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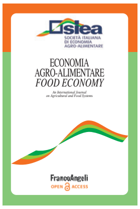

Economic characterization of irrigated and livestock farms in The Po River Basin District

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Abstract

This article highlights the potential for collecting and processing territorial data in order to facilitate planning and programming that respond to real local problems and include the political and regulatory framework in force. A case study is explored that involves the joint use of two databases with institutional functions: the Farm Accountancy Data Network (FADN) and the National Information System for Water Management in Agriculture (SIGRIAN). Both databases are managed by the Council for Agricultural Research and Economics (CREA). Those data were used to calculate economic-structural indicators for irrigated and livestock farms located in the Po River Basin District and to run the socio-economic analysis required to update the Water Management Plan. The updating of plans is governed by the Water Framework Directive (Directive 2000/60/EC), which establishes the community framework for water and requires all Member States to review and update their Plan every six years. The first update deadline was December 2015 and the second one will be December 2021. The integrated use of two databases made it possible to identify farms according to two types of irrigation:

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collective or self-supplied. With collective irrigation (Irrigation Water Service), the farm is a user of a Local Agency for Water Management (LAWM) that collects and distributes irrigation water. With self-supplied irrigation, the individual farmers collect and distribute water themself. The analysis carried out demonstrates the need and opportunity to develop coordinated data collection and management systems, thereby strengthening and refining the monitoring and programming of water use in line with the real needs of the territory.

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Introduction

Sustainable water management and the adaptation of the agricultural sector to climate change have become important issues within the international, European and national political contexts (FAO, 2017). Indeed, access to water and efficient water management are included in the 2030 Agenda for Sustainable Development Goals (UN, 2015). The increasing frequency and intensity of extreme climate phenomena (IPCC, 2014) necessitate more efficient water resource management for household, industrial, energy and agricultural uses (Benedetti *et al.*, 2019). Water resource management has a strategic function in terms of ensuring international food security amidst growing global demand for food (FAO, 2011; 2012).

Irrigation not only allows farmers to be flexible in choosing the production systems (INEA, 2009), but it also plays an important role already at the level of the economy of each individual farm, simply because it represents the most important element of intensification in agricultural production (Columba, Altamore, 2006). The immediate consequence of crop intensification, made possible by the water factor, is that farmers invest many of their other resources, such as working units and capital employed, in the irrigation sector instead of in the non-irrigation- related ones. Irrigated crops, especially crops with high market value, contribute significantly to the gross saleable production (GSP) of farms and the efficient use of water resources allows a quantitative and qualitative improvement of production, which is essential in securing a role in the national and especially international scenario. Non-restrictive access to water also allows for irrigation of crops that not necessarily need water, leading to an increase in the value of production and therefore of the farm's income.

In Italy, the agricultural sector produces added value, guarantees employment, and generates an important flow of exports that promote the quality of agri-food production (CREA, 2021). Irrigated agriculture also plays a decisive role in protecting the natural territory and in generating important environmental benefits for ecosystem services (MEA, 2005; Van der Meulen *et al.*, 2018; Dominati *et al.*, 2010; Adhikari and Hartemink, 2016). Many of these benefits are positive externalities of production whose economic value is not recognised by the market (Natali and Branca, 2020).

Positive environmental externalities generated by agricultural irrigation include: (i) water regulation in terms of nutrient cycle and conservation of the territorial hydrogeological balance, water purification and assimilation of waste (e.g. aquifer recharge and water vivification), counteracting the rising saline wedge and soil salinization, and reduction of hydraulic and flood risk; (ii) improved natural habitats and increased plant and animal biodiversity, reduced risk of forest fire and parasite attacks on grassland-pastures, and protection of wetland biodiversity; (iii) improvement and enhancement of the rural landscape and its socio-cultural and recreational aspects (e.g. the historical canal system, hydraulic knots and artefacts, fountains, or hedges and rows associated with sliding channels which are important in combating the trivialization and urbanization of the landscape); (iv) crop diversification towards more environmentally sustainable crops, such as the maintenance of pasture meadows and the increase in fodder crops that allow longer-lasting land cover with benefits for organic matter and its carbon tanks (Bellver-Domingo *et al.*, 2016; FAO, 2019; Jandl, 2010; Martin-Ortega *et al.*, 2015; Peter *et al.*, 2008).

