes. 311). This measure was basically dedicated to agri-tourism companies for investments in structures. It gave support to the creation and development of micro-enterprises with the aim of promoting entrepreneurship and strengthening the economic fabric (Mes. 312) and encouraging tourism activities (Mes. 313). These measures were dedicated to non-agricultural companies but they play a fundamental role in maintaining the rural economy of the internal areas.

The measures, created with the aim of improving the quality of life in rural areas, included services essential for the economy and the rural population (Mes. 321). This

measure financed the public entities that have invested in the territory in terms of essential services, by way of example through the promotion of investments in broadband and in agriculture. They covered village development and renewal as well as protection and redevelopment of the rural heritage (Mes. 323). This measure financed, for example, the establishment of agricultural farmer museums and the restoration of traditional agricultural equipment. Another measure focused on training and information, aimed at economic operators engaged in sectors falling under the third axis (Mes. 331).

The fourth and final axis projected in the 2007/2013 Community Programming period is dedicated to the LEADER approach, represented in different programs, particularly those involving the development of local territorial development strategies. These were destined for well-defined rural areas, at a sub-regional level and for the promotion of public-private partnerships on the local level with the constitution or conformation of local action groups (LAGs), with autonomous decision-making power.

In particular, in this last axis there are five measures: the first three, are directives for which the granting administrators assign a separate ceiling to the measures created in the three axes preceding the LAGs. These are dedicated, according to the decreed bottom-up approach, regarding Competitiveness (Mes. 411). This provides for the direct implementation of the measures created in the first axis by the LAGs. The measure for environment and land management (Mes. 412) provides for the LAGs implementation of the measures projected in the second axis. The measure regarding the quality of life and diversification of the rural economy (Mes. 413), envisions the implementation directly by the LAGs of the measures envisaged in the third axis.

The two remaining measures are dedicated to inter-territorial and transnational cooperation (Mes. 421) and to the costs of management, animation and acquisition of skills (Mes. 431).

An important thing to emphasize is that the implementation of some measures could be addressed by individual measures or by groups of measures. For example, the youth package directive, which obligates newly formed farms admitted to financing to activate a measure relating to land improvement, or integrated supply chain plans. For this purpose, it was necessary that a group of agri-food companies had to organize themselves into a single legal entity to access individual corporate loans. This was inserted with the scope of creating complete supply chains from product to product

marketing. Moreover, relative to the integrated plans rural area, a group of public bodies had to recognize an individual as their so-called 'leader' who, in addition to presenting the project, had to ensure the coordination of the activities of the individual administrations in order to obtain results within a rural area and not by a single administration.

Between 2006 and 2008, the CAP simplification and health-check reform were proposed. The simplification set the objective of consolidating the 21 CMOs into a single document. While the health check includes, among other interventions, the full decoupling of all payments, enforcing the land delineations dedicated to fruit and vegetables in the SPS, simplified payments submission, and put a maximum threshold on company payments at one extreme, and canceling those below a certain threshold, on the other.

In May of 2007, Giovanni Anania published a revised version of the solicited report at the 51st Annual Conference of the Australian Agricultural and Resource Economics Society (which was held in Queenstown, New Zealand, 13-16 February 2007). This was carried out as part of the project "Agricultural Trade Agreements (TRADEAG)" funded by the European Commission. It focuses on a comparison between the distortive effects of the CAP in the years 1986-1988 and 2003-2005, among other observations, concluding that the new policies have led to satisfactory results on the support of producers which fell from 41% to 34%. It also produced results regarding the reduction of taxation on food products in favor of consumers which has been reduced from 37% to 19% and on the support of market prices which dropped from 97% to 63% and gave further improve prospects for subsequent policies.

Some authors, commenting on the purposes of the TFEU in the agriculture sector, posed criticisms of it with respect to the policies implemented in the sector from the 1980s to the present. They claimed that the choices made seem to be placed in a perspective favoring purposes that are very different from those currently confirmed in Art. 39 of the TFEU (Albisinni, 2010).

2.2. An assessment of current EU rural development policy

Consistent with Europe's 2020 Strategy "smart, sustainable and inclusive growth", the new CAP of 2014-2020 attempts to jointly pursue two seemingly contradictory macro-objectives. First, it pursues the competitiveness of agricultural enterprises, through

market orientation and income support. Secondly, it pursues the remuneration of public goods, through the strengthening of the conditions in the first pillar - in its very strong sense of greening and on the environmental component in the rural development policy. The objective is the gradual transition from undifferentiated income support to support the production of public goods (Bureau and Mahé, 2009; Zahrnt, 2009). Public goods can be defined as, “compensation for goods not paid by the market”, and are mainly environmental goods. Its definitive expression is greening, which expresses the attempt to compensate for the public goods produced by agriculture. Agri-climatic-environmental payments go in this direction, as do other environmental measures of the PDPs (Frascarelli, 2017).

The greening was the real novelty of the CAP 2014-2020 and above all the instrument that aroused the most criticism (De Filippis, 2014).

The impact of greening in Italy is bearable, also because Italian agriculture already has many structural elements of greening. In many Italian agricultural areas, the greening commitments were already applied by the farmers or were easily applied and, therefore, they did not require particular adaptations by the agricultural companies and/or farms. Just think of all the hilly and mountainous areas where diversification is part of ordinary agronomic practices and where areas of ecological interest are already present. The major changes are needed in areas of intensive agriculture, especially in the lowlands (Frascarelli, 2017).

The new rural development policy of 2014-2020 continues in the logic of multi-year planning, with the theme of innovation, through the Operative Groups under European Partnership for Innovation (EPI) (Frascarelli, 2017).

The reference legislation relating to the 2nd Pillar of the CAP, updated to the current programming period 2014/2020, is subdivided into General Regulations. Number 1303/2013 defines common provisions on the European Structural and Investment Funds (ESIF). Number 1306/2013 concerns the financing, management, and monitoring of the CAP. The collective directive regulation n. 2017/2393 introduces amendments to the regulations n. 1305/2013 and n. 1306/2013. While Regulation (EU) n. 1305/2013 supports rural development. From a procedural point of view, the 2014/2020 program based its approach on simplification, in particular within the Common Strategic Framework (CSF) redefining the set of ESI Funds, as a grouping of the European Regional Development Fund - ERDF, European Social Fund - ESF, Cohesion Fund,

European Agricultural Fund for Rural Development - EAFRD and European Fund for Maritime Affairs and Fisheries - EFMAF.

The reference legislation regarding the 2014/2020 programming period is represented by the EU Regulation n. 1305/2013. This regulation sets out the objectives listed below in place for planning and in fact abolishes the axes of the previous programming period in favor of 3 general objectives. These general objectives pursue a total of 6 priorities represented in 20 measures including the technical assistance measure of the regional rural development program.

The first objective is to stimulate the competitiveness of the agricultural sector. It consists of the former first axis measures from the previous programming. Some measures have been better clarified, in addition to being updated in terms of numbering, they are also updated in their contents. For example, in the concession of the premiums designated for the measure relative to the first settlement (Mes. 6.1), it not only receives an increase in the premium compared to the past programming but is characterized by a different mode of implementation. Previously, the premium was paid in a single sum, with the current programming, this award is granted in two payments in order to ensure the closure of the improvement plan, as seen previously in the community directive package designated for youths.

Another change to the previous programming period is the subdivisions within structural measures. For example, there are changes relative to investments intangible fixed assets (Mes. 4), regarding business upgrades (Mes. 4.1), in investments for water resources (Mes. 4.3) or for renewable energies (Mes. 4.4). The new measures are described below. A constitution of associations and organizations of producers (Mes. 9) which has the objective of favoring the processes of stable aggregation of agricultural operators. The promotion of cooperation (Mes. 16) between individuals in the agricultural and forestry sectors and the food chain (creation of poles and networks, operational groups of the European Innovation Partnership on Agricultural Productivity and Sustainability (APS). A package of risk management tools (Mes. 17) managed at a national level which provides for the insurance of the crops, animals, and plants. Furthermore, mutual funds for interventions in the event of adverse weather conditions, animal and plant diseases, parasitic infestations, and environmental emergencies. As well as an income stabilization tool consisting of the payment of financial contributions

to mutual funds for the payment of financial compensation to farmers following a drastic drop in income.

The second objective is to guarantee the sustainable management of natural resources and climate action. In particular, a group of measures that trace, in a clearly revised manner, what has already been outlined by the second axis of the previous programming and subdivides the measures into two macro-areas. These two macro-areas are concerned with a) preserving, restoring and enhancing ecosystems related to agriculture and forestry, b) encouraging the efficient use of resources and the transition to low carbon and climate-resilient economy in the agri-food sector and forest.

An interesting factor of the present objective is, with respect to past programming, the identification of separate measures. Take for example the agricultural environmental measure (Mes. 10), with its various actions of intervention that are additional with respect to the past, and the measures related to the cultivation with biological method (Mes. 11).

The third objective is to achieve a balanced territorial development of rural economies and communities. This includes the creation and maintenance of jobs, working towards social inclusion, poverty reduction and economic development in rural areas. This objective traces the path of the third axis of the previous programming.

Once again, as a demonstration of the efficiency and effectiveness of this structural policy, the Regulation regarding the programming for Local Action Groups (LEADER) is activated as a separate measure. This includes all the objectives of the measure set out above with the addition of technical assistance in its implementation. Another administrative innovation is represented by the “Verifiability and Controllability Measures” (or VCM). These procedures are governed by art. 62 of EU Regulation 1305/2013, in order to standardize the levels of control at a national level.

Two other administrative changes to the new structural policy of the Union relating to the first to changes on the automatic disengagement. In substance, it is expected that the European Commission will disengage the allocated resources, connected to a commitment in year N, not covered by a pre-financing or by a request for payment (payment requests) in the year N + 3 (so-called “N + 3” rule). This represents a change from the 2007/2013 program which provided (in continuity with the 2000-2006 period) the so-called “N + 2” rule. In the case of automatic disengagement, the participation of the EAFRD in the RDP suffers a reduction equal to the amount subject to

disengagement in relation to the year of expenditure to which it refers. Subsequently, the Managing Authority must present a re-formulated financial plan in order to divide the amount of the reduction of the contribution between the various measures of the RDP (Frascarelli 2018). In terms of performance reserve to favor the effective use of the funds, 6% of resources (for Italy that equals 625.8 million euros of EAFRD resources) will be assigned to the best performing Regions. While those Regions with unsatisfactory results will be sanctioned. The allocation of the reserve will be conditional on the achievement of the results linked to the objectives of the program. The performance framework, in fact, is based on a system of indicators. These are mainly linked to the financial implementation and the interventions carried out through the program, for which intermediate targets (milestones) have been set to be achieved by December 31, 2018 and to be evaluated in 2019. Therefore in 2019, after having verified the state of implementation of the various programs with the so-called performance review (art. 21 Reg. 1303/2013), the European Commission, within two months of receipt of the respective annual implementation reports for the 2019, will adopt a decision based on which it will assign the performance reserve (performance reserve), a sort of reward for the best (Frascarelli, 2018a). Pursuant to Annex I of the Delegated Regulation (EU) 2015/791, the financial allocation available to Member States (EU 28) for the EU programming period 2014/2020 (Table 1), is represented by € 100 billion.

In Italy, 21 rural development programs are active at the Regional level and autonomous Provinces (RDPs), in addition to two national programs. These address four measures considered strategic: risk management, animal biodiversity, irrigation infrastructures, and National Rural Networks. There are 118 European RDPs. Most countries have opted for only one national RDP: Holland, Ireland, Austria, Denmark, Sweden, Poland, Hungary, Romania, Bulgaria, Slovakia, Croatia, Slovenia, Czech Republic, Greece, Latvia, Estonia, Lithuania, Cyprus, Luxembourg, and Malta. Other countries have chosen to draft regional RDPs. France is the country with the greatest number of RDPs (30), followed by Italy (23), Spain (19) and Germany (15) (Frascarelli, 2018c). From a strictly economic point of view, the analysis of the table concerning the financial allocation of European RDPs shows that the most significant programs are represented by the nations of France (11.43%), Italy (10.49%), Germany (9.49%), Poland (8.73%), Spain (8.33%) and Romania (8.16%).

Table 1. Breakdown of Union support for Rural Development (2014-2020) EU 28.

Member state	Total financial allocation in% of the total amount
Belgium	0.65
Bulgaria	2.38
Czech Republic	2.32
Denmark	0.92
Germany	9.49
Estonia	0.83
Ireland	2.20
Greece	4.74
Spain	8.33
France	11.43
Croatia	2.03
Italy	10.49
Cyprus	0.13
Latvia	1.08
Lithuania	1.62
Luxembourg	0.10
Hungary	3.44
Malta	0.10
Netherlands	0.77
Austria	3.95
Poland	8.73
Portugal	4.08
Romania	8.16
Slovenia	0.84
Slovakia	1.57
Finland	2.39
Sweden	1.77
United Kingdom	5.22
Technical Assistance (0.25 %)	0.24
Total	100.00

Source: Our elaboration from Annex I Reg. EU 791/2015.

In the general European framework, the priority that benefits from the most resources is the 4th, relating to the defense and restoration of natural ecosystems connected to agriculture and forests. Wanting to make a comparison with the old programming, this priority roughly corresponds to Axis 2. The available data show that almost half of the resources will serve as financing interventions for the preservation the environment and for the sustainability of the development of rural areas. This great attention to the

environment and sustainability is visible above all in the countries of central and northern Europe, where agriculture is already competitive and modern. Consequently, a further step forward is aimed at improving environmental performance, to have a primary sector that is remunerative and guarantees, at the same time, a greater resilience of the rural environment. The most striking case concerns England, which has chosen to invest 85% of resources on priority 4 (preserving, restoring and enhancing ecosystems related to agriculture and forestry). This highlights the main objective that is to respond to the multiple challenges posed by climate change, promoting the spread of sustainable agricultural practices. The same is true for Finland, which has programmed around 70% of the resources on the priority in question, in particular through measures dedicated to disadvantaged areas and agri-climatic-environmental practices. This has been done in order to ensure the survival of agriculture in difficult climatic conditions and to secure the rural landscape, given its importance for the conservation of Finnish biodiversity. Again, regarding priority 4, the RDPs of Austria and Denmark were targeted with an allocation of around 65% of the funds. Austria demonstrates, in line with the two previous programs, that it wishes to confirm its commitment to supporting the environment and biodiversity. Denmark expresses its clear intention to focus on sustainable agricultural practices, with the specific objective of doubling the area dedicated to organic farming and aims to create 1,000 new green jobs. Among the countries of Eastern and Southern Europe there is a more balanced attitude in the distribution of resources, in particular between priority 2 (strengthening the profitability and competitiveness of agriculture) and priority 4. This indicates that, while maintaining primarily the interest in the protection and enhancement of ecosystems, the agricultural systems of these States need interventions aimed at increasing their competitiveness and profitability. Priority 2 is the second in terms of resources allocated, with around 21% of the total budget. The modernization of the sector (objective of Focus Area 2a, the one on which more resources are concentrated) is the main objective pursued, among others, by the RDPs of Portugal, Poland and Lithuania which, on this priority, allocated respectively 40, 33 and 31% of their resources. This was done particularly for the benefit of the measure dedicated to material investments. These investments, together with support for generational change and the spread of innovations, can lead to significant progress in agriculture both in terms of productivity and quality of production. The third priority in terms of allocated resources is the 6th, on social

inclusion and economic development in rural areas. Resources are allocated to it, equal to 15% of the total. Three-quarters of these resources will be used through local development strategies and, in fact, the Focus Area with the largest allocations is 6b, dedicated to the Leader approach. Above all, it is the German regional RDPs that focus on local development strategies to guarantee a balanced territorial development of the rural areas and the communities that inhabit them. This is done through the provision of services, to improve the living conditions in these areas and promote the creation of new jobs. Priority 3 is more neglected. It promotes the integration of operators along the supply chains (7% of resources). Priority 5 is aimed at promoting the sustainable use of resources and the transition to renewable energy (5%). In some cases, these priorities have not even been foreseen, or they have been assigned a minimum allocation. In the case of Priority 5, those who have opted for this choice, ensure that investments made on other priorities (in particular Priority 4), will still have a significant impact on resource use efficiency. Priority 1 concerning knowledge transfer and innovation, is a cross-cutting priority. The funds dedicated to it along with the interventions in the field of training and consulting are programmed within the other priorities. This is done in order to provide the necessary support to ensure that human capital is able to acquire that wealth of knowledge without which any investment in competitiveness, sustainability, and innovation would not take root at its best. Almost 1.2 billion euros (2% of total resources) fall under technical assistance. Finally, just under 700 million, headed by six Member States, concerns the “early retirement” measure, no longer provided for in the current programming, but for which there are still outstanding payments. These are insignificant amounts except for Lithuania and Poland. In the case of Lithuania, they are around 90 million (5% of the entire package of resources allocated to the Baltic country), in the case of Poland, they amount to 560 million, 4% of the resources available.

3. THE RURAL DEVELOPMENT POLICY IN ITALY

3.1. Introduction

Starting from the funding and implementing regulations of the structural funds (in particular, in Italy, ERDF and ESF), the Commission has issued the Community Strategic Guidelines (CSG) specific to the cohesion policy and related to: “making Europe and the European regions more attractive for investment and business activities”; “promoting knowledge and innovation in favour of growth”; “better and more jobs”. Based on these CSGs, the National Strategic Framework (NSF) has been drawn up for Italy, as well as for the other Member States. The NSF representing the strategic framework within the regions and autonomous provinces has drawn up Regional Operational Programs (ROPs) in which interventions financed by the ERDF and the ESF are projected, and where the complimentary areas between the cohesion policy and the rural development policy are concretely identified.

3.2. National Regional Development Plan (NRDP)

The EU Reg. 1305/2013 has assigned Italy a financial resources endowment of the EAFRD (European Agricultural Fund for Rural Development) of 10.43 billion euros for the period 2014-2020. Community financial resources must be supplemented by those deriving from national co-financing, resulting in a total public expenditure of 20.87 billion euros. In the 2014-2020 programming, Rural development is also implemented through a National Rural Development Program (NRDP), together with regional programs; representing an absolute novelty with respect to the past. With 90% of the funds (18.6 billion euros) allocated to the implementation of regional programs and 2.2 billion euros to national measures. This is done with 4 lines of action: risk management, irrigation infrastructure, animal biodiversity, and national rural network. (Frascarelli, 2019a).

The 2014-2020 programming period sees the coexistence of two national RDPs together with the traditional 19 regional RDPs and the 2 RDPs of the Autonomous Provinces of Trento and Bolzano, for a total of 23 RDPs. National RDPs are respectively the RDP relating to the “National rural network” and the “National Rural Development Program”. The latter concerns three measures: risk management; animal biodiversity and irrigation infrastructure. The Italian region with the highest financial allocation is

Sicily with 2.2 billion euros; following Campania with 1.8 billion euros and Apulia with 1.6 billion euros (Frascarelli, 2019a).

In the State-Regions Conference of January 16th in 2014, Italy provided a National Rural Development Program (NRDP) for the period 2014/2020. This program was based on three lines of intervention upon confirmation of the contribution of the National Rural Network, and 21 Regional Rural Development Plans (RRDPs).

The European Commission adopted Italy's 2014 - 2020 Rural Development Program for the National Rural Network (NRN) on May 26th, 2015. With a budget of around 115 million euros (59.6 million from the EU budget and 55 million euro of national funding), the Network will support policies for rural development, through the exchange of experiences and knowledge between rural areas and through better implementation and management of Italian RDPs. The program aims to ensure better visibility of the results achieved and the greatest possible involvement of all those interested in rural development in Italy.

Concerning the NRDP, the first line of intervention is dedicated to the risk management measure. The national program will guarantee continuity and improvement, as well as the expansion of the existing and functioning system to support subsidized agricultural insurance. Moreover, regarding the most innovative instruments, such as mutual funds and the Income Stabilization Instrument (ISI), it will offer the possibility of creating the critical mass necessary for more effective and efficient operation. A national measure also allows the construction of a more diversified portfolio, guaranteeing greater solidity of the instruments. However, the launch of such operations in regions where there is not a widespread aptitude for risk management could prove difficult.

The second line of intervention is dedicated to the Investments measure in irrigation infrastructure. The activation of a national measure plan for the financing of investments in irrigated infrastructure is part of the context of the application of the Water Framework Directive 2000/60, which constitutes the European regulatory reference for the safeguard and protection of surface and underground water bodies, and to improve the quality of water resources. The national standard (Legislative Decree 152/2006) established eight river basin districts as the main unit for the management of river basins. These basin districts consist of both small and large neighboring river basins and their respective underground and coastal waters with very diversified hydrographic, hydrogeological and environmental features of national, regional, and

interregional importance. Some irrigation schemes of significant size are of an interregional nature, and the fundamental nodes of the network can serve different regions using the main supply schemes much in the same way as a reservoir works. Therefore, a strategic approach at national level in the context of rural development becomes necessary, alongside the RDPs, to guarantee effective and efficient protection of the country's water resources. This ensures suitable dimensions to achieve environmental sustainability as well as optimal operational and economic performance. The third line of intervention is dedicated to the genetic improvement of livestock and animal biodiversity. The objective of the national biodiversity strategy is primarily represented by the development of new actions aimed at the conservation of biodiversity in species of animals of livestock interest. This is done through the maintenance and sustainable use of genetic variability with the implementation of innovative actions to support the tools traditionally used in this area (holding of the Genealogical Books and of the Registry) (sub-measure 10.2). At the same time, the objective is to improve the performance of Italian farms based on the use of tools that represent real priorities for the future of livestock productions. In particular, the following are considered: (1) the improvement of species and breeds bred in terms of adaptation to the effects of climate change (increasing resilience); (2) the reduction of emissions into the atmosphere; (3) improving the general aspects of animal welfare; (4) the improvement of productive and reproductive efficiency understood above all as quality and sustainability of productions; (5) improvement of natural diseases resistance of animals and the progressive reduction of the use of drugs in farming (sub-measure 16.2).

Achievement of improvements in the general performance of Italian farms will happen through the creation of a partnership aimed at collecting and sharing of zootechnical information in the form of an "Open Data" system. There is a need to overcome the fragmentation of the present system in order to respond effectively to the objectives of the Rural Development Policy regarding the resources for the genetic conservation and improvement of animals. This can be done through innovative strategies and solutions and by creating a new integrated model that develops synergies that can aid the national zootechnical system in responding effectively to these RDP objectives.

The promotion of greater synergy and integration between those who operate with various functions within the livestock sector, often independently of one another, will allow the development of an integrated system. This system, will be based on protocols

and relatively standardized procedures, focusing on horizontal cooperation at a national level in specific and related areas, such as biodiversity, genetic selection, animal health and welfare, food safety, traceability, and environmental impact. At the same time, the creation of “Open Data” databases will provide access to information as well as make it available to companies, research institutes, institutions, business consulting systems, etc. to support economic sustainability, environmental and social aspects of the livestock sector. With respect to this, only the management of information in a unified manner at national level will guarantee homogeneity and reliability of the data collected, as well as technological uniformity and adherence to international standards.

The NRDP also proposes an intervention to streamline the resources currently being used; avoiding unnecessary redundancies and benefiting economies of scale. Finally, a national approach will better ensure the persistence of the actions undertaken in the long term and therefore the achievement of set objectives.

The NRDP relating to the Rural Network has a budget of 100 million euros, the other 3 national interventions respectively 1,640 million euros for risk management, 200 million euros for animal biodiversity and 300 million euros for the irrigation plan. In total, the four national actions provide for a total public expenditure of 2,240 million euros. For risk management, the program aims to consolidate and expand the assurance of agricultural production to new sectors and territories, developing new instruments such as mutual funds and corporate income stabilization. The program therefore continues and strengthens the protective role forecasted against natural disaster damage as guaranteed by the National Solidarity Fund, which will remain operational only for the compensation of actual damages. The measure of irrigation investments aims to support the competitiveness of the sector, becoming part of the Water Framework Directive 2000/60, which is the European regulatory reference for safeguarding and protecting bodies of water. The evaluation of investment projects in the irrigation sector will be carried out at the level of the interregional catchment area. Additional funding for the sector can be secured through the Development and Cohesion Fund, especially for southern Italy. The measure regarding the protection of animal biodiversity has the objective of safeguarding and improving animal populations and breeds of zootechnical interest with the aim of increasing animal health and welfare, reducing environmental impact and improving quality of productions. The National Program also aims to foster the cooperation of all the players in the supply chain with the creation of a data bank

inspired by principles of resulting transparency and public utility of the products. Among the objectives of the biodiversity measure, there is that of giving substance to the commitment undertaken by the Parliament and the Regions regarding the implementation of the reform of the law 30/1999, contained in the so-called “connected agriculture”.

At the European level, the rural development policy for the 2014/2020 programming period suffers an additional decrease in the resources allocated compared to what happened in the past. This increase in disparity has associated the replacement of the compulsory modulation, foreseen in the first pillar of the previous programming, with the optional modulation or flexibility between pillars. This was assumed by some Nations but not by Italy, and the financing of the measure relative to Risk Management was previously covered by the management and financial responsibility of the first pillar.

As for Italy, to compensate for the cuts on the first pillar (EAGF fund), the financial envelope referring to the EAFRD fund for the 2014/2020 programming period undergoes a total national increase of 5.3% (from 8,944 million euros it has gone to 9,422 million euros). At the Regional level, we note that the regions with competitive objectives and those in transition have an average increase in the financial envelope of 10%, with regard to the regions with regional convergence objectives there is an increase of about 1%. For the Calabrian region, with respect to the previous programming, a 2.1% increase in the funding from the Union Budget has been foreseen (from 654 million euros to 668 million euros).

In the context of financial allocation with respect to priorities, Italy presents a distribution of resources without excessive imbalances in favor of a single priority. As for the other European RDPs taken into consideration, the two priorities with the most funds available are the 4 and 2, demonstrating the attention to improving both environmental and economic performance of Italian agriculture. As in other Member States, there are no neglected priorities: both the integration of operators along the supply chains (Priority 3) and the contrast and adaptation to climate change (Priority 5) have a share of resources around at 15%. While funds equal to 10% of the total are dedicated to social inclusion and economic development in rural areas (Priority 6).

3.3. State of the art on Italian Rural Development Programs

In the State of the Regions conference of 16/01/2014, following the European negotiations on the PAC 2014-2020 funds, the allocation at the national level of the funds provided by the EAFRD for the EU programming 2014/2020, as well as the quotas of Community, national and regional funding (Table 2).

Table 2. Allocation of funds for rural development 2014-2020 by the State Regions conference 2014.

Region	Total Public expenses	EU Financing		National Co-financing	
		EAFRD	Quota EAFRD	State quota 70%	Regional Quota 30%
Bolzano	366.4	158.0	43.12%	145.9	62.5
Emilia Romagna	1,189.6	513.0	43.12%	473.6	203.0
Friuli Venezia Giulia	296.1	127.7	43.12%	117.9	50.5
Lazio	780.1	336.4	43.12%	310.6	133.1
Liguria	313.7	134.8	42.98%	125.2	53.7
Lombardy	1,157.6	499.2	43.12%	460.9	197.5
Marche	537.9	232.0	43.12%	214.2	91.8
Piedmont	1,093.0	471.3	43.12%	435.2	186.5
Toscany	961.8	414.7	43.12%	382.9	164.1
Trento	301.5	129.6	42.98%	120.3	51.6
Umbria	876.6	378.0	43.12%	349.0	149.6
Aosta Valley	138.7	59.8	43.12%	55.2	23.7
Veneto	1,184.2	510.7	43.12%	471.5	202.1
Total of more developed Regions	9,197.2	3,965.2		3,662.4	1,569.7
Abruzzo	432.8	207.7	48.00%	157.5	67.5
Molise	210.5	101.0	48.00%	76.6	32.8
Sardinia	1,308.4	628.0	48.00%	476.3	204.1
Total of Regions in transition	1,951.7	936.7		710.4	304.4
Basilicata	680.2	411.5	60.50%	188.1	80.6
Calabria	1,103.6	667.7	60.50%	305.1	130.8
Campania	1,836.3	1,110.9	60.50%	507.7	217.6
Apulia	1,637.9	990.9	60.50%	452.9	194.1
Sicily	2,212.7	1,338.7	60.50%	611.8	262.2
Total of less developed Regions	7,470.7	4,519.7		2,065.6	885.3
Total Regional RDPs	18,619.6	9,421.6		6,438.4	2,759.4
National Program					
Risk Management	1,640	738	45.00%	902.8	0
Animal Biodiversity	200	90	45.00%	110	0
Irrigation Plan	300	135	45.00%	165	0
National Rural Network					
National Rural Network	100	45	45.00%	55	0
TOTAL for ITALY	20,859.60	10,429.60	50.00%	7,671.20	2,759.40

Based on the provisions of EU Regulation n. 1303/2013, which governs the division of the objective regions into three categories, the conference decided on the co-financing quotas to be assigned taking into account both the capacity to use the Community resources and the “historical criteria”. These criteria are very diversified between formerly competitive and ex convergence regions. Therefore:

- a) For less developed regions (former competitiveness regions), whose per capita GDP is less than 75% of the EU-28 average GDP, a co-financing quota of 60.50% was allocated by the EAFRD (Campania, Apulia, Basilicata, Sicily, and Calabria);
- b) For regions in transition, whose GDP per capita is between 75% and 90% of the average GDP of the EU-28, a co-financing quota of 48% was assigned by the EAFRD (Abruzzo, Molise, and Sardinia);
- c) For the more developed regions (ex convergence regions), whose per capita GDP is higher than 90% of the average of the EU-28 GDP, a co-financing quota of 43.12% and 42.98% was assigned by the EAFRD (Piedmont, Tuscany, Umbria, Aosta Valley, Veneto, Emilia Romagna, Friuli Venezia Giulia, Marche, Lazio, Lombardy, Umbria and the Autonomous Province of Trento and Liguria).

The internal allocation of resources is covered by the Inter-ministerial Committee for Economic Planning (CIPE) Resolution of January 28th, 2015 regarding the definition of the criteria for national public co-financing of European Programs for the 2014-2020 programming period. This internal allocation establishes additional funding for the Liguria Region and for the Autonomous Province of Trento equal to 0.14%. This explains the reason for which the allocation of the European Union EAFRD quota for these two territories is equal to 42.98% because thanks to the additional national financing they reach the predetermined financing quota for the most developed regions.

By comparing a series of common indicators between the regions, arising from the sectoral analysis obtained from the RDPs at the date of their approval (Table 3), one can observe the average values (arithmetic average) that distinguish the Italian country in its Northern, Central, and Southern regions. This comparison makes it possible to explain some of the political choices on the implementation of RDPs at regional levels. In particular, in the following table, the physical indicators relating to the total Usable Agricultural Area (UAA) were surveyed for each Regional RDP. These are based on the programs approved by the European Commission and made available through the institutional website of the National Rural Network (NRN) and its relative macro use which distinguishes soils used as arable land, pasture meadows or tree crops expressed in hectares in the first case and as a percentage of the total UAA in the second case.

The livestock units (LSU) or adult bovine units are expressed both in relative numbers and in relation to the regional UAA. The number of farms is represented within the regional territory of reference as is their average physical size. Labour productivity is

expressed in terms of income obtainable from a single work unit (SWU). The average economic size is expressed in standard production (SP) per farm and finally, the overall amount of the regional RDP with the total regional UAA was reported in order to obtain an average figure on the opportunity for support that could be offered by the RDP per hectare. Analysis of the average data, divided according to the distinction between more developed regions, regions in transition, and less developed regions, are reported below. The total UAA at a national level is recorded at 12,856.052 million hectares, which is mostly present in Italy's more developed regions (52.59%). They are represented in order according to size. The maximum territory is the Piedmont region, represented by an extended territory for 1,010.780 hectares of UAA followed by Lombardy (986.830 ha), Veneto (811.440 ha), Tuscany (734.340 ha), Lazio (638.602 ha), Marche (471.830 ha), Umbria (326.880 ha), the Autonomous Province of Trento (137.220 ha), Aosta Valley (55.600 ha) and finally, with the minimum value also on a national level, is Liguria with 43,780 ha of UAA. Instead, 33.38% of the UAA is represented by the territory in less developed Italian regions. The highest percentage being in Sicily, which represents the most extensive territory even at the national level with 1.387.520 ha of UAA followed by the territory of Apulia (1,285.290 ha), Campania (549.530 ha), Calabria (549.250 ha), with a minimum percentage in Basilicata with 519.130 ha of UAA. The remaining 14.04% is represented by the regions in transition, respectively Sardinia (1,153.690 ha), Abruzzo (453.630 ha), and finally Molise (197.520 ha).

These surfaces are also distinguished by macro use of the soil or differentiated as a percentage of arable land, permanent grasslands, and permanent crops of the total representative UAA of the referenced territory. The arable crops are mainly represented by the regions in central and northern Italy with percentages exceeding 50% for the Marche regions (79.40%), Emilia Romagna (78%), Friuli Venezia Giulia (74.30%), Lombardy (72.50%), Molise (72.30%), Veneto (70.20%), Umbria (64.60%), Tuscany (63.60%), Basilicata (60.20%), Piedmont (53.60 %), Apulia (50.70%) and Lazio (50.40%). The minimum percentages are recorded in the Aosta Valley region (0.60%) and in the autonomous provinces of Bolzano (1.70%) and Trento (2.30%). Permanent grasslands and pastures are mainly represented in the regions of northern Italy with percentages greater than 50% for the regions Aosta Valley (97.70%), the Autonomous Province of Bolzano (88%), the Autonomous Province of Trento (81%), Sardinia (60.10%) and Liguria (50%).

The minimum percentages of grasslands and pastures are instead recorded in the regions of Apulia (8%) and Emilia Romagna (9.60%). Permanent crops are mainly represented by regions in southern and northern Italy with percentages above 30% for the regions of Calabria (45.7%), Apulia (41%) and Liguria (32.80%). The minimum percentages of permanent crops are recorded in the regions of Aosta Valley (1.50%) and Lombardy (3.70%).

From the zootechnical point of view we can observe the distribution, at a national level, of the cattle livestock units (LUs) present in the Italian territory, immediately noticing the absolute predominance of four northern regions that individually have values equal to or greater than the combined total of those in the regions in transition and less developed regions. The regions with the highest LUs percentages are Lombardy (2,736,680 LUs), Veneto (1,361,540 LUs), Emilia Romagna (1,203,660 LUs) and Piedmont (1,030,400 LUs) where, on a regional level, reporting the number of LUs with the total UAA there are values above 100%, respectively (277.32%), (167.79%), (113.10%) and (101.94%).

The number of farms present in the national territory is equal to 1,601,618. These are divided into 51.08% in the less developed regions, 40.54% in the more developed regions, and the remaining 8.38% in the regions in transition. Clearly, the average physical size of farms is greater in the regions in transition with an average value of 11.10 hectares, compared to 10.68 hectares for developed regions and 5.80 hectares for less developed regions. Considering the minimum and maximum values present in the different regions it is noted that the region with the highest average hectares is Sardinia with 19, followed by Lombardy (18.20 ha), Aosta Valley (15.70 ha), Piedmont (15.10 ha), followed by Calabria, Campania, and Apulia, where there is a value of 4 hectares, with the minimum percentage being represented by Liguria (2 ha).

Analyzing the data relating to the average economic size of Italian farms, expressed in Standard Production, it is noted that in the developed regions the average values per farm amount to € 44,048.96/farm, regions in transition € 23,453.29/farm and in the less developed regions € 15,971.12/farm. The maximum standard production statistics, with average standard production exceeding € 40,000.00, are recorded in five regions of northern Italy, respectively Lombardy (135,986.21 €/farm), Emilia Romagna (86,658.09 €/farm), Piedmont (57,659.16 €/farm), Veneto (46,116.85 €/farm) and Friuli Venezia

Giulia (45,043.78 €/farm); the minimum production values are found in two regions of southern Italy, respectively Apulia (13,165.48 €/farm) and Calabria (14,277.12 €/farm). Data related to average size in work units or units of labor (ULa) show a certain uniformity throughout the national territory with data lower than the unit, in particular for the most developed regions the average is 0.82 ULa/farm, for the regions in transition (0.53 ULa/company) and finally for the less developed regions (0.46 ULa/company).

Labour productivity is higher in more developed regions with a value of € 23,132.48/UAA (Units of Arable Area) and in the less developed regions (€ 20,179.32/UAA) than in the regions in transition (€ 14,170.93 / UAA).

The last indicator calculated is relative to the average investment per hectare of UAA calculated, by region, relating the financial allocation by measure to the total UAA. From this comparison it is noted that the region that invests the most with the RDP is Liguria with € 3,040.00/ha followed by Campania (1,195.50 €/ha), Umbria (1,224.89 €/ha), Calabria (1,199.88 €/ha), and Aosta Valley (1,061.91 €/ha) while the minimum value is in Emilia Romagna (475.81 €/ha).

Given what has been said, in Table 4 the measures activated for each regional RDP are represented and the impact expressed as a percentage of financial endowment, of each measure within the Regional RDPs.

The measures can be grouped into two macro groups, the first consisting of the measures that have activation in all the regional RDPs, the second consisting of measures not activated in all the regional RDPs.

Measure 1 (Knowledge transfer & information actions) is activated by all Italian RDPs that more or less invest the same financial endowment as a percentage, the Molise region represents the maximum value (2.78%) while the minimum value is represented by the Sardinia region (0.23%).

Measure 2 (Advisory services) is not activated by the regions of Friuli Venezia Giulia, Aosta Valley and the Autonomous Provinces of Trento and Bolzano. For the other regions, the maximum value is once again represented by the Molise region (2.65%).

Measure 3 (Quality schemes) is not activated by the Autonomous Provinces of Trento and Bolzano, for the other regions, the maximum value is represented by the Piedmont region (2.85%).

Table 3. Comparison between Regions (physical, economic and political indicators). Processing on National Rural Network data updated to the latest version available.

Regions	Labour productivity in the agricultural sector €/ULA	Agricultural farms (numbers)	Average size of surface areas Hectares/UAA/farm	size and economic averages PSE/farm	Average size and labour units ULA/farms	UAA total in hectares	Cultivations % on UAA total	Pastures and permanent meadows% per UAA total	Perm. cultivations % of UAA total	UAA total (number)	Rapport of total UAA to hectare	Average investment of RDP €/ha
Average of Developed Regions	23,132.48	49,934.62	10.68	44,048.96	0.82	520,037.85	48.22	37.85	13.57	593,973.77	88.12	867.38
Bolzano	17,608.40	20,250.00	11.90	28,164.84	1.40	240,540.00	1.70	88.00	10.20	115,258.00	47.92	648.35
Emilia Romagna	30,781.70	73,470.00	14.50	86,658.09	0.90	1,064,210.00	78.00	9.60	12.20	1,203,660.00	113.10	475.81
Friuli Venezia Giulia	18,172.00	22,320.00	9.80	45,043.78	0.70	218,440.00	74.30	13.80	11.70	203,800.00	93.30	577.01
Lazio	26,602.40	98,220.00	6.50	24,906.79	0.50	638,602.00	50.40	30.20	19.20	380,717.00	59.62	555.24
Liguria	21,563.60	20,210.00	2.20	18,275.34	0.90	43,780.00	15.50	50.00	32.80	29,304.00	66.93	3,040.00
Lombardy	37,426.30	54,330.00	18.20	135,986.21	1.20	986,830.00	72.50	23.80	3.70	2,736,680.00	277.32	499.31
Marche	12,795.00	44,870.00	10.50	28,197.11	0.50	471,830.00	79.40	12.20	7.90	200,480.00	42.49	637.17
Piedmont	19,082.60	67,150.00	15.10	57,659.16	1.00	1,010,780.00	53.70	36.70	9.40	1,030,400.00	101.94	460.28
Tuscany	31,730.00	72,690.00	10.40	32,930.10	0.70	754,340.00	63.60	12.00	23.50	182,210.00	24.15	542.71
Trento	30,851.70	16,450.00	8.30	28,916.53	0.90	137,220.00	2.30	81.00	16.60	54,420.00	39.66	932.07
Umbria	18,456.40	36,240.00	9.00	23,291.16	0.50	326,880.00	64.60	21.00	14.20	194,340.00	59.45	1,224.89
Aosta Valley	11,171.20	3,570.00	15.70	16,490.46	0.90	55,600.00	0.60	97.70	1.50	28,850.00	51.89	1,061.91
Veneto	24,480.90	119,380.00	6.80	46,116.85	0.60	811,440.00	70.20	16.10	13.50	1,361,540.00	167.79	621.22
Average of Regions in Transition	14,170.93	44,739.33	11.10	23,453.29	0.53	601,613.33	48.80	39.30	11.47	286,276.67	46.46	516.51
Abruzzo	15,211.20	66,840.00	6.80	19,351.97	0.50	453,630.00	40.00	41.70	17.70	173,510.00	38.25	507.34
Molise	11,754.10	6,568.00	7.50	16,162.67	0.40	197,520.00	72.30	16.10	11.00	99,460.00	50.35	504.86
Sardinia	15,547.50	60,810.00	19.00	34,845.22	0.70	1,153,690.00	34.10	60.10	5.70	585,860.00	50.78	537.34
Average of Less Developed Regions	20,179.32	163,570.00	5.80	15,971.12	0.46	858,144.00	47.44	21.64	30.60	269,029.60	35.83	1,138.24
Basilicata	22,745.60	51,760.00	10.00	15,159.00	0.40	519,130.00	60.20	29.60	9.90	127,390.00	24.54	782.43
Calabria	13,354.40	137,790.00	4.00	14,277.12	0.50	549,250.00	28.40	25.60	45.70	147,720.00	26.89	1,199.88
Campania	22,475.80	136,870.00	4.00	17,522.09	0.60	549,530.00	48.80	21.90	28.70	448,980.00	81.70	1,995.50
Apulia	18,102.10	271,750.00	4.70	13,165.48	0.40	1,285,290.00	50.70	8.00	41.00	214,688.00	16.70	761.01
Sicily	24,218.70	219,680.00	6.30	19,731.89	0.40	1,387,520.00	49.10	23.10	27.70	406,370.00	29.29	952.36

Table 4. Financial allocation, measure impact on Regional RDPs (%).

Measure	Regions																				
	Abruzzo v. 5/18	Basilicata v. 7/18	Autonomous Provinces of Bolzano v. 7/19	Calabria v. 5/18	Campania v. 6/18	Emilia Romagna v.8/18	Friuli Venezia Giulia v. 8/19	Lazio v. 7/19	Liguria v. 7/19	Lombardy v.6/19	Marche v.6/19	Molise v. 6/19	Piedmont v. 7/19	Apulia v. 8/19	Sardinia v. 4/18	Sicily v. 6/19	Tuscany v.6/18	Autonomous Provinces of Trento v. 5/18	Umbria v. 5/18	Aosta Valley v. 7/19	Veneto v. 7/18
M01	0.97	1.34	0.39	0.92	1.28	1.50	1.71	0.81	1.64	0.85	1.66	2.78	3.69	1.55	0.23	0.41	1.09	0.50	1.11	0.29	1.90
M02	0.87	0.56	0.00	1.26	0.55	0.24	0.00	0.77	0.88	0.99	0.72	2.65	1.23	0.73	0.70	0.14	1.90	0.00	1.06	0.00	1.67
M03	1.98	0.85	0.00	1.69	0.44	0.69	1.16	0.66	0.89	0.50	2.79	0.96	2.85	1.11	0.39	0.46	0.82	0.00	0.88	1.46	1.53
M04	35.08	21.78	13.05	28.90	31.45	29.70	34.34	23.26	30.05	36.19	23.67	26.47	25.98	32.47	20.12	32.51	28.21	33.00	23.39	20.23	35.75
M05	2.44	1.70	0.00	0.92	0.58	2.01	0.00	1.29	2.04	0.79	1.86	0.00	0.97	1.24	1.16	0.57	2.21	0.00	1.83	0.00	0.35
M06	10.43	8.51	7.11	5.18	9.10	8.33	6.18	14.70	9.24	5.12	8.12	4.81	5.84	10.52	6.19	10.27	10.52	5.71	4.09	3.43	11.10
M07	9.07	6.90	4.92	4.04	7.85	5.90	5.76	8.07	6.84	4.59	4.30	14.44	8.11	1.24	4.90	1.74	5.46	5.54	11.85	5.55	4.42
M08	3.34	13.34	5.82	6.72	8.25	3.07	8.21	2.34	13.20	9.04	5.31	5.78	3.65	6.80	3.17	9.26	14.31	3.36	8.66	2.41	3.46
M09	0.00	0.24	0.00	0.37	0.13	0.00	0.00	0.29	0.26	0.00	0.29	0.00	0.00	0.31	0.19	0.00	0.00	0.00	0.00	0.00	0.00
M10	11.66	12.06	27.65	7.13	11.01	16.31	10.34	6.66	4.84	21.03	3.99	6.74	24.40	11.88	12.64	10.29	6.12	15.77	16.21	20.67	16.75
M11	6.26	12.84	2.49	22.02	4.25	10.11	3.59	17.09	3.90	3.94	15.49	8.66	3.79	15.40	6.06	19.09	16.19	2.38	4.14	1.66	2.63
M12	0.00	3.79	0.00	0.00	0.00	0.58	0.51	0.00	0.68	0.29	0.65	0.00	0.61	0.02	0.00	1.92	0.00	0.00	0.86	0.58	0.00
M13	8.34	4.16	32.35	7.78	11.55	7.65	12.49	5.31	9.74	6.83	9.04	11.46	5.56	0.00	17.24	4.69	2.18	24.60	7.75	30.24	10.28
M14	0.00	0.00	0.00	2.60	1.13	0.62	0.34	5.15	0.80	0.00	4.02	0.00	0.02	0.00	17.47	0.00	0.01	0.00	2.57	5.84	0.13
M15	0.00	0.00	0.00	0.00	1.82	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.06	0.00	0.39	0.18	0.24	0.00	0.54	0.00	0.00
M16	2.06	2.98	0.44	1.62	2.72	5.25	4.89	3.04	3.49	1.51	5.26	5.29	3.91	4.64	2.45	1.88	3.18	1.96	7.57	0.80	2.55
M19	5.61	5.54	5.61	6.09	6.06	5.65	6.99	7.30	8.04	6.39	10.84	5.63	6.05	9.77	5.93	5.62	6.01	6.05	5.51	5.62	6.11
M20	1.84	3.43	0.17	2.74	1.66	2.38	3.47	2.22	3.42	1.95	1.86	3.37	3.23	2.32	0.77	0.97	1.35	1.13	1.96	0.83	1.37
M113	0.06	0.00	0.00	0.02	0.16	0.00	0.00	0.88	0.03	0.00	0.00	0.95	0.06	0.00	0.00	0.00	0.20	0.00	0.00	0.37	0.00
M131	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
M341	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Measure 4 (Investments in physical assets) for different regions of Italy has the highest value within the RDP and this suggests that the Italian RDPs are more strongly supported by a structural policy rather than an income support policy. The regions with the highest allocation on the measure are represented by the Lombardy region (36.19%), Veneto (35.75%), Abruzzo (35.08), Friuli Venezia Giulia (34.34%), Autonomous Province of Trento (33 %), Sicily (32.51%), Apulia (32.47%), Campania (31.45%), Liguria (30.05%). The minimum value is recorded for the Autonomous Province of Bolzano (13.05%), which we recall has an agricultural territory represented by use of 88% permanent meadows and pasture, while for the remaining regions the percentages are only higher than 20%.