The Common Agricultural Policy (CAP) environmental objectives – both current objectives and those post-2022 – are strongly interconnected with European regulations aimed at the protection of natural resources, and primarily the Water Framework Directive 2000/60/EC (WFD). With the adoption of the WFD, water is no longer assessed as a mere productive resource; rather, due to its many functions, it is considered an essential element in ensuring stability in ecosystems and sustainability in general. The WFD emphasises economic value and makes use of tools and incentives such as volumetric pricing to achieve environmental objectives. Moreover, it introduces the concept of "full cost" (Gallerani, Viaggi, 2006), which not only includes financial costs, but also the opportunity cost, that is quantified on the basis of alternative uses of water and environmental costs. By including the opportunity cost, the use of water mainly in more profitable activities is encouraged, thus reducing waste as much as possible. Finally, the aim of environmental costs is to apply "the polluter pays" principle, thereby discouraging the generation of this type of costs (Dono, Severini, 2006). For this reason, water management programming provided by the WFD is in line with the future CAP programming through the preparation of National Strategic Plans by the Member States.

This difficult challenge entails obstacles typical of water resource management that derive from the variety of interconnected territorial competences and programming approaches, all of which address productive enhancement or environmental protection. From this point of view, considering the competences composition of Regions and Ministries, it is not risky to hope that the implementation of the WFD and the CAP can help each other, experimenting virtuous synergy or exploiting experiences and past mistakes.

The WFD and the CAP both promote efficient and sustainable water resource management, reduce agricultural pressure on the quantitative and qualitative state of surface and groundwater, and general maintenance of water bodies. In addition to the CAP, the *European Union's Green Deal the "Farm to Fork"* and biodiversity strategies may have significant implications for water resource management for agriculture. Optimum use of water resources must entail protecting quality and preventing the leaking of pesticides and fertilizers that can generate negative externalities in the environment.

In line with the WFD, each Member State divided its territory into River Basin Districts[1], the territorial reference unit for sustainable water resource management. In Italy, there are seven Riven Basin District Authorities: the Po River, the Eastern Alps, the Northern Apennines, the Central Apennines, the Southern Apennines, Sicily, and Sardinia.

The River Basin District Authorities (RBDAs) are responsible for implementing the operational measures in the Water Management Plans (WMP) in order to achieve the environmental objectives of the WFD. The analyses of the characteristics of River Basin Districts required by Article 5 of the WFD, the impact of human activities on surface and groundwater, and the economic analysis of all water uses (including agricultural) adhere to the WMP. The WFD expects the drafters of the WMP to be supported by an economic analysis of the social and economic sustainability of environmental measures.

Since the first planning cycle (2011-2015), the economic analyses by RBDAs have not been performed in a uniform way, due to a lack of information sources and the difficulty of comparing and processing conflicting data. For this reason, the European Commission formalised a pre-litigation procedure (EU Pilot 7304) for the application of RBDAs economic analyses in the drafting of the WMP. In response, the current Ministry of Ecological Transition (MiTE) launched an action plan to develop an operational and methodological Manual for Economic Analysis (MEA), to be drafted in consultation with the RBDAs, the Ministry of Agricultural, Food and Forestry Policies (MiPAAF), the Council for Agricultural Research

1. Land and sea area, consisting of one or more neighbouring hydrographic basins and their respective groundwater and coastal waters.

and Economics (CREA), the Regulatory Authority for Energy Networks and Environment (ARERA) and the National Statistical Institute (ISTAT) (MATTM, 2018)[2].

The economic analysis in support of the WMP is, therefore, drawn up in accordance with the MEA, which provides valid and uniform indications throughout the national territory. The MEA established indicators for each type of water resource use and service. Many of these indicators require economic data from the Farm Accountancy Data Network (FADN), particularly data from the socio-economic analysis of the collective water service, self-supply irrigation, and livestock use.