Measure 5 (Damage restoration & prevention actions) is not activated by the regions of Friuli Venezia Giulia, Aosta Valley, Molise and the Autonomous Provinces of Trento and Bolzano, for the other regions, the maximum percentage is represented by the Abruzzo region (2.44%).

Measure 6 (Farm & business development) is activated by all regions and the maximum percentage is represented by the Lazio region (14.70%).

Measure 7 (Basic services & village renewal) is activated by all regions and the maximum percentages are represented by the regions of Molise (14.44%) and Umbria (11.85%).

Measure 8 (Investments in forest areas) is activated by all regions and the maximum percentage is represented by the regions of Tuscany (14.31%), Basilicata (13.34%) and Liguria (13.20%).

Measure 9 (Producers groups & organizations) is activated by eight regions and the maximum percentage is represented by the Calabria region (0.37%).

Measure 10 (Agri-environment-climate) confirms its importance being activated by all regions, with maximum percentages in the Autonomous Province of Bolzano (27.65%) and in the regions of Piedmont (24.40%), Lombardy (21.03%) and Aosta Valley (20.67%) with the minimum percentage being found in the Marche region (3.99%).

Measure 11 (Organic farming) confirms its importance from different programs being activated by all regions, with maximum percentages in the Calabria region (22.02%), Sicily (19.09%), and Lazio (17.09%) with the minimum percentage being found in the Aosta Valley (1.66%).

Measure 12 (Natura 2000 & WFD) is activated by 11 regions and the maximum percentage is represented by the Basilicata region (3.79%). Measure 13 (Areas with constraints) confirms its importance from different programs being activated by all the regions, with maximum percentages, in the Autonomous Province of Bolzano (32.35%), in the Autonomous Province of Trento (24.60%) and in the Aosta Valley (30.24%). The minimum percentage is found in the Apulia region not reaching even 0.01%.

Measure 14 (Animal welfare) is activated by 13 regions with the highest percentages in the Sardinia region (17.47%) Aosta Valley (5.84%) and Lazio (5.15%).

At the national level, there seems to be a very significant paradox as the regions that in terms of numbers represent the bulk of the Italian animal husbandry are precisely those that have renounced this application. Indeed, in Lombardy the measure is not active, Veneto (0.13%), Emilia Romagna (0.62%), and Piedmont (0.02%), which demonstrates that this measure in the previous programming led to very important application difficulties. Measure 15 (Forest-environmental-climate) is activated by 7 regions with the highest percentage in the Campania region (1.82%).

Measure 16 (Cooperation) is activated by all regions and the maximum percentage is represented by the regions of Umbria (7.57%), Molise (5.29%), Marche (5.26%), and Emilia Romagna (5.25%), with the lowest percentage found in the Autonomous Province of Bolzano (0.44%).

Measure 19 (LEADER/CLLD) confirms its importance in various programs; Marche (10.84%), Apulia (9.77%), Liguria (8.04%), and Lazio (7.30%), with the minimum but still an important percentage found in the Umbria region (5.51%).

Measure 20 (Technical assistance) in support of the Managing Authorities of Rural Development Programs has its maximum percentages in the regions of Basilicata (3.43%), Friuli Venezia Giulia (3.47%), Liguria (3.42%), and Piedmont (3 , 23%), while the minimum is in the Autonomous Province of Bolzano (0.17%).

Finally, regarding the measures carried over from the previous programming, it is noted that the former Measure 113 (Early retirement) is activated by 9 regions with a percentage less than one unit and the measures ex 131 and ex 341 are activated by 1 region with a percentage less than one unit. Finally, in table 5 the last progress of the EARDF expenditure, for the second quarter of the year 2019, is reported. It can be seen that the regions of Emilia Romagna, Umbria, Veneto, Molise, Sardinia, Calabria and the Autonomous Provinces of Trento and Bolzano, on the date of 06/30/2019 have reached

the expenditure target set according to the financial rule “N+3”, as discussed previously. The Region that presents serious difficulties in achieving the objective set before 12/31/2019 is Apulia, due to administrative difficulties in implementing measure 4 relating to investments intangible fixed assets which have even led to the resignation of the competent regional councilor (Frascarelli, 2019b). Unfortunately, as always, the financial advances of rural development programs reveal the real financial situation compared to that which was agreed upon during the approval of the program. The financial state of the art cannot provide data on the progress of the physical and economic indicators of the companies; for that, we refer to annual reports that program management authorities must communicate to the European Commission.

Table 5. Financial progress of the Italian RDPs as of 06/30/2019 (Source: Frascarelli, 2019c).

Programming period 2014-2020		Progress of public expenses actually sustained				Expenditure to be implemented by 31 December 2019	
Program	Program Overall budget		Cumulative expenditure (from 1 January 2015 as of June 30, 2019)		Overall equipment advancement%	Public expenditure to be spent by 12/31/2019	EAFRD quota with automatic disengagement risk at 12/31/2019
	Public expenditures	EAFRD	Public expenditures	EAFRD			
Bolzano	361,672,078	155,953,000	207,735,751	89,306,731	57.40%	0	0
Emilia Romagna	1,174,315,863	506,365,000	446,339,023	190,756,414	38.00%	0	0
Friuli Venezia Giulia	292,305,195	126,042,000	93,060,801	40,060,096	31.80%	16,915,444	7,293,939
Lazio	822,298,237	354,575,000	241,078,511	103,435,388	29.30%	49,428,176	21,313,429
Liguria	309,657,980	133,091,000	72,199,975	30,890,070	23.30%	44,467,747	19,112,238
Lombardy	1,142,697,124	492,731,000	367,900,899	156,316,205	32.20%	66,798,706	28,803,602
Marche	697,212,430	300,638,000	146,525,302	63,082,256	21.00%	53,207,618	22,943,125
Piedmont	1,078,937,848	465,238,000	386,504,939	165,997,089	35.80%	20,392,365	8,793,188
Tuscany	949,420,223	409,390,000	325,590,392	139,984,800	34.30%	32,057,417	13,823,158
Trento	297,575,617	127,898,000	133,931,117	57,414,599	45.00%	0	0
Umbria	928,552,876	400,392,000	329,893,967	141,867,380	35.50%	0	0
Aosta Valley	136,924,861	59,042,000	47,235,468	20,318,533	34.50%	4,321,853	1,863,583
Veneto	1,169,025,974	504,084,000	577,808,432	248,522,654	49.40%	0	0
Total of Developed Regions	9,360,596,306	4,035,439,000	3,375,804,576	1,447,952,216	36.10%	287,589,326	123,946,263
Abruzzo	479,465,592	230,143,484	102,284,308	48,912,323	21.30%	58,601,253	28,128,601
Molise	207,750,000	99,720,000	84,611,025	40,397,409	40.70%	0	0
Sardinia	1,291,510,417	619,925,000	528,317,177	253,121,649	40.90%	0	0
Total of Regions in Transition	1,978,726,009	949,788,484	715,212,510	342,431,381	36.10%	58,601,253	28,128,601
Basilicata	671,376,860	406,183,000	166,535,802	99,711,172	24.80%	87,426,063	52,892,768
Calabria	1,089,310,744	659,033,000	461,300,032	276,379,506	42.30%	0	0
Campania	1,812,543,802	1,096,589,000	537,336,089	323,586,499	29.60%	146,118,834	88,401,895
Apulia	1,616,730,579	978,122,000	341,680,504	205,110,132	21.10%	268,381,317	162,370,697
Sicily	2,184,171,901	1,321,424,000	645,414,570	388,707,656	29.50%	178,101,869	107,751,631
Total of Less Developed Regions	7,374,133,884	4,461,351,000	2,152,266,997	1,293,494,965	29.20%	680,028,083	411,416,990
PSR a livello nazionale	2,084,734,479	938,130,516	702,357,167	315,181,382	33.70%	93,214,652	41,946,593
Rete Rurale Nazionale	114,665,194	59,671,767	26,228,739	13,649,436	22.90%	19,239,584	10,012,279
Total National Level Programs	2,199,399,674	997,802,283	728,585,906	328,830,818	33.10%	112,454,235	51,958,872
Total	20,912,855,872	10,444,380,767	6,971,869,990	3,412,709,380	33.30%	1,138,672,897	615,450,727

4. THE FRAMEWORK OF RURAL DEVELOPMENT PROGRAMME (RDP) FUNDING IN CALABRIA

4.1. The Rural Development Programme of Calabrian Region for 2014-2020 programming period

The Rural Development Program of Calabrian Region, under the 2014/2020 community programming period, was approved by the European Commission on November 24th, 2015. This occurred almost 2 years after the start of the programming (01/01/2014). This demonstrates the fact, as previously highlighted by several authors in the second chapter, that the procedures for the approval of the program are not simple nor is its implementation. From 2015 to date, the same program has undergone 5 changes, respectively on May 23rd, 2017, November 14th, 2017, March 2nd, 2018 and the last version, No. 5, which dates back to October 8, 2018. These changes mainly concerned the financial provisions for surface area measurements. Consider that in the previous programming, the Rural Development Program underwent 8 changes, throughout the programming period 2007/2013, including the necessary change due to the "new challenges" set at the European level following the reform of the Health Check and Recovery Plan.

The RDP 2014/2020 for Calabria, as foreseen by the EU Regulation 1305/2013, begins its journey from the ex-ante evaluation. In addition to describing the long approval process, it correlates the objectives set forth by the Community regulations and the needs of the regional territory according to the latest official statistical surveys in accordance with what emerged from the ex-post evaluation of the previous RDP. The interesting data for the purpose of preparing this document mainly refers to the description of the reference territory from a physical, economic, political, and social point of view. The interesting data is relative to both the financial progress and the physical progress of the previous program.

Unfortunately, from the point of view of physical monitoring, there is no data relating, for example, to how much 'new' area is dedicated to tree cultivation in the regional territory as a result of the investments, to what extent the farming machinery or parks have been renewed, to what extent rural buildings used for business have been modernized and so on. There is no data, apart from the numerical data that can tell us, for example, how many companies have benefited from the financing provided by a

single measure. This topic would need particular attention in order to evaluate structural policies at the regional level.

From the physical point of view, the territory of the Calabrian Region is in the process of drawing up its program. However, according to what was noted by the last General Agricultural Census in 2010, is represented by a total agricultural area (TAA) of 706,480.04 hectares and a usable agricultural area (UAA) equal to 549.250 hectares, which represent 8.5% of the national TAA and 4.1% of the national UAA.

The composition of the regional UAA demonstrates high specialization with respect to agricultural orchard cultivations, which cover an extension of 250.983,71 hectares equal to about half of the regional UAA (45.7%). Arable land uses 28.4% of regional UAA, permanent meadows and pastures 25.6%. Among the agricultural orchard crops, the olive tree is the most representative both in terms of farms involved, 113,307, and in terms of committed UAA, equal to 185,914 hectares (74.5%). The fruit trees are present in 11,736 farms and occupy 7.4% of the UAA of agricultural wood crops. The grapevines are cultivated in 13.413 farms and occupy an additional 4% of the UAA of the crops under observation. The forest area and other wooded areas in Calabria extend over 612.931 hectares and represent 40.64% of the total regional area (national 34.74%).

From a demographic point of view, based on declarations in the drafting of the program, the Calabrian territory has detected a decrease in resident population in the decade 2000-2010. This was detected in the 409 municipalities forming the regional territory and occurring mainly in the mountainous areas (-2.6%) and in rural areas this phenomenon was more pronounced (-3.4%). The Calabrian regional municipal administrations are classified as having between 1,000-5,000 inhabitants in the majority of cases, while only 21 regional municipalities are classified as having a population greater than 15,000 inhabitants.

The regional territory, in the current rural development program, has been re-classified, deciding that the “urban and peri-urban areas” (class “A”) coincide with the five provincial capital cities (Cosenza, Catanzaro, Crotona, Vibo Valentia, and Reggio di Calabria). The changes in the three classes of regional rural areas (B, C, and D) are due to the fact that the new classification methodology has quantified the forest area as well as the agricultural area as a “rural area”. This determines a greater rural surface in the regional municipalities and, consequently, an increase in the municipalities that fall into

areas where the rural population has a more significant weight than the total population (which corresponds to the rural areas "D"). This reclassification process led to a reduction in the number of municipalities in the "B" area by 33 units, with a consequent reduction in the surface area in the "B" area by 43.5%, compared to the previous programming period. A further reduction of the common of class "C" of 15 units, with a consequent reduction of the surface falling in class "C" of 33.8%. And an increase in the number of municipalities in class "D", which grew by 49 units, with a consequent increase in the surface area in the relative class of 40.8%.

From a social point of view, the data relating to the employment rate (41.6%), recorded in 2012, are quite worrying. They show a difference of 15 percentage points compared to the national average and the most critical data is recorded in the youth unemployment, which is equal to 19.3% in the same observation period and has a percentage almost double that of the national (10.7%) and European (10.5%) contexts. Employees in the region, surveyed in 2012, have a high concentration rate within the agricultural sector equal to 9.2% of all those employed regionally (Italy 3.4%). Those employed in the forestry sector equate to 1.4% of all those employed in the region (Italy 0.2%). According to the program, the employment weight of the agricultural sector shows, however, low labor productivity. This is measured in Annual Work Units (AWU), as an average of the values of the 2009-2011 period of the value-added/AWU, with € 13.354,4 €/AWU which is equal to 64% of the national reference value (€ 20,897.7/AWU).

The situation of the agricultural labor force, which emerges from the 2010 Census, records the employment of 280,110 people, equal to 51,610 AWU. Most of the employed are male (51.4%) even though the region is characterized by having a higher than average share of female employees, which is equal to 37.1% (national 33.2%; European (27- 29.8%). The Calabrian farms, also given their average size, are characterized by more intensive use of labor provided by the tenants (49%) and make less use of non-family labor, employing 14,530 people outside their family (5.2% of the total employed persons). The standard per capita working days in the region are lower for both the family labor, with 259.488 units, conducive to 41 days per capita, (national 69), and for the non-family labor with 99.327 units, conducive to 50 days per capita. (national 53). Only 19.8% of regional companies make use of non-family labor, while 47.7% employ less than 50 days of family labor.

From an economic point of view, Calabria has an accentuated gap with respect to national and European values, both in terms of per capita GDP data relating to a difference of about € 8,800 compared to the national value. This continues to be seen in the poverty index measured in 2011, which is evident in 46.5% at the regional level is both at risk of poverty or social exclusion, compared to 28.2% at the national level, and 24.2%, at the European level. The regional structure of the economy focused primarily in the tertiary sector also presents a strong representation of the primary sector which in 2011 shows values of 4.12% of the total, national (1.96%). This is confirmed by the data on agricultural employment which in the same year records a value equal to 11% of the regional total, national 3.7%.

The number of farms surveyed in 2010 is 137,790, decreasing from a numerical point of view, compared to the previous 2000 census but with slightly larger dimensions. However, the average regional farm size in Calabria still remains among the smallest when compared to other Italian regions. The land schemes have become more flexible, with a shift towards forms of rented land, although the process is less dynamic than in the rest of Italy. Most farms (84.7%) continue to occupy only owned land, accounting for 64.4% of the UAA. Regional farms have an average UAA of 4 hectares, equal to half of the national average (7.9). The regional farms have a greater concentration in the smaller area classes, with 57,882 farms having a size less than 1 hectare.

Taking into account the physical structure of the farms, their average economic size (measured in euros by standard output) is €14,277, against a national average of € 30,514 and European (27) of € 25,450.

The diffusion of small-sized farms (both physical and economical) is easily associated with a further structural feature represented by the weight assumed by farms with prevailing self-consumption by members of the agricultural farm families equaling or exceeding 50% of farm products, which account for 62.3%. The regional farms that are sold products to the market in 2010 are 69,039 and represent just over half of the total (national 64.0%). Unlike the national context, the most common sales channel is direct sales, which involves 44,192 companies (64% of the companies that sell their products). The other sales channels are used by 32,371 regional companies, which represent 47% of companies selling their products (national 85.0%). In particular, in the region, 6% of the farms selling their products sell those products to other farms, 11% to industrial

companies, 28% to commercial enterprises, while only 7% (national 32%) sells or gives to associative bodies.

The regional gross saleable production (GSP), equal to 2.059 billion euros (average 2011-2012), is represented by 78% in four main sectors, among which three referred to agricultural orchard crops: the olive sector (24.25%), that of citrus fruits (23.43%), fruits and vegetables (17.25%) to which zootechnics are added, both from milk and meat (12.44%).

In particular, as far as the agricultural sector is concerned, the regional olive-growing sector assumes an important weight on national production, both in terms of the olive-growing areas they represent (17% of the national olive grove areas), and in terms of olive production (26.6 % of national production), and of oil produced (28% of the national total). The high levels of citrus fruit cultivation, include products representing high levels in the total national production. In particular, citrus fruits such as *citrus Clementina* (clementine), which are recognized by a PGI (Protected Geographic Indication), and products such as *citrus medica* (Cedro) and *citrus bergamia* (Bergamot), exclusive in the national context and in that of biodiversity protection, currently at risk of extinction.

The regional agri-industrial system is predominantly represented by the Calabrian plains, which fall into the “B” areas of the regional territory and include the Sibari, Lamezia, Gioia Tauro and Crotonese plains. These areas host 17% of the agricultural farms and regional UAA with the highest share of UAA being concentrated in the cultivation of agricultural orchard crops. In the “C” areas, where 27.1% of farms and 23.9% of the regional UAA are present; the most representative crops are agricultural orchard crops (45.6%) and arable crops (37.5%). In the “D” areas, we find 51.8% of the farms and 54.7% of the UAA. In these areas specialized use of the UAA is observed in permanent meadows and pastures (35.3% of the UAA), which translates into the presence of more extensive animal husbandry and the presence of pastoralism (typical of the mountainous areas of the region). Arboriculture of woods annexed to the farms is concentrated in the same areas representing 60% of the regional total. In the "A" areas, agriculture accounts for 4.2% of the regional UAA and occupies areas surrounding the few large urban centers which represent short-range consumer markets that are potentially capable of absorbing agricultural production along with concentrated processing facilities and food marketing.

In the regional RDP, the operational effectiveness of both the Quality Production Districts (QPDs) and the governance methods adopted by the Integrated Supply Chain Products (ISPs) in the previous programming, which, despite having had excellent results in numerical terms, have not led to the same success with respect to strengthening the sales capacity of the products.

The specific context of the mountain areas shows a good capacity for the permanence of the agricultural economy, due in part to the intervention of the RDP. This intervention contributes to the performance of territorial and environmental protection and resilience to the effects of climate change. It allows for the availability of agricultural and food production including those produced by extensive livestock farming (sheep farming) which offer an important basket of quality products for the markets. The 35,809 farms that fall within the mountain areas (ISTAT) have a weight on the regional total of 13% (national 8%), being more representative both in terms of UAA, working days and also of standard production value, which in the region reaches 8% of the regional value (national 4%).

Another success declared by the program is the intensity of organic farming systems adoption (5%) by the farms, national (2.7%), which in turn represents a UAA of 17.7% compared to the regional total (national 6.1%, European 3.7%). The crucialness remains on the ability of these entrepreneurs to sell their organic (“Bio”) products and the absence of large market opportunities for these products in the regional territory.

With regards to the other certified Protected Destination of Origin/ Protected Geographic Indication (DOP/IPG) products, a low level of diffusion is detected despite the region holding 15 regional awards for DOP/IPG quality products, out of the 245 Italian total, and a further 18 awards for DOP/IGP wines (RDP 2014/2020 of the Calabria Region).

The profitable activities connected to those of cultivation and breeding, through which it is possible to observe the degree of diversification and the multi-functionality of the agricultural farms, are practiced by 2,344 farms. That is just under 2% of the total, an undersized value if compared to the national average figure, in which the correlated remunerative activities are practiced by just under 5% of the farms.

The management of irrigation water resources directly involves 32,326 Regional farms (23% of the regional total) that use irrigation systems. The total irrigated UAA in the region is 74,710 hectares; representing 13.6% of the total area.

The regional livestock population, which is distributed in 10,189 farms, has a stock of 147,720 adult livestock units (LUs), 1.5% of the national LUs. By comparing the total cattle LUs raised on the regional UAA, Calabria shows a load of 0.26 /hectare, much lower than the national reference value (0.77) and European (0.78).

The agricultural training of regional farm managers is mainly to be associated with basic training (87.3%). For heads of farms under the age of 35, the possession of complete agricultural training is more consistent, while it is noted that in the last ten years there has been a process of "qualitative" generational turnover in the companies, with company managers without qualifications that go from 19.8% to 10%, while those who have a degree go from 3.2% to 6.2%. The contribution to new agricultural start-ups led by young farmers brought on by the intervention of the RDP 2007/2013 is significant; as of 31/12/2015, it has initiated support for the creation of over 1,212 new farms.

The gross fixed investments of Calabrian farms, recorded by ISTAT in 2011, amounted to € 317.3 million, which is 3% of the national number € 10,733 million. If compared to the added value of agriculture, forestry and fishing productions, they represent 28.03%, against a national value of up to 40.7%. These numbers highlight the slow renewal of the physical capital of Calabrian farms which in turn slows down the competitiveness recovery. This, at least in part, can explain the lower productivity of production factors, which are confirmed by the main asset indicators. The RDP 2007/2013 contributed to the structural modernization of regional farms, supporting around 1,400 interventions, of these, over 800 were aimed at introducing new products and / or new techniques. It also supported innovation cooperation programs that introduce new products and/or new techniques that directly involved 23 farms.

As of 2012, the regional tourism supply sector numbered 195,141 beds, representing 4% of the total number of national beds.

The regional policy, based on the opportunities provided by the current Rural Development Programming, has decided to adopt 16 of the measures projected by the Community reference regulation, including the measure related to the technical assistance of the RDP for the 2014/2020 programming. In the table below (Table 6), the measures and their interconnections including the priorities of the interventions and the relative directives focus area are represented in order to help explain the complexity of the new programming period for rural development at the European level. In the

current programming, it can be seen how the measures cannot follow a sectoral order but instead take into account the different priorities of interventions, which focuses our attention on how some of them are transversal to the majority of the objectives set. Unlike previous programming period which grouped the measures by priority intervention axes. In all, the measures M01 - Transfer of knowledge and information actions (art. 14) which concerns 15 focus areas of reference and M02 - Consultancy, replacement and assistance services for farm management (art.15) with 12 focus area of reference, followed by the M04 - Investments intangible fixed assets (art. 17), the M16 - Cooperation (art. 35) and so on. Instead, for the LEADER programming a single measure M19 - Support for local development LEADER - LDPT - local development of a participatory type) [Article 35 of Regulation (EU) n. 1303/2013] concerns a single focus area 6B) Stimulating local development in rural areas.

It is necessary to specify that the financial monitoring of the measures projected in the current rural development program, is carried out on the basis of separate financial chapters by size and focus area. This is done to allow the expenditure to be identified by grouping it together by measure and therefore with results in the financing of the measure in different focus areas, as well as by grouping it by focus area and then results from the financing of the individual focus area represented in the various intervention measures.

Table 6. Priorities and Focus Area activated in the current programming period by the Calabrian Region. Elaborations on RDP Calabria 2014/2020.

Measure	PRIORITY																	
	P1: Promote the transfer of knowledge and innovation in the agricultural and forestry sectors and in rural areas			P2: Strengthen the profitability of farms in all regions and the competitiveness of agriculture in all its forms and promote innovative technologies for agriculture farms and sustainable forestry management			P3: Promoting the organization of the agri-food chain, including the processing and marketing of agricultural products, animal welfare and risk management in the agricultural sector		P4: Preserving, restoring and enhancing ecosystems connected to agriculture and forestry			P5: Encouraging the efficient use of resources and the transition to a low-carbon and climate-resilient economy in the agri-food and forestry sectors			P6: Working towards social inclusion, poverty reduction and economic development in rural areas			
	FOCUS AREA																	
	1A) Stimulating innovation, cooperation and development of the knowledge base in rural areas	1B) Strengthening the links between agriculture, food production and forestry, on the one hand, and research and innovation, on the other, also in order to improve environmental management and performance	1C) 1C) Encourage lifelong learning and vocational training in agriculture and forestry	2A) Improve the economic performance of all farms and encourage the restructuring and modernization of farms, in particular to increase market share and market orientation as well as the diversification of activities	2B) Encourage the entry of suitably qualified farmers in the agricultural sector and, in particular, generational change	3A) Improving the competitiveness of primary producers by better integrating them in the supply chain food farming through quality schemes, the creation of added value for agricultural products, the promotion of products in local markets, short supply chains, producer associations and organizations and inter-professional organizations	3B) Support the prevention and management of business risks	4A) Safeguarding, restoring and improving biodiversity, including in the Natura 2000 areas and in areas subject to natural constraints or other specific constraints, in high natural value agriculture, as well as the landscape of Europe	4B) Better management of water resources, including the management of fertilizers and pesticides	4C) Prevention of soil erosion and better soil management	5A) Making water use in agriculture more efficient	5B) Making energy use more efficient in agriculture and the food industry (not activated by the program)	5C) Promote the supply and use of renewable energy sources, by-products, waste materials and residues and other non-food raw materials for the purpose of the bioeconomy	5D) Reduce emissions of greenhouse gases and ammonia produced by agriculture	5E) Promote carbon conservation and sequestration in agriculture and forestry	6A) Promote the diversification, creation and development of small businesses as well employment	6B) Stimulating local development in rural areas	6C) Promote the accessibility, use and quality of information and communication technologies communication (ICT) in rural areas
M01 - Transfer of knowledge and information actions (art. 14)	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
M02 - Consultancy, replacement and assistance services for farm management (art.15)	X			X	X	X		X	X	X	X	X	X	X	X			
M03 - Quality schemes for agricultural and food products (Article 16)						X							X	X				
M04 - Investments in tangible fixed assets (art. 17)				X	X	X		X	X	X		X						
M05 - Restoring agricultural production potential damaged by natural disasters and catastrophic events and introduction of adequate prevention measures (Article 18)							X											
M06 - Development of farms and businesses (art. 19)				X	X							X				X		
M07 - Basic services and renovation of villages in rural areas (Art. 20)								X	X	X		X			X		X	
M08 - Investments in the development of forest areas and in improving the profitability of forests (articles 21 to 26)			X					X	X	X				X				
M09 - Establishment of associations and producer organizations (Article 27)						X												
M10 - Agri-climate-environmental payments (art. 28)								X	X	X				X				
M11 - Organic farming (art. 29)								X	X	X								
M13 - Compensation in favor of areas subject to natural constraints or other specific constraints (art. 31)								X	X	X								
M14 - Animal welfare (article 33)						X												
M16 - Cooperation (art. 35)	X	X		X	X	X		X	X	X								
M19 - Support for local development LEADER - (SLIP - community-based local development) (Article 35 of Regulation (EU) n. 1303/2013)																	X	

4.2. Distribution of public funding under the Rural Development Programme of Calabria Region

In this chapter data referring back to the previous 2007/2013 programming period are provided starting from the ex-post evaluation report of the RDP 2007/2013 (Lattanzio Advisory Public Sector, 2016). The data for examination below is based on the methodological guidelines contained in the report for the ex-post evaluation of the 2007-2013 Rural Development Programs (EEHRD, 2014). First of all, it is necessary to specify that the previous Community programming period RDP 2007/2013 ended financially on 12/31/2015 (Table 7). This is an important bit of information to know regarding the expenses from 01/01/2014 to 06/30/2016. Aside from some surface area measurements, they mainly refer to financial commitments previously taken on (so-called drag-and-drop measures).

The results obtained from the previous community planning as of December 31st, 2015, recorded important milestones in the first axis. In particular, the measure relative to the modernization of agricultural holdings (Mes. 121), with which, 1,314 farms have been subsidized according to the data reported in the aforementioned evaluation. Additionally, 1,212 newly established companies deriving from the application of the measure concerning the setting up of young farmers (Mes. 112). Another noteworthy measure within the axis is the one which concerns increasing of the added value of agricultural and forestry products (Mes. 123) which allowed the financing of 154 agri-industrial companies. The measure dedicated to the improvement and development of infrastructures together with the development and adaptation of agriculture and forestry (Mes. 125) supported modernization investments for 422 exclusively public beneficiaries.

With regard to the second axis, it is noted that the measures projected are indeed the most requested by agricultural farms. In fact, the numbers of beneficiaries of these interventions (Mes. 211 and Mes. 212) are respectively 5,958 and 6,963. These measures relate to compensatory allowances in mountain areas and in disadvantaged areas other than the mountain areas. Regarding the agri-environmental measures, there are 11,951 requests (Mes. 214.1), which, as mentioned above, include various actions including integrated agriculture organic farming (Mes. 214.2), and genetic conservation of livestock (Mes. 214.4). Also noteworthy, with regards to this axis, is the measure dedicated to animal welfare (Mes. 215) which funded 266 livestock farms. The forestry measures included in this axis relative to the measure on afforestation of agricultural

land (Mes. 221) were mainly provided for by commitments made in the previous 2000/2006 programming and provided funding to a total of 535 initiatives.

Table 7. Financial Allocation of the Calabrian RDP 2007/2013.

Measure	Approved financial measure (v. 8) € mln
111	9,884,039
112	32,785,750
113	1,661,715
114	5,833,333
115	5,378,619
121	348,880,656
122	24,268,374
123	174,666,666
124	6,778,861
125	77,442,357
126	3,683,333
132	3,017,156
133	17,866,792
Tot. Axis I	712,147,651
211	38,631,210
212	44,200,636
214	250,300,733
215	12,000,000
216	3,833,333
221	45,096,325
223	7,869,728
226	33,750,000
227	28,874,578
Tot. Axis II	464,556,543
311	116,396,028
312	6,970,670
313	11,317,274
321	40,737,365
323	23,299,897
331	2,665,806
Tot. Axis III	201,387,040
411	19,300,000
412	2,300,000
413	55,627,000
421	5,514,938
431	7,627,500
Tot. Axis IV	90,369,438
511	20,814,752
Total	1,489,275,424

The measure related to the afforestation of non-agricultural land (Mes. 223), although not the most successful, financed 25 initiatives. Instead, interesting results were obtained by the structural measures relating to the reconstitution of potentially preventive forestry interventions (Mes. 226) and to support non-productive investments in the forestry sector (Mes. 227).

Regarding the third axis, quite interesting results are found in the measure relating to diversification into non-agricultural activities (Mes. 311) with the funding of 398 agritourism companies, to the extent that they are related to essential services for the economy and the rural population (Mes. 321) with the funding of 221 initiatives. Also significant is the measure regarding the protection and requalification of the rural heritage (Mes. 323) with the funding of 111 initiatives.

We confirm what has already been said for the fourth axis dedicated to LEADER programming within which 13 Local Action Groups or LAGs were formed. These LAGs, in turn, have financed 264 initiatives related to the measure of competitiveness (Mes. 411), 138 initiatives relating to the measure dedicated to the environment and land management (Mes. 412), 334 initiatives related to the measure dedicated to the quality of life and diversification of the rural economy (Mes. 413).

In regard to the 2014/2020 community programming, the approved financial budget is shown below (Table 8).

It is possible to note right away that the main financial resources are concentrated on surface area measurements, affecting approximately 31.75% of the total financial allocation, not taking into consideration the financial envelope related to the surface area measurements that are located within the forestry measures (Mes. 8); such measures (Miss. 10-11-13 and 14), as mentioned above, have a very similar implementation to the measures envisioned for the first pillar of the CAP. Among the strictly structural measures, it emerges that the only measure dedicated to investments intangible fixed assets (Mes. 4), concerns 28,90% of the total financial allocation. Following the importance of the measure dedicated to forestry, within which they are financially allocated, as mentioned, there are surface and structural measures (Mes. 8). These surface and structural measures related to LEADER programming (Mes. 19) concern respectively the total allocation for about 6.7% and 6%. Worthy of note is the financial endowments attributed to the measure relating to the development of farms and businesses (Mes. 6), involving 5.18% of the total budget, the measure relating to basic services and renovation of villages in rural areas (Mes. 7) which affects 4.04%, and finally the measure dedicated to the technical assistance of the Calabrian RDP which affects 2.73%.

Table 8. Financial framework of the RDP (5th and latest version). Elaborations on the Calabrian RDP for 2014/2020.

Measures	Description of measure	Financial allocation EAFRD	TOTAL Financial allocation share
M01	Actions regarding the transfer of Knowledge and Information	6,050,000	10,000,000
M02	Consultancy, replacement and assistance services for farm management	8,280,000	13,685,942
M03	Quality schemes for agricultural and food products	11,169,000	18,461,158
M04	Investments in tangible assets	190,490,410	314,860,180
M05	Restoring agricultural production to areas potentially damaged by natural disasters / catastrophic events and prevention	6,050,000	10,000,000
M06	Development of farms and businesses	34,141,590	56,432,380
M07	Basic services and renovation of villages in rural areas	26,650,250	44,050,000
M08	Investments in the development of forest areas and improvement of the profitability of forests	44,293,210	73,211,930
M09	Establishment of associations and producer organizations in the agricultural and forestry sectors	2,420,000	4,000,000
M10	Agri-climatic-environmental payments	47,000,000	77,685,950
M11	Organic farming	145,100,000	239,834,710
M13	Compensation in favor of areas subject to natural constraints or other specific constraints	51,243,500	84,700,000
M14	Animal Welfare	17,150,000	28,347,110
M16	Cooperation	10,708,500	17,700,000
M19	LEADER - LAGs	40,141,750	66,350,000
M20	Technical Assistance	18,025,000	29,793,389
M113	Early retirement (RDP 2007/2013)	119,790	198,000
Total		659,033,000	1,089,310,749

As of September 26th, 2019, the financial progress of the Calabrian RDP of 2014/2020 is shown in Table 9, from where the surface areas/head measurements can be seen immediately (Mes. 10-11-13 and 14). Today they represent a level of expenditure exceeding 50% of their planned financial allocation, even for the measure relating to compensatory allowances (Mes. 13), it is noted that the financial envelope has been exceeded by 3.50 percentage points, and this will certainly be the subject of the next revision of the financial support plan of the program.

The figure regarding the measure of investments in tangible fixed assets (Mes. 4) is interesting. It is within this measure, that we find the measure relating to the modernization of agricultural holdings which has an impact on the expenditure of approximately 27 euro million.

Table 9. Financial progress of the Calabrian RDP 2014-2020 on 09/26/2019. Elaborations on Agricultural Distribution Agency for the Region of Calabria (ARCEA) data.

Measure	Total spent	Total financial endowment RDP	% of progress
1	121,677.72	10,000,000.00	1.22
2	-	13,685,942.00	0.00
3	90,957.17	18,461,158.00	0.49
4	95,987,987.20	314,860,180.00	30.49
5	969,589.07	10,000,000.00	9.70
6	20,523,119.69	56,432,380.00	36.37
7	4,543,860.57	44,050,000.00	10.32
8	14,720,793.68	73,211,930.33	20.11
9	-	4,000,000.00	0.00
10	44,985,768.36	77,685,950.00	57.91
11	186,810,018.31	239,834,710.00	77.89
13	87,668,166.62	84,700,000.00	103.50
14	15,232,307.48	28,347,110.00	53.73
16	781,019.24	17,700,000.00	4.41
19	6,235,351.56	66,350,000.00	9.40
20	10,413,066.72	29,793,389.00	34.95
ex 113 (2007/2013)	-	198,000.00	0.00
Total	489,083,683.39	1,089,310,749.33	44.90

In Table 10 we can see the impact of the community directive measures and their drag on current programming. This table shows that 48.70% of the expenditures made since January 1st, 2014 (financial start of the new programming) to date, have had an impact of 21.86% on the total amount of funding. This is due to commitments made by the previous programming period of 2007/2013. In addition to the data relating to surface area measurements (Mes. 8-10-11 and 13), which have been thoroughly discussed, the relevant data applies to measure 4 (43 Mln). This demonstrates that the beneficiaries encounter various complications on the financial-administrative path when carrying out the investment plan which was proposed during the project presentation and approved by the administration. These impediments are mainly due to the fact that the beneficiaries, not seeing the publication of projects periodically but with distances of years, do not adopt these projects to the real needs of the company but in fact overextend the financial capacity of their company to participate in them. The result is that in the period allowed for the implementation of the project (usually 12 months plus any eventual extensions) despite the possibilities of payment provided (advance, payment, and balance) they still fail to financially manage the investment also for the reasons expressed above regarding the question of additional expenses, like VAT for example. Another age-old question is clearly the bureaucracy, understood as a period of preliminary investigation that intervenes beginning with the requests for support up to

the approval and on the final ranking of the beneficiaries admitted to financing. This bureaucracy continues subsequently on the payment requests that must meet different types of preliminary investigations ranging from administrative control of all the applications presented to the on-the-spot inspections carried out on a sample basis and to the subsequent and final inspection by the Paying Entity for the provision of the request.

Table 10. Impact on financial progress as of September 26th, 2019. Elaborations on ARCEA data.

<i>a) Commitments to dragging 2007/2013</i>	
Measures	Total
1	121,677.72
3	27,550.58
4	43,669,290.95
6	7,053,119.69
7	4,085,855.49
8	14,212,077.22
10	9,073,558.84
11	130,947,551.49
13	23,188,309.65
14	2,981,614.29
16	781,019.24
19	1,463,522.52
20	595,042.96
Total	238,200,190.64
<i>b) New commitments 2014/2020</i>	
Measures	Total
3	63,406.59
4	52,318,696.25
5	969,589.07
6	13,470,000.00
7	458,005.08
8	508,716.46
10	35,912,209.52
11	55,862,466.82
13	64,479,856.97
14	12,250,693.19
19	4,771,829.04
20	9,818,023.76
Total	250,883,492.75

4.3. Measure 4.1.1- Investments in agricultural holdings

Pursuant to art. 17 of the EU Regulation 1305/2013, the Calabria RDP 2014/2020 activated the measure 4.1.1. Intended in particular for interventions that improve the

overall performance and sustainability of the farm, with particular reference to investments in modernization, restructuring, and innovation within farms aimed at improving competitiveness and corporate sustainability. This measure can be activated throughout the region. In order to achieve the objectives, as set by these measures, the planned interventions are summarized in Table 11.

Table 11. Measure 4.1.1. Investments in agricultural holdings.

-
1. Land improvement linked to production, soil conservation, crop protection, protection of farms, and farm equipment
 2. Construction, acquisition, restructuring/improvement/expansion of buildings for processing, conversions, storage and marketing of the farm's agricultural and livestock products
 3. Purchase of new machinery and equipment
 4. Construction and renovation of structures and plants for the storage and treatment of wastewater coming from company activities, including structures built with technologies capable of reducing greenhouse gas emissions
 5. Acquisition of hardware aimed at the adoption of information and communication technologies (ICT), electronic commerce (e-commerce)
 6. Equipment aimed at reducing the environmental impact of agriculture through soil conservation (conservation agriculture) and safeguarding agricultural / livestock biodiversity
 7. Adoption of defence systems aimed at protecting crops from damage caused by wild animals and protecting farms against predators
 8. Water treatment plants for the treatment of farming wastewater deriving from business activity transformation
 9. Energy efficiency (thermal insulation of buildings, standardisation / efficiency improvement and / or replacement of heating, air conditioning, power supply, motive power and lighting, systems and functional equipment to contain energy consumption
 10. Purchase of used equipment and systems
 11. General expenses related to investments referred to in numbers from 1 to 10, such as fees for professionals and consultants, fees for consultancy on environmental and economic sustainability, including feasibility studies. Overhead expenses, including feasibility studies, are allowed and limited to a 9% of the total eligible expenditure of the subsidized intervention
 12. Acquisition of computer programs aimed at the adoption of information and communication technologies (ICT), electronic commerce (e-commerce)
-

Source: Calabrian 2014-2020 Rural Development Programme (RDP).

The beneficiaries of the measure are agriculturists and/or farmers conducting agricultural activities, who must comply with a series of requirements, unlike previous community programs, as mentioned in the previous chapters.

In particular, the agriculturist or farmer, a potential beneficiary of the measure, in order to participate in the calls for project applications issued by the Calabrian Region, must

represent a regularly established farming activity registered with the Chamber of Commerce. The farmer also must hold a position as a Professional Agricultural Entrepreneur (PAE) or Direct Grower (DG) or agricultural employer, so it is clear that the measure sets a minimum participation selection ceiling compared to the farms surveyed at the regional level in the 2010 General Census of Agriculture, where the presence of 137,790 farms in the regional territory was recorded.

This selective level is also set in the subsequent requirements, where Standard Production is used (this calculator allows sizing a farm based on the average farm production obtainable from the type of land use representative of the farm). In this case the farm that is about to present a request for support must, on the date of presentation of the project, have a minimum economic company size that must be greater than or equal to 12,000 euros of Standard Production (in areas subject to natural disadvantages) or greater than or equal to 15,000 euros of Standard Production in the rest of the regional territory. The aim is to direct support towards companies that are potentially able to reach levels of competitiveness and income levels allowing for at least adequate compensation of the work of the farmer and the farming family. Other farms, such as TEO farming companies (change of Technical-Economic Orientation - TEO) may foresee variations in their productive structure with investment. For example, take a farm with production that derives mainly from farming an area of arable land; however, following the investment, and due to TEO, it will instead be characterized by a production deriving mainly from tree crops. The minimum economic business size for access to support can be verified according to the results of the investment program, or if it is able to determine an economic dimension in future Standard Production equal to at least double that which is projected as the minimum intervention threshold (ie at least € 24,000 for areas subject to natural handicaps and at least € 30,000 for other areas).