The aim of the present article is to highlight the potential for collecting and processing territorial data in order to facilitate planning and programming that respond to real local problems and include the political and regulatory framework in force. A case study is explored that involves the joint use of two databases with institutional functions: the Farm Accountancy Data Network (FADN) and the National Information System for Water Management in Agriculture (SIGRIAN). Both databases are managed by the Council for Agricultural Research and Economics (CREA).

The joint use of the FADN and SIGRIAN databases can provide the information necessary for socio-economic analysis. An opportunity also exists to expand the database on irrigation water use. This would improve the performance of agricultural and environmental policies.

The introduction of new variables concerning irrigation systems in the FADN database and monitoring of information being constantly added to the SIGRIAN database on the one hand, and the joint use of these data on the other, would guarantee a complete and shared knowledge of the management of water resources in agriculture. This is an important concept both at the national and international level and includes social and economic sustainability as well as environmental and agronomic aspects. This could lead to the creation of a system for monitoring the sustainability of farms and evaluating the performance of sustainable and certified food systems.

The benefits of such an approach are borne out in the results of a socio-economic analysis of irrigation and livestock in the Po River Basin District (which includes the Regions of Piedmont, Valle d'Aosta, Lombardy, and Emilia-Romagna, and partly the territory of Liguria, Veneto, Tuscany, Marche, and the Autonomous Province of Trento).

The data and methodology, results, and final considerations of that analysis are presented below.

2. This Manual represents, among other things, the application and complementary tool to the MITE Decree of 24 February 2015 no. 39 "Regulation containing the criteria for defining environmental and resource costs for the various sectors of water use".

1. Methodology and databases

The economic and structural indicators required by the MEA for different agricultural uses concern employees, total turnover, turnover per employee, and value added for the two years referenced: 2016 and 2018[3].

Irrigated agricultural use includes the following aspects:

- the Irrigation Water Service (i.e. the water service provided collectively by Local Agencies for Water Management - LAWMs);
- the self-supply irrigation (defined in Article 6 of RD 1775/1933);
- water for livestock and aquaculture.

Collective irrigation is managed by LAWMs, which can be of a public (Reclamation and Irrigation Consortia) or private legal nature. According to the Ministry of Agriculture Guidelines[4] (M.D. 31 July 2015) LAWMs are required to join the National Information System for the Management of Water Resources in Agriculture (SIGRIAN). Within the SIGRIAN, the territory of each LAWM is divided into irrigation areas, i.e., physical, and administrative territorial units served, in whole or in part, by a system of irrigation networks. In general, the area is defined by as irrigated with respect to the development of an irrigation scheme[5], in each area of its territory, that is a territorial unit that identifies areas equipped for irrigation. The irrigation areas are divided into LAWMs, i.e. areas where the water distribution network is developed powered by its own divider[6].

The self-supply irrigation by farmers, who are not associated and served by LAWMs and therefore do not fall within the Irrigation Water Service (IWS), constitutes withdrawal in self-supply. The availability of SIGRIAN information on areas falling within LAWMs and served by irrigation services makes it possible to calculate areas potentially affected by self-supply withdrawals by difference. This estimate assumes that wells or other self-supply methods are not in use in the LAWMs territories. Unfortunately, the current information system does not make it possible to verify whether and to what extent this assumption is true, in the lack of a timely and reasonably complete collection of self-supply sampling points in the agricultural context.

3. The 2017 agricultural year is not considered because it has been characterized by extreme weather conditions.

4. Ministerial Decree 31/07/2015 of Ministry of Agriculture "Guidelines for the regulation by the regions of the methods for quantification of water volumes for irrigation".

5. All the hydraulic infrastructure necessary for the distribution of water for irrigation purposes; it consists of a source of supply from which the supply network to which the distribution network is connected branches out and which distributes water within the individual irrigation districts. SIGRIAN currently collects information about the main network and only partially the distribution network.