The priorities declared in the program by the administration, will focus on the choice of project proposals aimed at the greatest increases in the economic dimension of the proposing farm. Therefore increases in economic dimensions are prioritized in terms of standard production; in greater product added value, in product use regarding functionality and innovation and in terms of higher profitability of the agricultural company or farm. This can come in the form of greater income obtainable from the company itself, to greater coherence of the investment with the main supply chain indications that emerged in the context analysis, to attainment of community directives

targeting the RDP intervention. This can also be in the form of financing project proposals that are a priority in the regional context; to the belonging of the proposing enterprise to a band of smaller economic dimensions (targeting of the farm), so as to favour the increase in the size of the companies, a factor that was highlighted as lacking in the sector at the regional level. Priorities can also take the form of investments that do not consume agricultural land, with the logic of not financing new agricultural company infrastructures but of wanting to make the structures already present within the agricultural company more efficient. Investments that are better able to determine multiple positive effects on the most important environmental issues for Calabria such as agricultural biodiversity, soil quality, water quality, air quality, greenhouse gas emissions can also be prioritized. These priorities may include investments that are better able to improve the adaptability and resilience of agricultural activities to climate change in terms of soil erosion risk; at the location of the initiative in disadvantaged territory (decreasing importance: mountain areas referred to in article 32 of Regulation (EU) 1305/2013, rural areas classified by the Program as areas “D” and “C”). Prioritizing can be in the interest of the planned intervention toward certified quality products, giving higher priority to organic products; to the belonging of the proponent to an Integrated Supply Chain Project, as an agricultural enterprise that confers products. It can also be given for the efficiency of the expenditure and for the proponent’s ability to cope with the co-financing of the expenditure program measured through an index that relates the financial value of the investment to the economic dimension (in standard output) of the proposing company. While community directives regarding the financial sustainability of the investments can be a priority, another could be for agricultural companies that have stipulated or undertaken to stipulate agricultural risk insurance, to incentivize this, a new measure was included in the European Agricultural Guarantee Fund (EAGF) in the previous programming period and which today is located within the EAFRD Fund and managed through the CAP strategic plans regulation (SPR) at the national level.

The measure provides support equal to 55% of the eligible investment cost made by farmers in disadvantaged areas or 45% of the eligible investment cost made by farmers in the rest of the regional territory. In the case of investments involving the processing, marketing, and development of agricultural products, the support drops to 50% of the eligible investment cost achieved. It is necessary to point out that the eligible

investment is related to the reporting of expenses that actually provide for other additional costs by the farm, which adds to the costs of the project presented and sometimes also creates a sort of selection of the beneficiaries. In particular, with reference to the Value Added Tax (VAT) which currently stands at 22%, this cost is added to the cost of the investment and, in fact, at the business accounting level, decreases the contribution given by the public support foreseen by the measure. However, this problem resides in all the structural measures and is foreseen by all the European funds, with exceptions that are usually foreseen for the measures that have public entities as beneficiaries. This VAT issue along with the numerous bureaucratic obligations are the main reasons why farms prefer financing through community policies that are provided by surface area measures or by the first pillar of the CAP rather than by structural measures.

A very significant share of farms do not yield to the market but carry out exclusively or predominantly self-consumption functions (about 60,000 companies (43.1% of all regional agricultural companies), ISTAT data, Census 2010). This could be due to the reasons set out above and considering the contextual situation of the regional agricultural sector in which they represent a very significant share. It could also be due in part to their reduced physical and economic size (in standard output). It is also important to consider that the regional agricultural structure is particularly varied and complex. Therefore, it may be necessary to finalize the interventions in order to direct resources towards those agricultural companies or farms and the needs of the productive sectors, which are better able to seize the opportunities offered by public support.

Interventions geared toward “active” farms, further targeting those structured as active agricultural businesses, structured as “enterprises” i.e. those identified throughout the Region as those that use and enhance the labor factor (of the farmer and/or members of the agricultural family and/or of the agricultural workers) have a higher propensity to take to the markets and produce income. That is to say, they are aimed at competitiveness recovery. The program supports the companies that use the labor factor, whether it comes from family member labor or that from hired employee labor (including the professional agricultural entrepreneur, direct farmer, agricultural employer).

In order to avoid the dead weight of the community directive or inertial effect, it was necessary to give priority to farms according to their economic size. In essence, it is

necessary to give priority to companies that can be encouraged more than others by the incentive effect of public support. These agricultural companies, in relation to the structure of the regional agricultural sector, can be included among the various economic classes starting from those at 15,000 euros of total Standard Production and up to 250,000 euros of total Standard Production. Companies falling within this economic dimension are given a decreasing priority, as their class of economic size grows with a substantially higher score than for smaller companies.

Farms, on the other hand, often face difficulties to enter the market due to their territorial location. These are factors (natural disadvantages of the territory, difficult morphological conditions, difficult climatic conditions, proximity to markets and consumers) that determine the need for these farms to make “additional” investments compared to those farms or regional agricultural companies that do not face these same difficulties. Such is the case of mountain areas, but also of rural areas classified as "D" and “C” by the RDP, in which the structural context presents greater difficulties for the agricultural companies that operate within them. Therefore it becomes strategic to also favor the territorial aspect in defining the target of agricultural companies and farms benefiting from support.

The Calabrian farms, as seen in the context analysis, operate in the multi-productive sectors that characterize the regional agriculture. Their multi-sectoral nature means that the entrepreneurial choices linked to seizing new market challenges can vary depending on the sector, and even more, on the specific problems inherent to every single sector, which companies face to maintain or improve their competitiveness and profitability. An answer to these needs can be given, giving priority to interventions that best meet the specific needs of regional agricultural sectors. In particular, this principle is implemented by assigning priority to the interventions more consistent with the results that emerged from the SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis on the regional description of the productive sectors and on the specific needs/requirements within individual sectors.

As far as the targeting of the RDP intervention is concerned, reference is made, in particular to the production chains which were priorities according to the analysis of the strengths and weaknesses of the agricultural economy.

Some types of investments have priority in all supply chains, others are concentrated according to the specific needs of each supply chain. Interventions relating to varietal

conversion in the protected designation of origin (PDO) or protected geographical indication (PGI) areas are common to all priority supply chains. These are limited to suitably classified soils, as identified in the aptitude map derived from the Soil Map of the Calabria Region (DGR 363/2012). This map is used to increase the surface areas dedicated to the cultivation of certified plants and traditional varieties closely related to the territory such as that regarding the olive supply chain. For the citrus supply chain, this is done by giving preference to varieties that meet the needs of the market and guaranteeing an expansion of production and marketing calendars with regard to the varietal reconversion of the perennial species. This is done also through replanting for cultivations related to the fruit and vegetable sector (vegetables, peaches and nectarines, apricots, plum and kiwi), which are defined as priorities exclusively in some areas of the Calabrian territory identified within the project calls for participant reference, and favouring investment in new plants in the chestnut supply chain. The interventions for the introduction of new technologies in the various cultivation operations able to ensure the containment of production costs and to improve the quality of the final product, with particular reference to the harvesting phase for the olive, wine, fruits and vegetables, and chestnut supply chains. The introduction of e-commerce and/or other forms of direct sales in order to allow companies to explore a more open market compared to the opportunities offered by the territory to which they belong as well as to investments aimed at the production of biogas from organic waste produced by the agricultural companies, which in turn can provide up to 1MW of power to satisfying the company's energy needs.

For the olive oil supply chain, interventions are also encouraged to ensure adequate processing and conservation of the certified product (PDO, PGI and organic). For citrus fruit, fruit and vegetable and protein crop chains, further priority is given to interventions for the distribution of irrigation systems aimed at saving water thereby replacing obsolete or older generation systems with systems featuring innovative technologies. For the wine supply chain, interventions aimed at marketing the product at the vineyards for the promotion of direct sales and the modernization of already existing cellars avoiding soil consumption and renovating buildings that have a certain historical value are considered priorities.

For the livestock supply chain, the interventions in order of importance with the assignment of a higher score first, are outlined below beginning with an intervention

that favors the construction of plants and structures aimed at the construction of extensive farms. Another priority in this area is aimed at company interventions favoring the creation of short supply chains (agricultural industries, sales points). Increasing the production of high-quality drinking milk and high-quality milk for PDO productions is another. Followed by the construction and modernization of livestock stalls. Also important is the employment of IT management in the phases of breeding and e-commerce development. Another priority is recovering zootechnical structures along the transhumance grazing trails. Lastly, there is a priority to construct plants and structures for wastewater management; to mitigate the problems related to environmental pollution.

The order of importance for the nursery garden supply chain is given, in order of importance with the assignment of a higher score, to the automation of processes, the introduction of technological innovations to improve environmental sustainability, and to the recovery of irrigation and fertigation water.

Priorities for the beekeeping supply chain in order of importance with the attribution of a higher score are: the interventions regarding improvements in the breeding phase, innovations in the processes of production, initial product packaging, and overall improvement of the quality of hive products (honey, wax, pollen, royal jelly, propolis). Finally, for the protein crops chain, interventions regarding storage facilities with the use of technologies that ensure optimal preservation of the product are prioritized.

5. THE ASSESSMENT OF FARM' EFFICIENCY USING DATA ENVELOPMENT ANALYSIS (DEA)

5.1. The DEA-methodology: theoretical background

DEA is a non-parametric linear-programming-based method developed by Charnes et al. (1978) and based on Farrell's (1957) efficiency definition. It represents the most widely used procedure in estimating the technical efficiency of decision-making units (DMUs), which convert multiple inputs into multiple outputs. As observed by Joro and Korhonen (2015), DMUs, which may include firms or parts of firms, must be comparable, i.e., they must perform essentially the same task using similar inputs to produce similar outputs, operating in similar environmental conditions. Technical efficiency consists in the ability of a DMU to maximize outputs given the same level of inputs and technology or to minimize inputs given a same level of outputs. In this sense, technical efficiency analysis can be oriented towards two different way: increasing output (output-oriented approach) or reducing input (input-oriented approach).

DEA allows the construction of a production frontier (or Pareto-efficient frontier) on which the efficient DMUs are located and that are used to measure the relative efficiency of remaining inefficient units in terms of their distance from the frontier. For each inefficient DMU, DEA identifies the reference units or reference set by projecting it radially onto the efficient frontier. Thus, the reference set is used to benchmark these inefficiencies. When inefficient DMU is projected onto the frontier, its input/output are improved and, then, it can achieve its target values becoming efficient (Ozcan et al., 2014).

The most popular DEA approaches in scientific literature are the following:

- CCR (Charnes, Cooper, and Rhodes) model by Charnes et al. (1978) under the assumption of constant returns to scale (CRS), as depicted for the production frontier in the single input-single output case in Figure 1;
- BCC (Banker, Charnes, and Cooper) model by Banker et al. (1984) where variable returns to scale (VRS) are assumed (Figure 2).

Constant returns to scale indicate that the firm is able to scale the inputs and outputs linearly without increasing or decreasing efficiency. Conversely, if a proportional increase in all the inputs results in a more than proportional increase in the single output, increasing returns to scale (IRS) occur; if it results in a less than proportional

increase in the output, decreasing returns to scale (DRS) follow. The efficient DMUs are considered as having constant returns to scale.

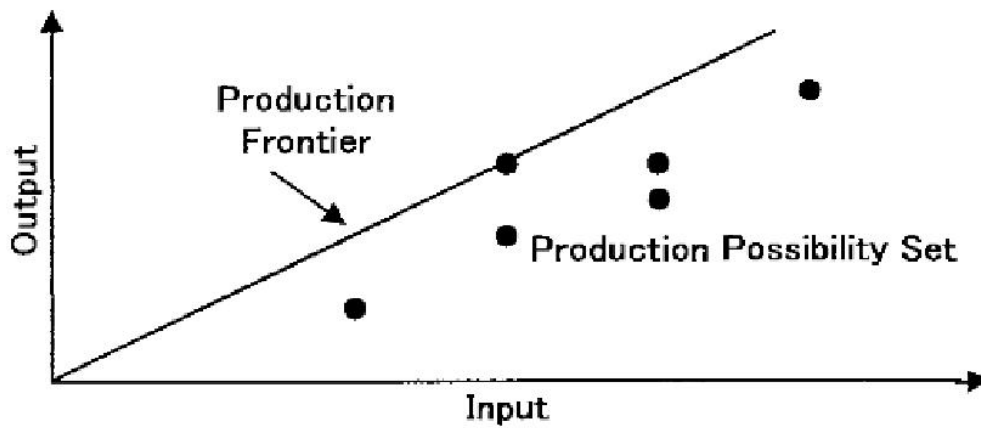


Figure 1. Production frontier of the CCR Model (source: Cooper et al., 2006).

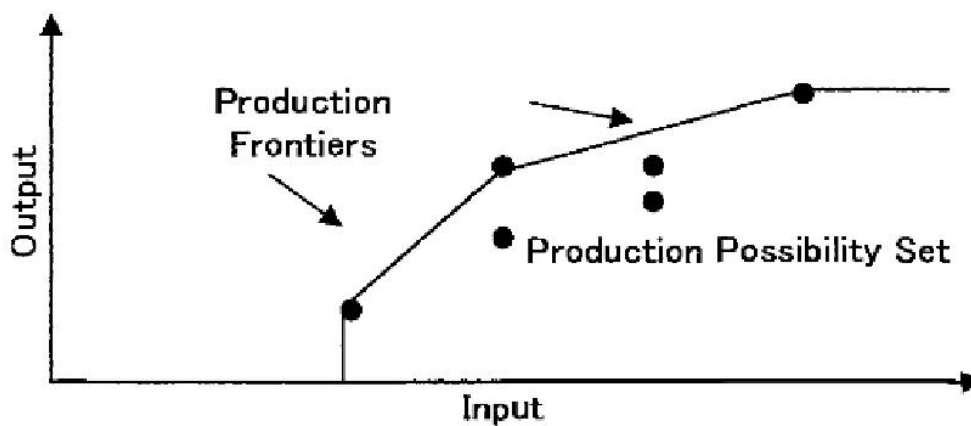


Figure 2. Production frontier of the BCC Model (source: Cooper et al., 2006).

The CRS model permits to estimate the overall technical efficiency (TE) of a DMU. TE efficiency, which takes no account of the scale effect, encompasses technical efficiency and scale efficiency. The former describes the efficiency in converting inputs to outputs; the latter identifies the productive scale size of a DMU and recognizes that economy of scale cannot be attained at all scales of production. The VRS model measures the pure technical efficiency (PTE) because it takes into account the variation of efficiency with

respect to the scale of operation. The CRS/VRS ratio calculate the scale efficiency (SE). The CRS efficiency of a DMU is always less than or equal to the pure technical (VRS) efficiency. If a DMU is fully efficient in both the CCR and BCC scores, it is operating in the most productive scale size (Cooper et al., 2007; Ramanathan, 2003). A complete theoretical background of the DEA model can be found in Cooper et al. (2006, 2007, 2011).

As mentioned above, the radial projection is supposed to project the DMU onto the efficient frontier. However, it can happen that after proportional reductions in inputs or increases in outputs, a DMU does not reach the efficiency frontier (to its efficient target) and then additional improvements (i.e., decrease in inputs and/or increase in outputs) are needed for a DMU to become efficient. These improvements are called “slacks” and are needed to push the DMU to the frontier (target). As an example, in Figure 3 the empirical efficient frontier based on the VRS assumption is illustrated (Joro and Korhonen, 2015). By considering the inefficient DMU1, in the input-oriented approach, it is necessary to reduce the input by moving from its current position left to reach the efficient frontier.

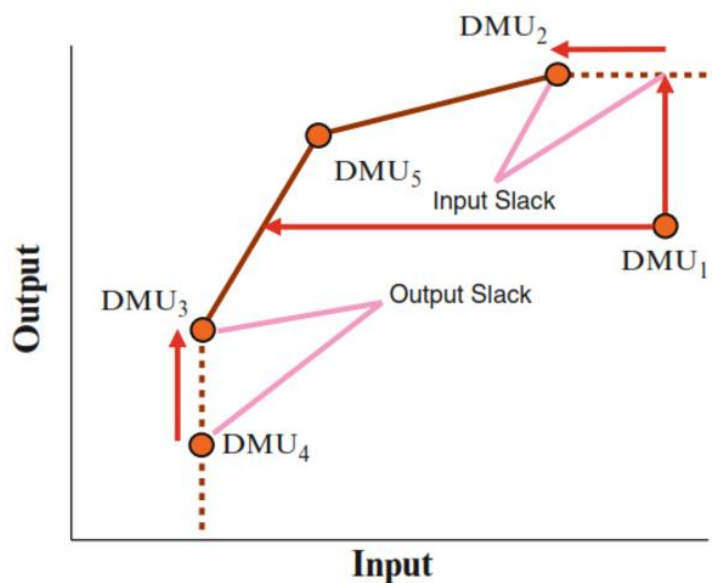


Figure 3. Slacks in VRS DEA Model (Source: Joro and Korhonen, 2015).

When using the output-oriented approach, DMU1 moves up by reaching the weakly efficient part of the frontier. To get onto the efficient frontier, it is necessary to move left to unit DMU2. The difference between the weakly efficient point and DMU is called the input slack.

5.2. Basic frontier models' implementation

In this section, the basic frontier models' formulation are illustrated. As widely described above, there are different kinds of DEA models that may be used depending on the conditions of the problem on hand. Such models can be identified based on scale and orientation of the model, as displayed in Figure 4.

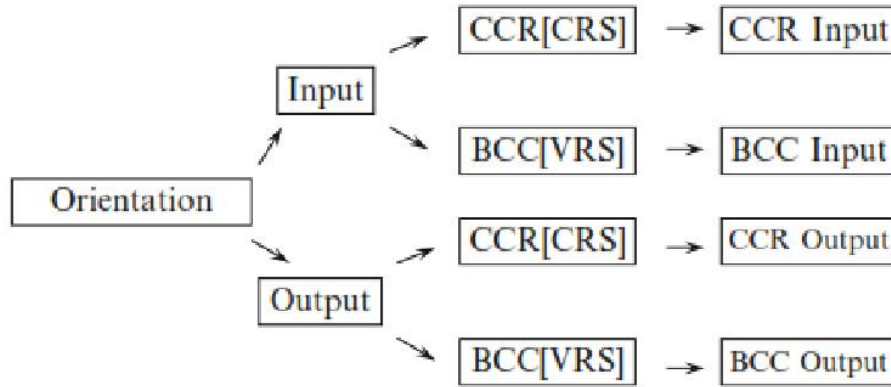


Figure 4. DEA model classifications-basic envelopment models (Source: zcan et al., 2014).

The formulation of **CRS input-oriented model** (Cooper et al., 2011) is expressed as follow:

$$\min \theta - \varepsilon \left(\sum_{i=1}^m s_i^- + \sum_{r=1}^s s_r^+ \right) \quad (1)$$

subject to:

$$\sum_{j=1}^n x_{ij} \lambda_j + s_i^- = \theta x_{io} \quad i = 1, 2, \dots, m;$$

$$\sum_{j=1}^n y_{rj} \lambda_j - s_r^+ = y_{ro} \quad r = 1, 2, \dots, s;$$

$$\lambda_j, s_i^-, s_r^+ \geq 0 \forall i, j, r$$

where n is the number of DMUs to be evaluated; each DMU consumes m inputs to produce s outputs; specifically, a DMU $_j$ consumes x_{ij} of input i and produces y_{rj} of output r ; λ_j are the weights assigned by the linear program; s_i^- and s_r^+ are the input and output slacks; ε is a non-Archimedean element defined to be smaller than any positive real number. The value of θ obtained will determine the technical efficiency score of each DMU. The performance of DMU $_o$ is fully efficient if and only if both (1) $\theta=1$ and (2) all slacks $s_i^- = s_r^+ = 0$. The performance of DMU $_o$ is weakly efficient if and only if both (1) $\theta=1$ and (2) $s_i^- \neq 0$ and (or) $s_r^+ \neq 0$ for some i or r in some alternate optima. If $\theta < 1$ DMU is inefficient and must decrease its inputs level.

When the restriction $\sum_{j=1}^n \lambda_j = 1$ is applied to the equation (1), the **VRS input-oriented model** is obtained (Cooper et al., 2011) as:

$$\min \theta_o - \varepsilon \left(\sum_{i=1}^m s_i^- + \sum_{r=1}^s s_r^+ \right) \quad (2)$$

subject to:

$$\begin{aligned} \theta_o x_{io} &= \sum_{j=1}^n x_{ij} \lambda_j + s_i^- \quad i=1,2,\dots,m; \\ 1 &= \sum_{j=1}^n \lambda_j; \\ y_{ro} &= \sum_{j=1}^n y_{rj} \lambda_j - s_r^+ \quad r=1,2,\dots,s; \\ 0 &\leq \lambda_j, s_i^-, s_r^+ \quad \forall i, j, r \end{aligned}$$

Below we modify the previous input-oriented definition of DEA efficiency to the output-oriented version. Thus, the following **CRS output-oriented model** (Cooper et al., 2011) is obtained as:

$$\max \varphi + \varepsilon \left(\sum_{i=1}^m s_i^- + \sum_{r=1}^s s_r^+ \right) \quad (3)$$

subject to:

$$\begin{aligned} \sum_{j=1}^n x_{ij} \lambda_j + s_i^- &= x_{io} \quad i=1,2,\dots,m; \\ \sum_{j=1}^n y_{rj} \lambda_j - s_r^+ &= \varphi y_{ro} \quad r=1,2,\dots,s; \end{aligned}$$

$$\lambda_j \geq 0 \quad j = 1, 2, \dots, n.$$

The output efficiency is defined by φ . DMUo is efficient if and only if $\varphi=1$ and $s_i^- = s_r^+ = 0$ for all i and r . DMUo is weakly efficient if $\varphi=1$ and $s_i^- \neq 0$ and (or) $s_r^+ \neq 0$ for some i and r in some alternate optima.

By adding the constraint $\sum_{j=1}^n \lambda_j = 1$ to the equation (3), the formulation of **VRS output-oriented model** (Cooper et al., 2011) is attained as follows:

$$\max \varphi + \varepsilon \left(\sum_{i=1}^m s_i^- + \sum_{r=1}^s s_r^+ \right) \quad (4)$$

subject to:

$$\begin{aligned} \sum_{j=1}^n x_{ij} \lambda_j + s_i^- &= x_{io} \quad i = 1, 2, \dots, m; \\ \sum_{j=1}^n y_{rj} \lambda_j - s_r^+ &= \varphi y_{ro} \quad r = 1, 2, \dots, s; \\ \sum_{j=1}^n \lambda_j &= 1 \\ \lambda_j &\geq 0 \quad j = 1, 2, \dots, n. \end{aligned}$$

The VRS output-oriented model formulation needs an additional set of constraints, i.e., the summation of λ values are set equal to 1 and the efficiency emphasis is removed from input (first constraint) and placed into output (second constraint) (Ozcan et al., 2014).

5.3. State of the art on DEA approaches in agricultural field

Technical efficiency in farming and the identification of its sources have received considerable attention by the scientific community as shown by Bravo-Ureta et al. (2007), who performed a meta-regression analysis including 167 technical efficiency studies at the firm level. Also, Liu et al. (2013) performed a literature survey on DEA applications, showing that agriculture and farm area was among the top-five industries addressed with a total number of papers equal to 258 from 1978 through August 2010. Recently, Emrouznejad and Yang (2018), who carried out a survey of the first 40 years of DEA-related articles in the literature from 1978 to 2016, revealed an exponential

growth in the number of DEA applications since the seminal work of CCR in 1978. In this analysis, the agro-food sector was among the top 5 application fields of DEA with the greatest numbers of journal articles in 2015 and 2016.

Several researchers have used DEA for efficiency estimation in crop production. Among these, Banaeian et al. (2011) examined the technical and scale efficiency of Iranian greenhouse strawberry production by applying the input-oriented DEA technique. In another study by Mohammadi et al. (2011), the input-oriented DEA approach was employed to investigate the technical, pure technical and scale efficiency of kiwifruit production in Mazandaran province of Iran. Mousavi-Avval et al. (2012) used the DEA technique to evaluate the technical efficiency and identify the wasteful uses of the energy of barberry production in Iran. Mardani and Salarpour (2015) applied DEA to rank the technical efficiency of potato production in 23 Iranian provinces. Applications of DEA-Tobit two-step method have been found for rice farms. Particularly, Dhungana et al. (2004) measured the economic inefficiency of Nepalese rice farms by employing the DEA technique to model efficiencies as an explicit function of discretionary variables, and a Tobit regression framework to explain variations in measured inefficiencies. Boubacar et al. (2016) applied DEA models to estimate technical, pure technical and scale efficiency of rice farms in southwest of Niger, and Tobit regression to identify factors affecting their technical efficiency.

With respect to the citrus cultivation, Beltrán-Esteve and Reig-Martínez (2014) compared the relative efficiency of organic and conventional citriculture systems in Spain in relation to a metafrontier that envelops both technologies and they analyzed the efficiency of each system through benchmarking process. Clemente et al. (2015) applied the output-oriented DEA approach in order to assess the technical efficiency of citrus producing properties in Brazil and he used an econometric approach to establish technical efficiency determinants.

Focusing on the grape and wine sectors, Khoshroo et al. (2013) used a two-stage methodology, i.e. input-oriented DEA method and Tobit regression, to identify the inefficiencies and their sources in Iranian grape farmers. Vidal et al. (2013) examined the efficiency of Spanish Designations of origin (Dos) in the wine sector through a joint use of DEA and a new additive based measure known as “bounded adjusted measure”. Urso et al. (2018) first investigated the comparative efficiency of wine and grapevine producers in Italy by using DEA model and, subsequently, they identified the

determinants of the estimated levels of efficiency through an econometric model (Tobit).

Applications of DEA can be found also for animal production sector, for example: Galanopoulos et al. (2006) used an input-oriented DEA model to evaluate the degree of technical and scale efficiency of commercial pig farming in Greece; Lansink and Reinhard (2004) applied DEA to compute input-based measures of technical efficiency of Dutch pig fattening farms; and Theodoridis et al. (2012) estimated the level of relative technical efficiency of Chios sheep farms in Greece by applied output-oriented DEA model.

In the field of olive production, several studies dealing with the computation of technical efficiency by employed DEA models. In the work by Amores and Contreras (2009), the DEA techniques were used to examine the economic efficiency of olive-growing farms in Andalusia and provide information for a better assignment of European agricultural subsidies. The results showed that the assignment of subsidies should be made in terms of Farm Efficiency results since the efficiency of farms would be under-estimated by an overall measurement (Overall Efficiency). Moreover, the results indicated that efficiency is positively related to the size of the farm and, then, large farms are more likely to improve their techniques. Artukoglu et al. (2010) compared the technical efficiency of organic and conventional olive farms in Turkey by using both input and output oriented DEA approaches. Their main finding was that the technical efficiency of conventional olive oil farms is lower than that of organic farms. Also, the Authors observed that the inefficiency is caused by the fact that the farms do not use minimum input or do not raise the maximum output from the actual inputs.

In another study by Aparicio et al. (2016), a Luenberger-type indicator based on a specific weighted additive model in DEA was used to estimate and decompose productivity change for Protected Designations of Origin (PDOs) in the Spanish virgin olive oil sector. According to their results, the most productive PDOs were those with an important number of oil mills and packaging/marketing companies. Furthermore, their findings revealed that productivity changes were mostly the consequence of downwards and upwards of the frontier of the technology over time. The Authors suggested that these changes were explained, to a certain extent, by the evolution of the economic crisis. Jurado et al. (2017) employed the DEA method to analyze the level of economic efficiency of organic olive oil producers in Andalusia. In addition, a second

DEA stage using quality comparative analysis was applied to obtained levels of efficiency. They found that only a very small number of organizations were efficient in terms of economic profitability. Moreover, the Authors observed that the commitment to online sales, the commitment to web tools, the academic training of the leading manager, exports and the size of the organization were clear determinants of the most efficient organizations.

6. MATERIALS AND METHODS

6.1. Experimental design: sampling and data gathering

The data used for this research focused less on the level of expenditures carried out by the regional administration, of which in this thesis there is a minimum hint of an exclusively informative nature, but rather on company data. Specifically, on data of a physical nature such as the company size expressed in usable agricultural area (UAA), the planned usage of the cultivated land of single agricultural companies divided by crop class and the type of tenure. Included in the research is data of an economic nature such as the description of the company's production, the collection of data relating to the economics of cultivation clearly composed of both revenue (production deriving from the cultivation and / or re-use of company by-products) and expenditures (taking into account costs relating to fertilizers, pesticides, labour costs, as well as social security, and other costs such as fuel, electricity and any rentals). This research was done while also taking into account the recording of data relative to the income statement, such as the items considered in the macro-statement of loans consisting of fixed capital assets (land and agricultural capital) and the working capital consisting of the liquidity of the agricultural entrepreneur and the sources' macro-items consisting of third-party capital and proprietary assets. Lastly, included in the research data, was the company cash flow as stated in the total cash flow value to end up with the economic and financial indicators.

In particular, for the last aforementioned item, the data relating to the profitability ratios were collected and analysed. This included the return on investments (ROI) which, by way of example, express the return on the capital invested in that company by comparing the operating result with the net operating capital invested or return on capital employed (ROCE), the return on equity (ROE) which is a percentage index for which the net income or net profit (NP) produced in a year is compared to the company assets (OM) and finally the return on sales (ROS) which represents the profitability ratio of sales measured by the ratio between operating profit and net sales revenues. That sum is then compared to the composition indices, such as the structure index, the financial coverage index of fixed assets and the debt ratio. Subsequently, the data was further analysed to reveal the efficiency indexes, such as growth, the ratio between Gross Saleable Production (GSP) and Utilised Agricultural Area (UAA), the ratio between (GSP) and the annual work unit (AWU). Moreover, the data relative to

profitability margins, such as EBITDA (“Earnings Before Interest, Taxes, Depreciation and Amortization”, and also known as PBITDA for "Profits Before Interest, Taxes, Depreciation and Amortization") which shows the gross income of a company. The EBITDA analysis is based only on its operational management, without considering the interest on loans (financial management), taxes (fiscal management), depreciation of assets and amortization and the value added (VA), useful for calculating the return on an investment, and finally the cash flow of the overall management.

It is appropriate to specify that the reference data have been collected on the basis of the declarations made by the beneficiaries and by the design engineers during the compilation of the documents presented for the purposes of effectuating the request for support. Particularly, in reference to documents related to the Business Plan, as a useful economic-financial tool for the farm or agricultural business, not subject to the preparation of an annual report, however used solely for the purpose of assessing the admissibility of projects by the competent administration. The data were obtained from the online applications held by the Agency of the Calabria Region for Agricultural Provisions (ARCEA). Data were used in order to analyse the performance of public funding by comparing the farms’ situation ex-ante and ex-post investment.

Starting from a overall population of 429 Calabrian beneficiaries for the entire measure 4.1.1 (Investments in tangible fixed assets (art. 17 Reg. EU 1305/2013) pursuant to PSR Calabria 2014/2020) applied in overall territory, the case study focused on the olive sector, due to his high significance level in regional area.

The data was derived from the publication on the institutional site of the Calabria Region of the definitive ranking order relative to a call for tender published in 2016.

Analysing these whole data (Table 12), it was possible to detect the activation of twenty one production chains, of which 14 have covered, albeit with different importance, principle roles and the remaining were represented by less than 4 companies on the whole (value in percentage equal to 0%). The total financial allocation from the call for proposals was 70 million euros of EU funds, equal to 6.50% of the total budget of the Calabria Region's rural development program for the 2014/2020 program. These companies have been subdivided into production chains that involve investments in agricultural crops (347 farms that represent 80.89% of the total number of agricultural companies admitted with a financial allocation assigned that occupies 66.08%) and production chains regarding investments for zootechnical companies (80 zootechnical

companies represent 18.65% of the total admitted companies, with a financial endowment that occupies 30.29%). With regard to the type of investments that the beneficiary companies of the contribution have proposed to carry out, the investments for land improvement have the majority; occupying a value of 37.46% of the total (41% of the agricultural crops and 23% in the zootechnics). This was followed by investments in the purchase of machinery and tools with a value of 26.02% (in both macro chains), investments for the construction and modernization of buildings for agricultural use with a value of 15.73% (11% crops agricultural and 28% animal husbandry), and investments for the transformation, conservation and development of products with a value of 11.96% (12% agricultural crops and 13% animal husbandry). Lastly, investments carried out for the purchase of equipment with the aim of reduction of the environmental impact had a value of 4.64% (5% agricultural crops and 4% animal husbandry), for all the other expense items the total value is below 2.50%.

As far as agricultural crops are concerned, the most representative supply chain, with the largest number of beneficiaries admitted, was the olive oil production chain, represented by 163 farms, which represent 38.00% of the total and for which, in this context, resources equal to 28.00% of the total financial allocation of the call for proposals were invested.

In particular, it can be noted that the investments of major importance for the supply chain concern the items relating to land improvement, which represents 30.00% of the total value of the supply chain and the purchase of new machinery and equipment, which represents 29.00% of the total chain. Investments for the transformation, marketing and development of products, represent 17% of the total value of the supply chain, while investments for the construction and/or modernization of rural buildings representing 11% of the total supply chain. Lastly, investments for the purchase of machines for the reduction of the environmental impact which represent 7%.

In terms of numerical importance, the second sector is represented by the citrus production chain with n. 61 farms (14.22% of the total) and for which, in the context of which it is concerned, resources were invested equal to 8.00% of the total allocation of the tender. Among the beneficiary citrus farms, 8 of them provided for investments in modernization in the cultivation of bergamot, a fruit typically from the area of Reggio Calabria. In the rest of the sample, the benefactors are mainly farms or agricultural businesses that invest in clementine and lemon groves. For this sector, the main

investments were concerning items relating principally to land improvements, which represent 46.00% of the total value of the supply chain. Followed by the purchase of new machinery and equipment, representing 23.00% of the total chain. Subsequently, investments regarding the construction and/or modernization of rural buildings represent 13% of the total supply chain. Additional investments concerning the transformation, marketing and development of products, represent 7% of the total supply chain for this sector, and finally investments for the purchase of machines to reduce the environmental impact which represent 8%.

Another supply chain that has shown interesting developments is that relating to the cultivation of actinidia or kiwi which is present with 28 farms, numerically equal to 6.53% of the total and for which the administration has decided to invest resources of 4%. This is followed by the supply chain for vegetables (those grown in greenhouses such as tomatoes and strawberries as well as those cultivated in open fields such as the potato) and nuts (almond, hazelnut and chestnut) with 19 farms participating, which represent 4.43% of the total numerically, while the financial resources available to them are 7% and 3% respectively. Other fresh fruit represented (including apple, fig, cherry, and pear orchards, pomegranate plants, as well as lotus and berries) by 17 farms numerically 3.96% of the total, financially 2%. With fresh flowers and plants (medicinal plants, nurseries and industrial crops) represented by 12 farms; numerically 2.80% of the total, financially 6%. Fresh stone fruit (peach and apricot trees) was present with 13 farms numerically and financially about 3% of the total. The sector of viticulture with 12 vineyards participating; numerically and financially 2.80% of the total. Finally, 2 farms that have planned investments for the cultivation of mushrooms; representing numerically 0.47% of the total, and financially 1.27%.

As far as animal husbandry is concerned, the most representative chain, with the highest number of beneficiaries admitted, was the cattle supply chain, represented by 24 zootechnical companies, which numerically represent 5.59% of the total and financially 15% of the total. Followed the sheep and goat supply chains with 18 livestock farms (which numerically represent 8.40% and financially 5% of the total). Next, apiculture or beekeeping, with 17 agricultural companies (which represent almost 4% of the total). Pig farming supply chains were represented by 13 farms (numerically 3.03% and financially 4.30% of the total). Horticulture, hens and chickens were present with 2

livestock farms (0.94% of the total) and lastly were ostriches, cultivation of cereals, and cultivation of fodder respectively with 1 livestock farm (0.46% of the total).

Table 12. Sample subdivision by production chain and type of investment (%).

Production lines	farms %	Items of expenditure																						TOTAL SUPPLY CHAIN		
		0001 - BASIC IMPROVEMENT		0002 - BUILDING, ACQUISITION, RENOVATION / IMPROVEMENT / BUILDING ENLARGEMENT		0003 - PURCHASE OF NEW MACHINERY AND EQUIPMENT		0004 - CONSTRUCTION AND MODIFICATION OF STRUCTURES AND PLANTS FOR STORAGE AND WASTEWATER TREATMENT		0005 - PURCHASE OF HARDWARE AIMED AT THE ADOPTION OF IT AND E-COMMERCE		0006 - EQUIPMENT FOR THE REDUCTION OF ENVIRONMENTAL IMPACT (CONSERVATIVE AGRICULTURE AND SAFEGUARD OF BIODIVERSITY)		0007 - PLANT FOR THE TREATMENT OF COMPANY WASTEWATER		0008 - ENERGY EFFICIENCY		0009 - GENERAL COSTS CONNECTED TO INVESTMENTS		0010 - ACQUISITION OF COMPUTER PROGRAMS FOR THE ADOPTION OF TLC AND E-COMMERCE		0011 - LAND ACQUISITION			0012 - PROCESSING, MARKETING AND DEVELOPMENT OF AGRICULTURAL PRODUCTS REFERRED TO IN ANNEX 1 TO THE TREATY	
		% on supply chain	% on total	% on supply chain	% on total	% on supply chain	% on total	% on supply chain	% on total	% on supply chain	% on total	% on supply chain	% on total	% on supply chain	% on total	% on supply chain	% on total	% on supply chain	% on total	% on supply chain	% on total	% on supply chain	% on total			
OLIVE OIL	0,38	0,30	0,23	0,11	0,19	0,29	0,31	0,01	0,33	0,00	0,23	0,07	0,44	0,01	0,36	0,00	0,00	0,02	0,26	0,00	0,37	0,00	0,36	0,17	0,41	0,28
CITRUS FRUITS	0,14	0,46	0,10	0,13	0,07	0,23	0,07	0,00	0,01	0,00	0,10	0,08	0,13	0,01	0,12	0,00	0,00	0,03	0,12	0,00	0,04	0,00	0,00	0,07	0,05	0,08
FRESH STONE FRUITS	0,03	0,52	0,04	0,06	0,01	0,19	0,02	0,00	0,00	0,00	0,04	0,02	0,01	0,00	0,00	0,00	0,01	0,02	0,00	0,02	0,00	0,00	0,20	0,04	0,03	
OTHER FRESH FRUITS	0,04	0,44	0,02	0,08	0,01	0,35	0,03	0,00	0,01	0,00	0,00	0,03	0,02	0,00	0,00	0,00	0,03	0,03	0,00	0,03	0,00	0,00	0,05	0,01	0,02	
KIWI	0,07	0,46	0,05	0,13	0,04	0,25	0,04	0,00	0,00	0,00	0,10	0,10	0,09	0,00	0,01	0,00	0,39	0,04	0,10	0,00	0,00	0,00	0,01	0,00	0,04	
FLOWERS AND PLANTS	0,03	0,45	0,08	0,11	0,04	0,32	0,08	0,00	0,00	0,00	0,02	0,00	0,00	0,00	0,04	0,00	0,00	0,02	0,05	0,00	0,06	0,00	0,10	0,05	0,06	
NUTS	0,04	0,54	0,04	0,14	0,02	0,22	0,02	0,00	0,00	0,00	0,00	0,03	0,02	0,00	0,01	0,01	0,53	0,04	0,06	0,00	0,05	0,00	0,03	0,01	0,03	
WINES	0,03	0,18	0,01	0,23	0,04	0,36	0,04	0,00	0,00	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,10	0,00	0,00	0,20	0,05	0,03	
EUCALIPTUS	0,00	1,00	0,02	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	
MUSHROOMS	0,00	0,60	0,02	0,20	0,02	0,17	0,01	0,00	0,00	0,00	0,00	0,03	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	
VEGETABLES	0,04	0,56	0,10	0,06	0,02	0,23	0,06	0,00	0,00	0,00	0,05	0,02	0,03	0,03	0,30	0,00	0,00	0,02	0,07	0,00	0,05	0,00	0,08	0,05	0,07	
HONEY	0,04	0,32	0,03	0,14	0,03	0,25	0,03	0,00	0,00	0,00	0,01	0,14	0,11	0,00	0,00	0,00	0,00	0,01	0,02	0,00	0,04	0,00	0,13	0,04	0,03	
CATTLE	0,06	0,21	0,09	0,35	0,33	0,30	0,17	0,02	0,24	0,01	0,31	0,02	0,06	0,00	0,02	0,00	0,00	0,01	0,12	0,00	0,05	0,00	0,64	0,07	0,09	
SHEEP AND GOATS	0,04	0,23	0,03	0,33	0,11	0,21	0,04	0,01	0,05	0,00	0,03	0,02	0,02	0,00	0,01	0,00	0,00	0,02	0,04	0,00	0,06	0,00	0,18	0,08	0,05	
PIGS	0,03	0,17	0,02	0,14	0,04	0,23	0,04	0,09	0,34	0,00	0,03	0,06	0,06	0,01	0,07	0,00	0,00	0,02	0,06	0,01	0,10	0,00	0,26	0,09	0,04	
CHICKENS AND HENS	0,01	0,32	0,01	0,12	0,01	0,31	0,02	0,02	0,02	0,01	0,07	0,03	0,01	0,03	0,05	0,00	0,09	0,05	0,03	0,00	0,02	0,00	0,12	0,01	0,01	
OSTRICH	0,00	0,43	0,01	0,09	0,00	0,27	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,22	0,01	0,01		
ELICULTURE	0,00	0,04	0,00	0,36	0,00	0,30	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,07	0,00	0,00	0,00	0,00	0,23	0,00	0,00		
WATER BUFFALO	0,00	0,00	0,00	0,00	0,00	0,10	0,00	0,00	0,00	0,00	0,00	0,14	0,00	0,00	0,00	0,00	0,06	0,00	0,00	0,00	0,00	0,70	0,00	0,00		
CEREALS AND FODDER	0,00	0,13	0,00	0,58	0,00	0,29	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	
VARIOUS CHAINS	0,00	1,00	0,10	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,04	
TOTALI	429	0,37	0,16	0,26	0,01	0,00	0,05	0,01	0,00	0,05	0,01	0,00	0,01	0,00	0,02	0,00	0,02	0,00	0,00	0,00	0,12					

From the overall population of 429 beneficiaries, a preliminary sample of 102 farms was selected, representing in economic terms 14.68% of the total budget foreseen by the funding announcement (Tables 13).

These farms are distributed throughout the Calabrian regional territory and in particular in 5 provincial territories. The greatest representation is in the province of Catanzaro in which there are 38 farms pertaining to the sample that represent 44% in terms of financial allocation assigned within the sample analyzed. Included in the sample are allocations relative to other Calabrian provinces such as Reggio Calabria in which there are 25 farms belonging to the sample, Crotona with 19 farms, Cosenza with 14 farms and Vibo Valentia with 6 farms.

The statistical results that have been returned from the first elaborations are represented by the growth of the olive-growing area at a regional level which should see an increase of about 337.04 ha at the end of the realization of all the investments admitted for financing.

A further selection was necessary in order to obtain a homogeneous sample of data and in order to avoid that other production systems could mislead technical and economic variables specifically linked to olive production process. For this purpose, a definitive sample of 50 olive farms was selected, taking into account the precise correlation between amount of investment and olive asset.

Table 13 - Summary Primary Database.

TERRITORY	farms	ITEMS OF EXPENDITURE											
		0001 - BASIC IMPROVEMENT	0002 - BUILDING, ACQUISITION, RENOVATION / IMPROVEMENT / ENLARGEMENT BUILDING	0003 - PURCHASE OF NEW MACHINERY AND EQUIPMENT	0004 - CONSTRUCTION AND MODIFICATION OF STRUCTURES AND PLANTS FOR STORAGE AND WASTEWATER TREATMENT	0005 - PURCHASE OF HARDWARE AIMED AT THE ADOPTION OF TLC AND E-COMMERCE	0006 - EQUIPMENT FOR THE REDUCTION OF ENVIRONMENTAL IMPACT (CONSERVATIVE AGRICULTURE AND SAFEGUARD OF BIODIVERSITY)	0007 - PLANTS FOR THE TREATMENT OF COMPANY DISCHARGE WATERS	008 - ENERGY EFFICIENCY	0009 - GENERAL COSTS CONNECTED TO INVESTMENTS	0010 - ACQUISITION OF COMPUTER PROGRAMS FOR THE ADOPTION OF TLC AND E-COMMERCE	0011 - LAND AQUISITION	0012 - PROCESSING, MARKETING AND DEVELOPMENT OF AGRICULTURAL PRODUCTS REFERRED TO IN ANNEX 1 TO THE TREATY
CS	0.14	0.15	0.08	0.12	0.00	0.18	0.03	0.00	0.00	0.08	0.06	1.00	0.14
CZ	0.37	0.37	0.41	0.37	0.39	0.59	0.66	0.73	0.00	0.25	0.64	0.00	0.57
KR	0.19	0.22	0.42	0.25	0.00	0.15	0.10	0.00	0.00	0.23	0.17	0.00	0.11
RC	0.25	0.21	0.07	0.17	0.44	0.07	0.12	0.00	0.00	0.38	0.08	0.00	0.12
VV	0.06	0.05	0.01	0.08	0.17	0.00	0.09	0.27	0.00	0.06	0.04	0.00	0.06

6.2. DEA model as applied to the case study

The present work aims at evaluating the performance of a farm by comparing it with the best managerial practices observed on the Pareto-efficient frontier. Specifically, with the purpose to evaluate the TE, PTE, and SE of olive farms under study, the input and output oriented CRS and VRS models were applied.