6. Hydraulic structure for the delivery of water to the consortium distribution network.

The data of the FADN used in the description of the farms are both structural and economic: there are elementary data on the business structure such as Technical Economic Orientation (TEO), Economic Dimension Unit (EDU), class of Utilized Agricultural Area (UAA), values of UAA, Total Agricultural Area (TAA) and irrigated, Adult Livestock Units (LU), Working Units (WU); balance sheet data such as total revenue, added value, and net income; data on certifications for animal species such as the type and subject of certification; crop data which include the plant species, the cultivation method, the relative total production; information on the cost of labour and on the irrigation systems present.

The FADN survey is a sample survey in which a sample of farms that are statistically representative of the national reality is extracted each year. The information listed above refers exclusively to the farms in the sample, but can be extended to the regional level, using multiplicative factors relative to the variables. However, no carry-over to the regional level was carried out since, being the FADN data classified by Region, for the Regions that are only partially included in the Po River Basin District the data would present a certain degree of imprecision. Therefore, it was decided to report the average data of the farms since, being a sample survey, it would not be correct to analyse the overall data. Furthermore, the FADN does not consider farms with Standard Production lower than 8,000 euros which, therefore, are not included in the sample survey. These farms are of very small size, both economic and physical, but the high number of these small and very small farms in the Italian national territory could lead to a non-negligible distortion in the representation of the analysed reality.

It is important to underline that the aim of these two databases is not the same. The FADN's priority task is to collect information for the definition and evaluation of the CAP through the simulation of different scenarios on farm sustainability (economic, environmental, social and innovations); SIGRIAN was created in 1994 in order to collect information on the irrigation water service. In 2015, in order to respond to the ex-ante Conditionalities for water resources, according to the Ministry of Agriculture Guidelines (M.D. 31 July 2015)[7], SIGRIAN became the national tool for quantifying and monitoring water volumes for irrigation both for the Irrigation Water Service and for self-supply irrigation. The two databases therefore contain complementary information on irrigation. Over the years, the FADN database has been updated with additional information on irrigation although to date it does not contain a breakdown of farms by type of irrigation used.

The FADN database used for the socio-economic analysis reports useful parameters for calculating the economic-structural indicators required by

7. The guidelines are finalized to promote the use of water metering and the application of water prices based on the volumes used in agriculture.

the MEA; it reports the municipality to which it belongs, the farm code and the geographical coordinates for the distinction of farms using the Irrigation Water Service and the self-supply irrigation, carried out through cartographic analysis.

The FADN dataset was reported in a Geographic Information System (GIS) software, using files in Comma Separated Value (CSV)[8] format and the farms coordinates in the sample for the two years, 2016 and 2018. This, in order to be able to cross with the *shapefiles* of the Po River Basin District and the LAWMs in the SIGRIAN Web-GIS platform, on a regional basis. It was thus possible to discriminate between the farms in the FADN sample falling within the limits of the SIGRIAN LAWMs (analysed in the Irrigation Water Service) and the farms falling outside the limits of SIGRIAN LAWMs (analysed in the self-supply irrigation).

Livestock farms, on the other hand, were isolated, on a regional basis, considering Adult Livestock Unit (LU) values greater than zero.

2. Results and discussion

2.1. *Economic-structural indicators of Farms using Irrigation Water Service*

In the study of Irrigation Water Service by FADN data, only the farms included in the SIGRIAN LAWMs have been considered. Tuscany and Liguria do not appear, in fact, in their territory included into the Po River Basin District, there is only self-supply irrigation.

To mitigate the impact of annual variability in the assessment, two years were considered: 2016 and 2018. Since the variability between those two years is relatively small, the data for 2018 will be discussed in general, keeping 2016 as a frame of reference.

In 2018, the sample consists of 54,873 farms, distributed as follows: 20,063 in Emilia Romagna, 14,691 in Lombardy, 11,794 in Piedmont, 334 in the A.P. of Trento, 867 in Valle d'Aosta and 7,124 farms in Veneto.

Starting from the analysis of farm Agricultural Area (Table 1), in the Regions and Autonomous Province (A.P.) it is equal, on average, to 35.6 hectares in 2018, compared to 31.3 hectares in 2016. The Utilized Agricultural Area (UAA) is, on average, equal to 27.5 hectares in 2018. The minimum value is recorded in the Autonomous Province of Trento, with 4.6 hectares in 2018, while the maximum values are found in Valle d'Aosta with 33.2 hectares in 2018. These values can be justified by the circumstance that

8. Comma Separated Value: Text files made up to contain information in a table-like manner. It is a file format that allows the transfer of data from one program to another.

farms with less than 8,000 euros of Standard Production are not included in the sample study, as mentioned above. This barrier means that the fruit farms of the A.P. of Trento with limited areas are, in any case, included in the analysis because of the high value of their production per hectare; quite the opposite happens for farms in Valle d'Aosta, where only the larger ones are included because they exceed the minimum threshold.

Table 1 - Average Agricultural Area (TAA), Average Utilized Agricultural Area (UAA) and Average Irrigated Utilized Agricultural Area for Farms into LAWN, years 2016 and 2018

Regions	Average farm TAA (ha)	Average Farm UAA (ha)	Average Farm Irrigated UAA (ha)	Average Farm TAA (ha)	Average Farm UAA (ha)	Average Farma Irrigated UAA (ha)
		2016			2018	
Emilia Romagna	32,87	30,32	10,58	30,18	27,96	7,80
Lombardy	31,86	30,19	26,73	53,69	28,66	24,92
Piedmont	32,28	30,76	25,56	30,69	29,57	21,70
A.P. Trento	–	–	–	4,83	4,59	2,60
Valle d'Aosta	90,71	46,19	8,37	37,49	33,23	6,70
Veneto	22,34	20,39	7,81	22,52	20,72	10,02
The Po River Basin Authority	**31,31**	**28,73**	**15,69**	**35,55**	**27,50**	**15,61**

Source: CREA PB processing about FADN and SIGRIAN data.

As of Working Units (WU), the situation is quite homogeneous among the Regions and the A.P. considered, with values around 1.5 WU per farm (Table 2).

For the irrigated UAA (Table 3), at farm level, there is significant variability among the Regions and the A.P. considered. The average value of the irrigated area on the UAA is equal, in 2018, to 56%; more than half of the average UAA is irrigated, with the highest value recorded in Lombardy (86%) and the lowest value in Valle d'Aosta (20%). In two other important Regions for the Po River Basin District, Piedmont and Emilia-Romagna, the ratio of irrigated UAA to UAA is 73% and 27% respectively.

Another important indicator is the ratio between UAA and WU, which indicates the number of hectares for each WU present on the farm. The average value of the UAA/WU ratio, in 2018, is 18.3 he/WU, with the maximum value in Piedmont (21 he/WU) and the minimum value in the A.P. of Trento (4.2 he/WU). In Piedmont, Lombardy and Emilia Romagna, the ratio is 21, 19.5 and 17.1 he/WU, respectively.

Table 2 - Average Work Unit (WU), Average Total Revenue (TR) and Average Added Value (AV) for Farms into LAWN, years 2016 and 2018

Regions	**Average Farm WU**	**Average Farm TR (€)**	**Average Farm AV (€)**	**Average Farm WU**	**Average Farm TR (€)**	**Average Farm AV (€)**
		2016			**2018**	
Emilia Romagna	1,59	129.481,47	73.426,25	1,63	119.956,24	67.315,09
Lombardy	1,62	183.316,20	105.578,78	1,47	173.560,92	89.262,51
Piedmont	1,86	161.407,78	89.897,19	1,41	102.256,84	52.546,48
A.P. Trento	–	–	–	1,09	81.117,34	63.992,78
Valle d'Aosta	2,04	54.516,47	32.280,34	1,67	59.339,66	34.250,90
Veneto	1,12	85.121,67	46.285,68	1,35	100.222,05	57.258,27
The Po River Basin Authority	**1,55**	**136.965,75**	**77.470,26**	**1,50**	**126.747,14**	**68.168,43**

Source: CREA PB processing about FADN and SIGRIAN data.