The choice to use both models (CRS and VRS) was due to our interest in determining the returns to scale of the farms under study and estimating their scale efficiency.

The output-oriented approach was selected because the interest of rural policies is aimed at increasing farming productivity, and furthermore because it is useful to measure the ability of farm to gain maximum output given a set of inputs and technology. In addition, input-oriented approach helps to explain the ability of producers to control inputs rather than output levels and also it is more appropriate to quantify the excess use of inputs during the production processes and to identify inputs optimization strategies also to support agricultural sustainable pathways.

The input variables used in the efficiency analysis are the following:

- (1) olive area (ha),
- (2) fertilizer cost (€),
- (3) pesticide cost (€),
- (4) labour cost (€),
- (5) working days (days).

The costs of fertilizers and pesticides, and labour cost are expressed in € per year. As the output variable, gross saleable production (€) was selected. The variables (inputs and outputs) selected in this study were in line with those utilized in similar studies.

Excel 2013 spreadsheet and DEA-Solver-LV were used for data processing. DEA program has been run separately for each system considered, i.e. ex-ante and ex-post investment.

6.3. Results and Discussion

Descriptive statistics for inputs and outputs used in DEA model as implemented in this study are illustrated in Table 14. It is worth noting the high variance of the individual variables. For example, the olive area input had a minimum value of 2.35 ha and a

maximum of 245.50 ha, and the values for working days ranged from 40.00 to 7,720 days for ex ante evaluations. Average gross output of the olive farms examined is 98,493.69, with a standard deviation of 143,518.04, which indicates the large variability of output among farms. Fertiliser and pesticide costs of the mean farm are $4,355.27 \pm 6,032.49$ and $2,203.32 \pm 3,797.44$, respectively, indicating the need for managerial efficiency. The same trend was found in ex-post evaluations. According to Baráth and Fertő (2015), such remarkable variances in input values indicate inequalities in the farm structure and suggest that farm size probably plays a role in the technological differences between farms. Furthermore, these results may not be completely unexpected, given that the farms in the sample reflect the features of the Calabrian olive system whose characteristic is the co-existence of small family-type farms with larger farms.

Table 14 - Descriptive statistics of the input and output used in DEA model.

	Olive area (ha)	Fertilisers (€)	Pesticides (€)	Labour cost (€)	Working days (days)	Gross Saleable Production (€)
EX-ANTE						
Max	245.50	32,360.00	24,000.00	393,260.00	7,720.00	745,280.00
Min	2.35	250.00	150.00	850.00	40.00	9,900.00
Average	22.47	4,355.27	2,203.32	39,574.80	1,039.53	98,493.69
St Dev	35.76	6,032.49	3,797.44	62,634.07	1,327.52	143,518.04
EX-POST						
Max	245.50	32,360.00	26,000.00	393,260.00	7,720.00	1,341,137.00
Min	4.68	500.00	200.00	2,125.00	50.00	24,600.00
Average	25.19	5,299.40	2,640.05	47,897.19	1,206.69	194,747.39
St Dev	35.33	6,096.67	4,039.17	64,665.74	1,290.01	245,774.63

Source: own processing.

In Table 15 the results achieved by the implementation of input-oriented CCR and BCC DEA models are reported. The findings revealed that average technical efficiency (TE score), under CRS assumption, of the olive farms before the investment (0.68) was slightly greater than farms after the investment (0.66). This means that, on average, the farms could reduce their inputs, and, then, reducing production costs, by 32% and 34%,

respectively, providing the same output level. According to Mohammadi et al. (2011), the variation in the technical efficiency of farmers could be caused by the incorrect application of the appropriate production techniques. Under VRS assumption, the “ex-ante” farms had higher pure technical efficiency (PTE score) (0.75) compared to “ex-post” farms (0.71), although there are no significant differences. It is worth noting the greater pure technical efficiency than overall technical efficiency in both scenario.

The outcomes achieved so far, can be better explained by analyzing the efficiency score distribution as illustrated in Figure 5. By applying the CRS model, the most of the “ex-ante” farms, equal to 34% of total, had technical efficiency between 0.40 and 0.59; 28% had technical efficiency of less than 0.79 and 12% of farms were close to the DEA frontier, showing technical efficiency score between 0.80 and 0.99. Only 16% of farms were full technical efficient, indicating rational management of existing technology and no improvement on input use. When the VRS model is carried out, 34% of the “ex-ante” farms had technical efficiency between 0.60 and 0.79 and 30% exhibited the full efficiency score. The mean scale efficiency was 0.90 and from the intensity variables, i.e. analyzing the Return To Scale (RTS) (see Table 15), it occurs that 22 farms operate under increasing returns to scale (IRS), 17 farms exhibit decreasing returns (DRS) and 11 constant returns to scale (CRS), confirming that small farm size constitutes one of the most important structural drawbacks of Calabrian farming. In effect, most of farms (22) were inefficient because operated at IRS, which indicates that for considerable changes in yield, technological change is required (Banaeian et al. (2011), as well as the need to increase their size in order to reach cost savings, as argued by Jiao et al. (2015). Additionally, 17 farms were found to operate at DRS, meaning that there could be the existence of constraints that prevent some productive factor from increasing in optimal proportions. For example, it can be assumed that the organizational capacity of farms is often limited and therefore, when the size of the farm increases, also the left-over of resources increases connected to organizational defects.

In terms of “ex-post” results, by using the CRS model, the most of the farms, equal to 32% of total, had technical efficiency between 0.40 and 0.59; 18% had technical efficiency of less than 0.79 and 14% of farms were close to the DEA frontier, showing technical efficiency score between 0.80 and 0.99. It can be noted as the number of full technical efficient farms was greater accounting for 20% than 16% of “ex-ante” scenario.

Table 15 - DEA scores and returns to scale for the olive farms under study, assuming **input-oriented** CCR and BCC DEA models.

DMU	EX-ANTE				EX-POST			
	TE score	PTE score	SE score	RTS	TE score	PTE score	SE score	RTS
1	0.3203	0.3204	0.9997	IRS	0.2943	0.2953	0.9966	CRS
2	1.0000	1.0000	1.0000	CRS	1.0000	1.0000	1.0000	CRS
3	1.0000	1.0000	1.0000	CRS	0.6541	0.6645	0.9843	CRS
4	0.5160	0.5534	0.9324	DRS	0.4151	0.4368	0.9503	IRS
5	0.7688	0.7918	0.9710	DRS	1.0000	1.0000	1.0000	CRS
6	0.4801	0.6691	0.7175	IRS	0.5427	0.5691	0.9536	CRS
7	0.6060	0.6518	0.9297	IRS	1.0000	1.0000	1.0000	CRS
8	0.5561	0.6689	0.8314	IRS	0.3574	0.4000	0.8935	CRS
9	0.7459	0.7597	0.9818	CRS	0.8151	1.0000	0.8151	DRS
10	0.4187	1.0000	0.4187	DRS	0.3800	0.3968	0.9577	CRS
11	0.7954	1.0000	0.7954	IRS	0.8548	0.9651	0.8857	DRS
12	0.3473	0.3486	0.9963	IRS	0.3551	0.4222	0.8411	IRS
13	1.0000	1.0000	1.0000	CRS	1.0000	1.0000	1.0000	CRS
14	0.7129	0.7173	0.9939	IRS	0.7224	0.7268	0.9939	IRS
15	0.9414	0.9460	0.9951	CRS	0.8509	0.8725	0.9752	DRS
16	0.4449	0.4474	0.9944	IRS	0.4868	0.5806	0.8384	IRS
17	0.5214	0.6051	0.8617	DRS	0.3756	0.3759	0.9992	IRS
18	1.0000	1.0000	1.0000	CRS	1.0000	1.0000	1.0000	CRS
19	0.5469	0.5527	0.9895	IRS	0.4508	0.6126	0.7359	IRS
20	0.9103	1.0000	0.9103	IRS	1.0000	1.0000	1.0000	CRS
21	1.0000	1.0000	1.0000	CRS	0.9806	1.0000	0.9806	DRS
22	0.7263	0.7924	0.9166	DRS	0.4090	0.4105	0.9963	CRS
23	0.4167	0.4598	0.9063	DRS	0.3932	0.3933	0.9997	CRS
24	1.0000	1.0000	1.0000	CRS	0.6895	1.0000	0.6895	DRS
25	0.9310	1.0000	0.9310	IRS	0.7849	0.9250	0.8485	DRS
26	0.8885	1.0000	0.8885	IRS	1.0000	1.0000	1.0000	CRS
27	0.4952	0.5317	0.9314	DRS	0.3582	0.3759	0.9529	IRS
28	0.5310	0.5482	0.9686	DRS	0.5070	0.5212	0.9728	IRS
29	0.5658	0.5900	0.9590	DRS	0.4583	0.5006	0.9155	IRS
30	0.7189	0.8698	0.8265	DRS	0.9044	0.9121	0.9916	IRS
31	0.5924	0.7936	0.7465	DRS	0.4027	0.5581	0.7216	DRS
32	0.3632	0.8732	0.4159	IRS	0.5025	0.6667	0.7537	CRS
33	0.5724	0.5853	0.9780	DRS	0.4635	0.5250	0.8829	IRS
34	0.5601	0.6234	0.8985	DRS	0.5135	0.5151	0.9969	IRS
35	0.7330	0.7817	0.9377	IRS	0.8239	0.8494	0.9700	DRS
36	0.6069	0.6884	0.8816	IRS	0.4833	0.4929	0.9805	DRS
37	0.6566	0.6959	0.9435	DRS	0.6950	0.6954	0.9994	CRS
38	0.7106	0.7806	0.9103	IRS	0.7509	0.9382	0.8004	DRS
39	0.5756	0.6442	0.8935	DRS	0.4058	0.4129	0.9828	IRS
40	1.0000	1.0000	1.0000	CRS	0.5900	0.5998	0.9837	DRS
41	0.3448	0.3809	0.9052	IRS	0.5679	0.6869	0.8268	CRS
42	0.7094	0.7487	0.9475	IRS	1.0000	1.0000	1.0000	CRS
43	0.5296	1.0000	0.5296	IRS	0.6993	0.7535	0.9281	IRS
44	1.0000	1.0000	1.0000	CRS	0.8106	1.0000	0.8106	DRS
45	0.8076	0.8093	0.9979	IRS	0.4679	0.5943	0.7873	CRS
46	0.4163	0.4942	0.8424	IRS	1.0000	1.0000	1.0000	CRS
47	0.7502	0.8462	0.8866	IRS	0.7578	0.8979	0.8440	DRS
48	0.7396	0.7856	0.9414	DRS	0.7242	0.7689	0.9419	CRS
49	0.9142	1.0000	0.9142	DRS	1.0000	1.0000	1.0000	CRS
50	0.3821	0.3933	0.9715	CRS	0.3531	0.4068	0.8680	DRS
Average	0.677	0.755	0.904	-	0.661	0.714	0.925	-
Max	1	1	1	-	1	1	1	-
Min	0.320	0.320	0.416	-	0.294	0.295	0.690	-
St Dev	0.214	0.211	0.133	-	0.240	0.243	0.089	-

Source: own processing.

Also when the VRS model is carried out, 32% of the farms had technical efficiency between 0.60 and 0.79, while the full efficiency score was reached by 28% of farms. In terms of mean scale efficiency, the result was slightly improved ranging from 0.90 to 0.92. However, examining the RTS, it occurs that 22 farms operate under CRS, 14 under IRS and 14 exhibit DRS, highlighting as some “ex-post” farms achieve an optimal production scale in comparison to “ex-ante” scenario. That could indicate a positive effect achieved from the rural public funding linked to investment in technological assets.

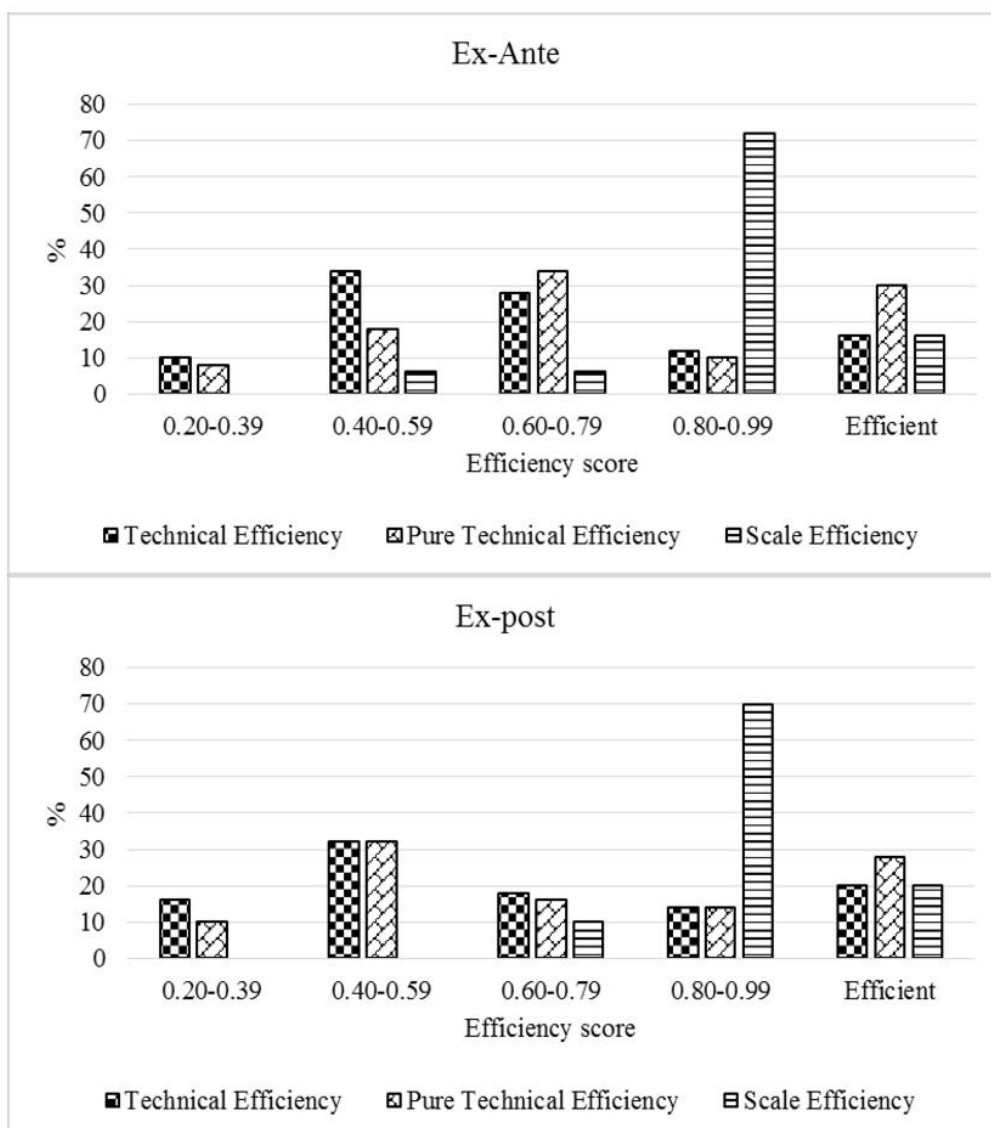


Figure 5. Efficiency score distribution for the olive farms under study, ex-ante and ex-post investment (Source: own processing).

The DEA scores achieved by the implementation of output-oriented CRS and VRS DEA models for the olive farms under study are presented in Table 16. According to the CRS model, TE in “ex-ante” evaluation was 0.68 indicating that there is substantial inefficiency in farming operations for the olive farms and suggesting that a 32% increase of the production value could be possible, given the level of inputs and the production technology, provided that the farms adopt the best observed practice. In the “ex-post” scenario TE was equal to 0.66, suggesting that there are no significant differences between scenarios. Referring to VRS model, the PTE is 0.75 for “ex-ante” scenario and 0.72 for ex-post one.

Assuming CRS model, equal results to input-oriented approach were founded both for “ex-ante” and “ex-post” scenario. Instead, when VRS model is carried out, 22% of the “ex-ante” farms had technical efficiency between 0.40 and 0.59, 30% between 0.60 and 0.79 and 30% exhibited the full efficiency score; while, in the “ex-post” scenario it can be observed a decrease of the farm characterized by full efficiency (28%), as well as for the farms ranging from 0.60 to 0.79 (16%). Instead, a increase equal to 10 points percentage was reached by score interval between 0.40 and 0.59 (Figure 6).

Examining the RTS (see Table 16), it can be noted that in the “ex-ante” scenario 10 farms operated under CRS, 12 under IRS and 28 exhibit DRS; while, in the “ex-post” scenario, 21 farms worked in CRS, 6 worked in IRS and 23 in DRS. This latter finding obtained by using output approach, confirms the results of the input-approach, namely the positive trend reached by the farms that enhanced their returns to scale by using efficiently public funding to invest in technological assets.

Table 16 - DEA scores and returns to scale for the olive farms under study, assuming **output-oriented** CCR and BCC DEA models.

DMU	EX-ANTE				EX-POST			
	TE score	PTE score	SE score	RTS	TE score	PTE score	SE score	RTS
1	0.3203	0.3395	0.9434	DRS	0.2943	0.3048	0.9656	CRS
2	1	1	1	CRS	1	1	1	CRS
3	1	1	1	CRS	0.6541	0.6912	0.9463	CRS
4	0.5160	0.5924	0.8710	DRS	0.4151	0.4190	0.9907	DRS
5	0.7688	0.7981	0.9633	DRS	1	1	1	CRS
6	0.4801	0.4838	0.9924	IRS	0.5427	0.5910	0.9183	CRS
7	0.6060	0.6555	0.9245	DRS	1	1	1	CRS
8	0.5561	0.5697	0.9761	IRS	0.3574	0.5058	0.7066	DRS
9	0.7459	0.7525	0.9912	CRS	0.8151	1	0.8151	DRS
10	0.4187	1	0.4187	DRS	0.3800	0.8608	0.4414	CRS
11	0.7954	1	0.7954	IRS	0.8548	0.9704	0.8809	DRS
12	0.3473	0.3832	0.9063	DRS	0.3551	0.3566	0.9958	DRS
13	1	1	1	CRS	1	1	1	CRS
14	0.7129	0.7684	0.9278	DRS	0.7224	0.7363	0.9811	CRS
15	0.9414	0.9475	0.9936	DRS	0.8509	0.8828	0.9639	DRS
16	0.4449	0.4665	0.9537	DRS	0.4868	0.5060	0.9621	IRS
17	0.5214	0.6297	0.8280	DRS	0.3756	0.3878	0.9685	CRS
18	1	1	1	CRS	1	1	1	CRS
19	0.5469	0.5654	0.9673	DRS	0.4508	0.4822	0.9349	IRS
20	0.9103	1	0.9103	IRS	1	1	1	CRS
21	1	1	1	CRS	0.9806	1	0.9806	DRS
22	0.7263	0.8123	0.8941	DRS	0.4090	0.4862	0.8412	DRS
23	0.4167	0.4928	0.8456	DRS	0.3932	0.4043	0.9725	DRS
24	1	1	1	CRS	0.6895	1	0.6895	DRS
25	0.9310	1	0.9310	IRS	0.7849	0.9371	0.8376	DRS
26	0.8885	1	0.8885	IRS	1	1	1	CRS
27	0.4952	0.5622	0.8808	DRS	0.3582	0.3625	0.9881	DRS
28	0.5310	0.5993	0.8860	DRS	0.5070	0.5128	0.9887	DRS
29	0.5658	0.6247	0.9057	DRS	0.4583	0.4630	0.9898	IRS
30	0.7189	0.8841	0.8131	DRS	0.9044	0.9081	0.9959	IRS
31	0.5924	0.8186	0.7237	DRS	0.4027	0.6596	0.6105	DRS
32	0.3632	0.3796	0.9568	IRS	0.5025	0.5298	0.9485	CRS
33	0.5724	0.6209	0.9219	DRS	0.4635	0.4711	0.9839	IRS
34	0.5601	0.6491	0.8629	DRS	0.5135	0.5504	0.9330	DRS
35	0.7330	0.7672	0.9554	IRS	0.8239	0.8747	0.9419	DRS
36	0.6069	0.6109	0.9935	DRS	0.4833	0.5124	0.9432	DRS
37	0.6566	0.7037	0.9331	DRS	0.6950	0.6974	0.9966	CRS
38	0.7106	0.7599	0.9351	IRS	0.7509	0.9490	0.7913	DRS
39	0.5756	0.6691	0.8603	DRS	0.4058	0.4304	0.9428	DRS
40	1	1	1	CRS	0.5900	0.6557	0.8998	DRS
41	0.3448	0.5385	0.6403	DRS	0.5679	0.6191	0.9173	CRS
42	0.7094	0.7344	0.9660	IRS	1	1	1	CRS
43	0.5296	1	0.5296	IRS	0.6993	0.7282	0.9603	IRS
44	1	1	1	CRS	0.8106	1.0000	0.8106	DRS
45	0.8076	0.8482	0.9521	DRS	0.4679	0.4827	0.9693	CRS
46	0.4163	0.4475	0.9303	DRS	1	1	1	CRS
47	0.7502	0.8268	0.9074	IRS	0.7578	0.9141	0.8290	DRS
48	0.7396	0.7918	0.9341	DRS	0.7242	0.7518	0.9633	CRS
49	0.9142	1	0.9142	DRS	1	1	1	CRS
50	0.3821	0.4195	0.9108	CRS	0.3531	0.4947	0.7138	DRS
Average	0.677	0.750	0.905	-	0.661	0.722	0.918	-
Max	1	1	1	-	1	1	1	-
Min	0.320	0.340	0.419	-	0.294	0.305	0.441	-
St Dev	0.214	0.210	0.115	-	0.240	0.241	0.116	-

Source: own processing.