Table 3 - Structural indicators for Farms into LAWN, years 2016 and 2018

Regions	**UAA/TAA**	**Irrigated UAA/UAA**	**UAA/WU**	**UAA/TAA**	**Irrigated UAA/UAA**	**UAA/WU**
		2016			**2018**	
Emilia Romagna	0,92	0,34	19,12	0,92	0,27	17,09
Lombardy	0,94	0,88	18,59	0,53	0,86	19,49
Piedmont	0,95	0,83	16,50	0,96	0,73	20,95
A.P. Trento	–	–	–	0,95	0,56	4,20
Valle d'Aosta	0,50	0,18	22,65	0,88	0,20	19,85
Veneto	0,91	0,38	18,25	0,91	0,48	15,31
The Po River Basin Authority	**0,91**	**0,54**	**18,51**	**0,77**	**0,56**	**18,28**

Source: CREA PB processing about FADN and SIGRIAN data.

A marked variability in economic data, such as total revenue (TR) and added value (AV) can be observed. Also, with respect to these variables, to mitigate seasonal variability, data are reported for two years: 2016 and 2018. As shown in Table 4, variations are found between the two years considered but these differences can be considered in a small range of variation, demonstrating that the sample is robust. Consequently, for consistency with the other information reported, it seems justifiable to comment only on the data for 2018.

For the TR/WU ratio in 2018, an average value of 84,278 euros is recorded. The highest value is recorded in Lombardy (118,017 euros),

Table 4 - Economic indicators for Farms into LAWN, years 2016 and 2018

Regions	TR/WU	TR/UAA	AV/WU	AV/TR	TR/WU	TR/UAA	AV/WU	AV/TR
	2016				2018			
Emilia Romagna	81.665,07	4.270,08	46.310,56	56,71%	73.329,08	4.289,04	41.149,62	56,12%
Lombardy	112.915,06	6.072,71	65.032,08	57,59%	118.017,16	6.054,27	60.696,31	51,43%
Piedmont	86.605,74	5.247,89	48.235,67	55,70%	72.451,17	3.457,69	37.230,31	51,39%
A.P. Trento	–	–	–	–	74.201,48	17.634,30	58.536,92	78,89%
Valle d'Aosta	26.740,32	1.180,35	15.833,50	59,21%	35.461,49	1.785,68	20.468,40	57,72%
Veneto	76.205,87	4.174,65	41.437,63	54,38%	74.086,15	4.835,95	42.326,46	57,13%
The Po River Basin Authority	**88.265,85**	**4.767,22**	**49.924,72**	**56,56%**	**84.277,93**	**4.608,83**	**45.327,21**	**53,78%**

Source: CREA PB processing about FADN and SIGRIAN data.

followed by the A.P. of Trento, Veneto, and Emilia-Romagna, with values above 73,000 euros; while the lowest value is recorded in Valle d'Aosta, with values around 35,000 euros. Therefore, the turnover per worker (measured in terms of TR), which indicates the average economic value of labour productivity, shows a very high variability in the District; a variability explained by the type of cultivation and by the structure of the farms, in terms of size and work organization. In any case, in most of the Regions of the District included in the Irrigation Water Service, there is a rather high TR/WU ratio, considering that, according to ISTAT data, at national level, the value of Agricultural Production per WU in 2018 is about 44,000 euros[9].

Significant variability is found in the Added Value (AV) per WU, an indicator of labour profitability. With an average value of 45,327 euros in 2018, the highest level is found in Lombardy (about 60,000 euros), followed by the A.P. of Trento, with 58,500 euros, and then by Veneto, Emilia Romagna, and Piedmont. The lowest value is observed in Valle d'Aosta (20,500 euros). Also, in this case, in order to have a reference benchmark, it can be considered that the national average value of the AV/WU ratio, according to ISTAT data, was equal in 2018 to about 24,400 euros.