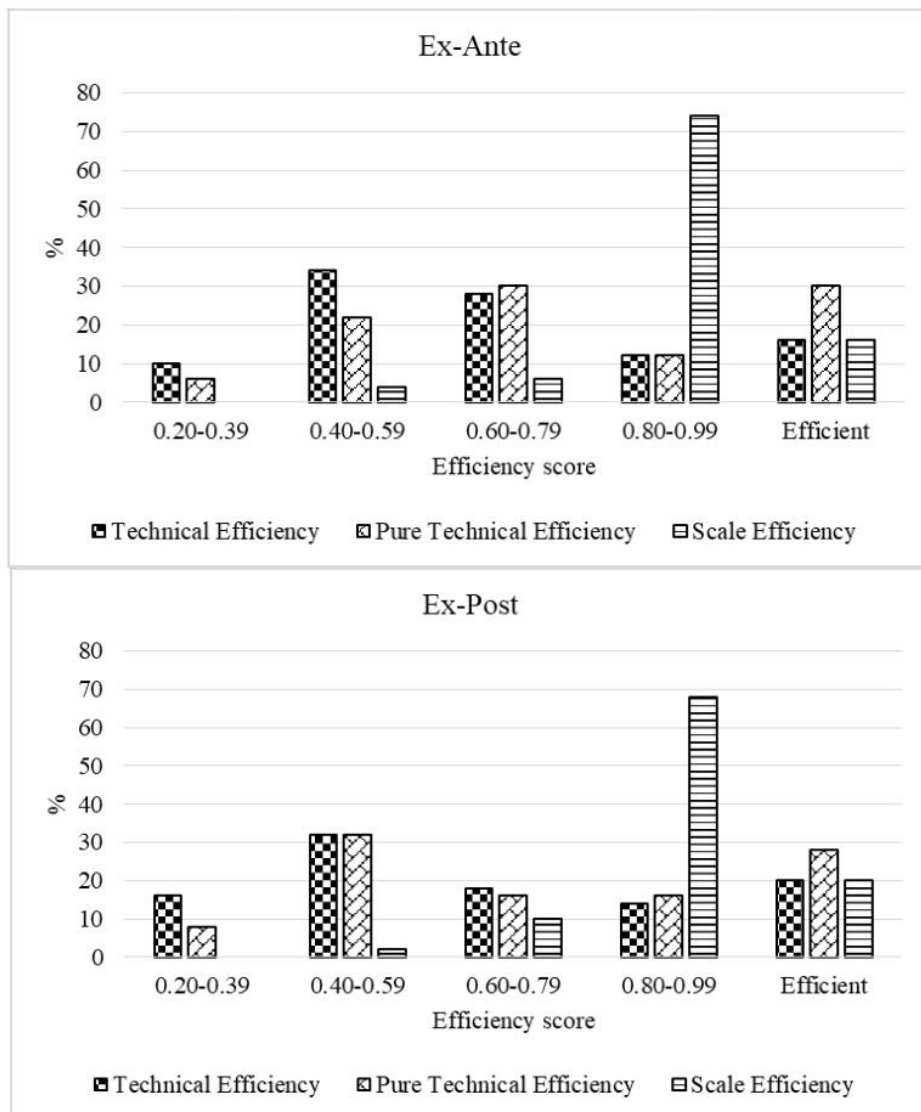


Figure 6. Efficiency score distribution for the olive farms under study, ex-ante and ex-post investment (Source: own processing).

7. Conclusions and Future Perspectives

The research focused on the effectiveness of the Community spending within the rural development policy in Calabria region (South Italy) during the 2014-2020 programming period. In particular, the investments associated to the measures aimed at restructuring and developing the physical potential and promoting innovation were considered, also in order to monitor the effects of the improvement on farm profitability over time and, overall, on regional agricultural sector. A focus on the implementation in olive sector of Measure 4.1.1 “Investments in agricultural holdings” was carried out to analyse the performance of public funding, in terms of investment granted and realized by beneficiary farms.

Data Envelopment Analysis (DEA) model was used to estimate the technical efficiency of a sample (n=50) of olive farms, by comparing two scenarios related to ex-ante and ex-post investment. The purpose was to measure the ability of farms - in terms of capacity in using investment - to maximize outputs given the same level of inputs and technology or to minimize inputs given a same level of outputs.

According to scientific literature, several studies in olive sector dealing with the computation of technical efficiency by employed DEA models that were used to examine the economic efficiency of olive-growing farms and provide information for a better assignment of European agricultural subsidies. Frequently, the results showed that the assignment of subsidies should be made in terms of farm efficiency results since the efficiency of farms would be under-estimated by an overall measurement. Moreover, the major of results indicated that efficiency is positively related to the size of the farm and, then, large farms are more likely to improve their techniques, and that the inefficiency is caused by the fact that the farms do not use minimum input or do not raise the maximum output from the actual inputs.

The evaluation of farm performances was carried out by comparing it with the best managerial practices observed on a Pareto-efficient frontier and, then, by applying input and output oriented DEA models. The choice to use both models was due to the interest in determining the returns to scale of the farms under study and estimating their scale efficiency. In particular, the input-oriented approach help to explain the major ability of producers to control inputs rather than output levels, while output-oriented approach is especially linked to the objective of rural policies in increasing farming productivity, in terms of economic results in gross saleable production.

The outcomes of the present doctoral thesis showed that the large variability of inputs and outputs used by farms analyzed, indicating inequalities in the farm structure and suggest that farm size probably plays a role in the technological differences between farms. This is appear coherent with features of the Calabrian olive system whose characteristic is the co-existence of small family-type farms with larger farms. Furthermore, focusing on variable costs, data variability signify the need for managerial efficiency.

The implementation of input and output oriented DEA models denoted in general similar results. Specifically, CCR model showed equal average results achieved by the farms, i.e., a slight worsening post investment, meaning that a wrong application of production techniques incurred, i.e., probably over-exploitation of inputs. The BCC model confirmed the negative trend both input and output approach, even if with some differences. On the contrary, in terms of scale efficiency, it can be noted a slight improvement. Indeed, analyzing the returns to scale, results showed as most “ex-post” farms achieve an optimal production scale in comparison to “ex-ante” scenario. That could indicate a positive effect achieved from the rural public funding linked to investment in technological assets.

REFERENCES

- Albisinni F (2010) Istituzioni e regole dell'agricoltura dopo il trattato di Lisbona. RDA.
- Amores AF, Contreras I (2009) New approach for the assignment of new European agricultural subsidies using scores from data envelopment analysis: Application to olive-growing farms in Andalusia (Spain). *Eur J Oper Res*, Vol. 193, No. 3, pp. 718-729. ISSN 0377-2217. DOI 10.1016/j.ejor.2007.06.059.
- Anania G (2007) Negoziati multilaterali, accordi di preferenza commerciale e Pac. Cosa ci aspetta?. Gruppo 2013 wp n. 3, Maggio 2007.
- Aparicio J, Monge JF, Ortiz L, Pasto JT (2016) Changes in productivity in the virgin olive oil sector: An application to protected designations of origin in Spain, *Span J Agric Res*, Vol. 14, No. 3, e0104, p. 12. ISSN 2171-9292. DOI 10.5424/sjar/2016143-9433.
- Artukoglu MM, Olgun A, Adanacioglu H (2010) The efficiency analysis of organic and conventional olive farms: Case of Turkey. *Agric Econ Res Rev*, Vol. 56, No. 2, pp. 89-96. ISSN 0139-570X.
- Banaeian N, Omid M, Ahmadi H (2011) Application of Data Envelopment Analysis to Evaluate Efficiency of Commercial Greenhouse Strawberry. *Res J Appl Sci, Engineering and Technology*, Vol. 3, No. 3, pp. 185-193. ISSN 2040-7467.
- Banker RD, Charnes A, Cooper WW (1984) Some models for estimating technical and scale inefficiencies in Data Envelopment Analysis. *Manage Sci*, Vol. 30, No. 9, pp. 1078-1092. ISSN 0025-1909. DOI 10.1287/mnsc.30.9.1078.
- Bartolini F, Viaggi V (2013), The common agricultural policy and the determinants of changes in EU farm size. *Land use policy*, 31, pp. 126-135.
- Beltrán-Esteve M, Reig-Martínez E (2014) Comparing conventional and organic citrus grower efficiency in Spain. *Agric Syst*, Vol. 129, pp. 115-123. ISSN 0308-521X. DOI 10.1016/j.agsy.2014.05.014.
- Boubacar O, Hui-qiu Z, Rana MA, Ghazanfar S (2016) Analysis on Technical Efficiency of Rice Farms and Its Influencing Factors in South-western of Niger. *J Northeast Agric Univ*, Vol. 23, No. 4, pp. 67-77. ISSN 1006-8104. DOI 10.1016/S1006-8104(17)30009-0.
- Bravo-Ureta B, Solís D, Moreira-López V, Maripani J, Thiam A, Rivas T (2007) Technical efficiency in farming: a meta-regression analysis. *JPA*, Vol. 27, pp. 57-72. ISSN 0895-562X. DOI 10.1007/s11123-006-0025-3.
- Bureau JC, Mahé LP (2009) CAP payments after 2013 and rural public goods. *QA–Rivista dell'Associazione Rossi-Doria*, n. 4.
- Centro studi Consiglio dell'ordine nazionale dei dottori agronomi e forestali - piani regionali di sviluppo rurale 2014 – 2020: dalla proposta all' approvazione. Febbraio 2016.
- Charnes A, Cooper WW, Rhodes E (1978) Measuring the efficiency of decision-making units. *EJOR*, Vol. 2, No. 6, pp. 429-444. ISSN 0377-2217. DOI 10.1016/0377-2217(78)90138-8.

- Clemente F, Lirio VS, Gomes MFM (2015) Technical efficiency in Brazilian citrus production. *BAE*, Vol. 4, No. 2, pp. 165-178. ISSN 2280-6180. DOI 10.13128/BAE-13597.
- Cooper WW, Seiford L, Tone K (2006) *Introduction to Data Envelopment Analysis and Its Uses*. New York, Springer US, p. 354, ISBN 978-0-387-29122-2.
- Cooper WW, Seiford L, Tone K (2007) *Data Envelopment Analysis: A Comprehensive Text with Models, Applications, References and DEA-Solver Software*, Second Edition. New York, Springer US, p. 490, ISBN 978-0-387-45283-8.
- Cooper WW, Seiford L, Zhu J (2011) *Handbook on Data Envelopment Analysis Second Edition*. New York, Springer US, p. 498, ISBN 978-1-4419-6151-8.
- De Filippis F, Storti D (2001) Le politiche di sviluppo rurale nell'Unione Europea: un secondo pilastro tutto da inventare. *Sviluppo Locale*, IX, 19, 2001.
- De Filippis F et al (2003) *La revisione di medio termine della politica agricola europea*. Edizioni Tellus, Roma.
- De Filippis F, Sotte F (2006) *Realizzare la nuova politica di sviluppo rurale Linee guida per una buona gestione da qui al 2013*. Gruppo 2013 wp n.1 - Novembre 2006.
- De Filippis F (2014), *La Pac 2014-2020. Le decisioni dell'Ue e le scelte nazionali*. Quaderni Gruppo 2013, Edizioni Tellus, Roma.
- De Filippis F, Henke R (2009) *La Pac verso il futuro. Una riflessione sui due pilastri della spesa agricola*. Gruppo 2013 wp n. 13.
- De Luca AI, Gulisano G (2009) *I fondi strutturali per lo sviluppo rurale nelle politiche comunitarie*.
- De Stefano, (1985) *Principi di politica agraria*. Il Mulino, Bologna.
- Dhungana BR, Nuthall PL, Nartea GV (2004) Measuring the economic inefficiency of Nepalese rice farms using data envelopment analysis. *Aust J Agric Resour Econ*, Vol. 48, No. 2, pp. 347-369. ISSN1467-8489. DOI /10.1111/j.1467-8489.2004.00243.x.
- Dono R (1999) *La politica agricola in Italia /1. Un profilo storico del secondo dopoguerra fino alle riforme dei giorni nostri*. Europass, dossier 13, Settembre, Anno II.
- Commissione CEE (1985) *Prospettive della PAC (Libro Verde)*. DOC COM 333 (85), Bruxelles.
- Commissione CEE (1988) *Il futuro del mondo rurale*. Comunicazione della Commissione. COM 501(88), luglio.
- Emrouznejad A, Yang GL (2018) A survey and analysis of the first 40 years of scholarly literature in DEA: 1978-2016, *Socio Econ Plan Sci*, Vol. 61, pp. 4-8. ISSN 0038-0121. DOI 10.1016/j.seps.2017.01.008.
- Fanfani R (1990) *Lo sviluppo della politica agricola comunitaria*. NIS Roma.
- Farrell MJ (1957) The Measurement of Productive Efficiency. *J R Stat Soc A Stat*, Vol. 120, No. 3, pp. 253-290. ISSN 00359238. DOI 10.2307/2343100.
- Sotte F (2009) *La politica di sviluppo rurale 2007-2013. Un primo bilancio per l'Italia "Il futuro del mondo rurale"*. (Commissione europea, 1988).

- Frascarelli A (2017) L'evoluzione della Pac e le imprese agricole: sessant'anni di adattamento. *Agriregionieuropa*, anno 13 n. 50, settembre 2017.
- Frascarelli A (2018a) Piani di sviluppo rurale guerra al disimpegno. *Terra e Vita* n. 25, 3 agosto 2018 anno LIX ISSN 2421-356X.
- Frascarelli A (2018b) Psr: tre mesi per evitare il disimpegno. *Terra e Vita*, n. 27, 7 settembre 2018 anno LIX ISSN 2421-356X.
- Frascarelli A (2018c) Psr, lotta al disimpegno e obiettivo performance. *Terra e Vita*, n. 36,30 novembre 2018 anno LIX ISSN 2421-356X.
- Frascarelli A (2019a) Psr, niente disimpegno resta il nodo della spesa. *Terra e Vita*, n. 4, 25 gennaio 2019 anno LX ISSN 2421-356X.
- Frascarelli A (2019b) Psr, torna il rischio disimpegno. *Terra e Vita* n. 18, 3 giugno 2019 anno LX ISSN 2421-356X.
- Frascarelli A (2019c) Apulia, Abruzzo e Marche Psr a rischio disimpegno. *Terra e Vita*, n. 25, 26 agosto 2019 anno LX ISSN 2421-356X.
- Galanopoulos K, Aggelopoulos S, Kamenidou I, Mattas K (2006) Assessing the effects of managerial and production practices on the efficiency of commercial pig farming. *Agric. Syst.*, Vol. 88, pp. 125-141. ISSN 0308-521X. DOI 10.1016/j.agsy.2005.03.002.
- Gulisano G (1995a) Evoluzione degli obiettivi e degli strumenti d'intervento della Politica Agricola Comunitaria delle strutture. *Tecnica Agricola*, Anno XLVII, n. 4, ottobre-dicembre.
- Gulisano G (1995b). *Agricoltura sostenibile ed evoluzione della Politica Agricola Comunitaria*. Annali della Facoltà di Economia, Vol. XI, Università di Cagliari, Franco Angeli, Milano.
- Henke R (2004), Il riorientamento delle politiche di sostegno all'agricoltura dell'UE, *Politica Agraria Internazionale*, n. 1-2.
- Hosseinzadeh-Bandbafha H, Safarzadeh D, Ahmadi E, Nabavi-Pelesaraei A (2018) Optimization of energy consumption of dairy farms using data envelopment analysis - A case study: Qazvin city of Iran. *Jssas*, Vol. 17, No. 3, pp. 217-228. ISSN 1658-077X. DOI 10.1016/j.jssas.2016.04.006.
- Jiao W, Fu Z, Mu W, Zhang X, Lu J, Xu M (2015) Estimating technical efficiency of Chinese table grape wholesalers. *BFJ*, Vol. 117, No. 6, pp. 1670-1688. ISSN 0007-070X. DOI 10.1108/BFJ-03-2014-0134.
- Joro T, Korhonen PJ (2015) *Extension of Data Envelopment Analysis with Preference Information: Value Efficiency*. New York, Springer US, p. 191, ISBN 978-1-4899-7528-7.
- Jurado EB, Moral AM, Uclés DF, Viruel MJM (2017) Determining factors for economic efficiency in the organic olive oil sector. *J Sustain Dev*, Vol. 9, No. 5, pp. 784. ISSN 2071-1050. DOI 10.3390/su9050784.
- Khoshroo A, Mulwa R, Emrouznejad A, Arabi B (2013) A non-parametric Data Envelopment Analysis approach for improving energy efficiency of grape production. *J Energy*, Vol. 63, pp. 189-194. ISSN 0360-5442. DOI 10.1016/j.energy.2013.09.021.

- Lansink AO, Reinhard S (2004) Investigating technical efficiency and potential technological change in Dutch pig farming. *Agric Syst*, Vol. 79, pp. 353-367. ISSN 0308-521X. DOI 10.1016/S0308-521X(03)00091-X.
- Liu JS, Lu LYY, Lu WM, Lin BJY (2013) A survey of DEA applications. *J Omega*, Vol. 41, No. 5, pp. 893-902. ISSN 0305-0483. DOI 10.1016/j.omega.2012.11.004.
- Mardani M, Salarpour M (2015) Measuring technical efficiency of potato production in Iran using robust data envelopment analysis. *IPA*, Vol. 2. No. 1, pp. 6-14. ISSN 2214-3173 DOI 10.1016/j.inpa.2015.01.002.
- Mohammadi A, Rafiee S, Mohtasebi SS, Mousavi Avval SH, Rafiee H (2011) Energy efficiency improvement and input cost saving in kiwifruit production using Data Envelopment Analysis approach. *J Renene*, Vol. 36, No. 9, pp. 2573-2579. ISSN 0960-1481. DOI 10.1016/j.renene.2010.10.036.
- Moro D, Sckokai P (2013) The impact of decoupled payments on farm choices: conceptual and methodological challenges. *Food policy*, Volume 41, August 2013, Pages 28-38.
- Mousavi-Avval SH, Mohammadi A, Rafiee S, Tabatabaefar A (2012) Assessing the technical efficiency of energy use in different barberry production systems. *J Clean Prod*, Vol. 27, pp. 126-132. ISSN 0959-6526. DOI 10.1016/j.jclepro.2012.01.014.
- Ozcan YA (2014) *Health Care Benchmarking and Performance Evaluation An Assessment using Data Envelopment Analysis (DEA)*. Second Edition, New York, Springer US, p. 329, ISBN 978-1-4899-7472-3.
- Ramanathan R, (2003) *An Introduction to Data Envelopment Analysis*. New Delhi, Sage Publications, p. 208, ISBN 978-0761997610.
- Sothe F (2013) *La nuova politica di sviluppo rurale*. Gruppo 2013 - wp n. 21 - Agosto 2013
- Stillitano T, De Luca AI, Iofrida N, Falcone G, Spada E, Gulisano G (2017) Economic Analysis of Olive Oil Production Systems in Southern Italy. *Quality - Access to Success*, Vol. 18, No. 157, pp. 107-112. ISSN 1582-2559.
- Stillitano T, Falcone G, De Luca AI, Spada E, Gulisano G, Strano A (2018) Long-term feasibility of Mediterranean olive production systems. *Acta Horti*, Vol. 1199, pp. 203-208. ISSN 2406-6168. DOI 10.17660/ActaHorti.2018.1199.33.
- Theodoridis A, Ragkos A, Roustemis D, Galanopoulos K, Abas Z, Sinapis E (2012) Assessing technical efficiency of Chios sheep farms with data envelopment analysis. *J Small rumres*, Vol. 107, No. 2-3, pp. 85-91. ISSN 0921-4488. DOI 10.1016/j.smallrumres.2012.05.011.
- Toma E, Dobre C, Dona I, Cofas E (2015) DEA applicability in assessment of agriculture efficiency on areas with similar geographically patterns. *J Aaspro*, Vol. 6, pp. 704-711. ISSN 2210-7843 DOI 10.1016/j.aaspro.2015.08.127.
- Urso A, Timpanaro G, Caracciolo F, Cembalo L (2018) Efficiency analysis of Italian wine producers. *J Wep*, Vol. 7, No. 1, pp. 3-12. ISSN 2212-9774. DOI 10.1016/j.wep.2017.11.003.

Vidal F, Pastor JT, Borrás F, Pastor D (2013) Efficiency analysis of the designations of origin in the Spanish wine sector. *Span J Agric Res*, Vol. 11, No. 2, pp. 294-304. ISSN 2171-9292. DOI 10.5424/sjar/2013112-3607.

Zahrnt V (2009) Public money for public goods: winners and losers from Cap reform. WP n. 08, ECIPE, Brussels.

SITOGRAPHY

<http://www.europarl.europa.eu>

https://ec.europa.eu/info/topics/agriculture_it

<https://enrd.ec.europa.eu>

<https://www.politicheagricole.it>

<http://www.ismea.it/istituto-di-servizi-per-il-mercato-agricolo-alimentare>

<https://www.reterurale.it>

<https://agrireregionieuropa.univpm.it>

TABLES INDEX

- **Table 1.** Breakdown of Union support for Rural Development (2014-2020) EU 28
- **Table 2.** Allocation of funds for rural development 2014-2020
- **Table 3.** Comparison between Regions (physical, economic and political indicators).
- **Table 4.** Financial allocation, measure impact of RDPs in Italian Regions
- **Table 5.** Financial progress of the Italian RDPs as of 06/30/2019
- **Table 6.** Priorities and Focus Area activated in the current programming period by the Calabrian Region.
- **Table 7.** Financial Allocation of the RDP 2007/2013
- **Table 8.** Financial framework of the RDP
- **Table 9.** Financial progress of the Calabrian RDP 2014-2020 on 09/26/2019
- **Table 10.** Impact on financial progress as of September 26th, 2019
- **Table 11.** Measures foreseen by the Measure 4.1.1. - Investments in agricultural holdings.
- **Table 12.** Sample subdivision by production chain and type of investment (%)
- **Table 13.** Summary Primary Database
- **Table 14.** Descriptive statistics of the input and output used in DEA model.
- **Table 15.** DEA scores and returns to scale for the olive farms under study, assuming input-oriented CCR and BCC DEA models.
- **Table 16.** DEA scores and returns to scale for the olive farms under study, assuming output-oriented CCR and BCC DEA models.

FIGURES INDEX

- **Figure 1.** Production frontier of the CCR Model
- **Figure 2.** Production frontier of the BCC Model
- **Figure 3.** Slacks in VRS DEA Model
- **Figure 4.** DEA model classifications-basic envelopment models (Source: zcan et al., 2014).
- **Figure 5.** Efficiency score distribution for the olive farms under study, ex-ante and ex-post investment.
- **Figure 6.** Efficiency score distribution for the olive farms under study, ex-ante and ex-post investment.

Ringrazio il Tutor Prof. Giuseppe Zimbalatti, la Cotutor Dr.ssa Anna Irene De Luca, il Prof. Giovanni Gulisano, il Prof. Alfio Strano e tutto il settore AGR-01.

Particolare ringraziamento lo rivolgo alla D.ssa Teodora Stillitano per avermi dato esempio della sua professionalità e dedizione nonostante i suoi importanti impegni familiari e al Dr. Bruno Francesco Nicolò per il supporto nella elaborazione dei dati.