In addition, it is interesting to note that the average AV/TR ratio is around 54% in 2018; this ratio depends on the extent of the costs of raw materials and services and derives from how much value the production process adds to the raw materials used: it is structurally different depending on the crops.

Another interesting indicator is the TR/UAA ratio, which represents the economic value of land productivity. An average of 4,609 euros/ha in 2018

9. ISTAT and FADN data are not perfectly comparable, but the comparison still provides a basic benchmark.

corresponds to very differentiated values, with the highest value in the A.P. of Trento, with as much as 17,600 euros, and the lowest in Valle d'Aosta (less than 1,800 euros). In Lombardy there is a rather high value, namely 6,000 euros/ha (the highest value after the A.P. of Trento), followed by Veneto and Emilia Romagna (values above 4,000 euros/ha) and then Piedmont (3,500 euros/ha).

2.2. *Economic-structural indicators of farms using self-supply irrigation*

In analysing FADN data for agricultural use of water in self-supply irrigation, only farms falling outside the SIGRIAN LAWMs were considered. Again, the variability between the two years considered is relatively low, so the data for 2018 will be discussed in general, keeping those for 2016 as a frame of reference.

In 2018, the sample of farms using self-supply irrigation consists of 83,850 farms, distributed as follows: 29.256 in Emilia-Romagna, 19.663 in Lombardy, 30.887 in Piedmont, 1.212 in the Autonomous Province (A.P.) of Trento, 391 in Valle d'Aosta, 1.359 in Veneto, 642 in Liguria, 301 in Marche and 139 in Tuscany. In terms of numbers, Emilia-Romagna, Piedmont and Lombardy are by far the most important regions (Table 5).

Table 5 - Number of Farms in the self-supply irrigation area, years 2016 and 2018

Regions	**2016**	**2018**
Emilia Romagna	25.924	29.256
Liguria	627	642
Lombardy	22.228	19.663
Marche	227	301
Piedmont	20.954	30.887
Tuscany	184	139
A.P. Trento	280	1.212
Valle d'Aosta	342	391
Veneto	1.683	1.359
The Po River Basin Authority	**72.451**	**83.850**

Source: CREA PB processing about FADN and SIGRIAN data.

An analysis of farm Agricultural Area (Table 6) shows that in the Regions and Autonomous Province considered, it amounts to an average 25,43 hectares in 2018, compared to 24,14 hectares in 2016. The Utilized

Table 6 - Average Agricultural Area (TAA), Average Utilized Agricultural Area (UAA) and Average Irrigated Utilized Agricultural Area for Farms in the self-supply irrigation area, years 2016 and 2018

Regions	**Average Farm TAA (ha)**		**Average Farm UAA (ha)**		**Average Farm Irrigated UAA (ha)**	
	2016	**2018**	**2016**	**2018**	**2016**	**2018**
Emilia Romagna	26,32	28,35	20,22	21,03	3,37	2,93
Liguria	13,38	12,74	12,62	12,07	0,25	0,24
Lombardy	20,42	22,92	18,9	21,15	10,1	11,17
Marche	18,58	26,99	16,97	23,96	–	–
Piedmont	23,7	23,35	19,2	18,41	3,72	3,86
Tuscany	224,85	277,25	80,07	78,89	–	–
A.P. Trento	12,97	9,92	10,91	9,06	2,38	3,2
Valle d'Aosta	76,1	66,19	63,08	62,4	6,18	6,12
Veneto	19,01	28,72	16,77	25,18	9,28	11,84
The Po River Basin Authority	**24,14**	**25,43**	**19,68**	**20,21**	**5,64**	**5,33**

Source: CREA PB processing about FADN and SIGRIAN data.

Agricultural Area (UAA) is, on average, 20,21 hectares in 2018. The lowest value is recorded in the Autonomous Province of Trento, with 9,06 hectares in 2018, while the highest values are found in Tuscany with 78,89 hectares in 2018.

As expected, from a structural point of view a very diversified reality emerges from Region to Region. In particular, Liguria and the Autonomous Province of Trento have very limited average farm sizes, both in terms of Total Agricultural Area (TAA) and Utilized Agricultural Area (UAA). On the contrary, farms in Tuscany have a particularly high average size (277,25 hectares of SAT and over 78 hectares of UAA in 2018). It is important to underline that these data are probably conditioned by the small size of the sample (falling in the Po River Hydrographic District) for this Region.

Regarding the average farm size in the different Regions, the most relevant information is that about the average irrigated UAA. According to these sample data, the average irrigated area is around 5,33 hectares in 2018, which corresponds to 26,4% of the average total UAA and these values are very similar to those of 2016. While in Lombardy and Veneto the average irrigated UAA is around 50%, in Piedmont it is around 20% and in Emilia-Romagna 14%, due to both the availability of irrigation and the conformation of the territory, more or less suitable for irrigation.

These values are lower than those related to the farms that are part of LAWMs but, in any case, higher than the average values of other farms located in the same areas, as a consequence of the way the sample was designed. From the analysis of these data, it emerges that Lombardy is, on the whole, the Region that contributes the most to the total irrigated UAA.

Turning to the economic characteristics of the farms, in particular in terms of labour, the average number of Working Units (WU) per farm is just under 1,5 units, both in 2018 and 2016, with different values from Region to Region. The minimum is 1,1 WU in Liguria and Marche and the maximum is 2,3 WU in Tuscany (Tables 7 and 8).

The total revenue of the farms using self-supply irrigation is around 99 thousand euros, but with considerable fluctuations from one Region to another, ranging from 33-34 thousand euros in Liguria to 150-160 thousand euros in Veneto. In Lombardy the average value of total revenues is around 110,000 euros, in Piedmont around 95,000 euros and in Emilia-Romagna 94,000 euros.

Also, in terms of added value there are important differences: the average added value per farm is about 54 thousand euros, with a minimum for Liguria equal to 22-23 thousand, and a maximum for Veneto where, in 2018, it exceeded 84 thousand euros. In the two years analysed, the ratio of added value to total revenues is between 54 and 55%, substantially in line with the

Table 7 - Average Work Unit (WU), Average Total Revenue (TR) and Average Added Value (AV) for Farms in the self-supply irrigation area, years 2016

Regions	**Average Farm WU**	**Average Farm TR (€)**	**Average Farm AV (€)**	**AV/TR (%)**
Emilia Romagna	1,39	93.408,66	51.248,66	54,86
Liguria	1,06	33.249,77	23.170,51	69,69
Lombardy	1,48	106.553,10	54.459,22	51,11
Marche	1,10	38.492,54	25.771,52	66,95
Piedmont	1,51	97.284,88	58.370,75	60,00
Tuscany	2,34	74.871,85	52.254,85	69,79
A.P. Trento	1,25	84.202,46	50.556,27	60,04
Valle d'Aosta	2,06	67.859,46	38.939,16	57,38
Veneto	1,66	150.533,28	68.511,81	45,51
The Po River Basin Authority	**1,46**	**98.993,72**	**54.313,62**	**54,87**

Source: CREA PB processing about FADN and SIGRIAN data.

Table 8 - Average Work Unit (WU), Average Total Revenue (TR) and Average Added Value (AV) for Farms in the self-supply irrigation area, years 2018

Regions	Average farm WU	Average farm TR (€)	Average farm AV (€)	AV/TR (%)	AV/WU (€/wu)	TR/UAA (€/ha)
Emilia Romagna	1,41	94.827,21	52.316,38	55,17	37.103,82	4.509,14
Liguria	1,07	34.489,79	22.158,86	64,25	20.709,21	2.857,48
Lombardy	1,43	115.152,33	57.654,69	50,07	40.317,97	5.444,55
Marche	1,12	49.329,17	33.345,87	67,60	29.773,10	2.058,81
Piedmont	1,49	93.126,27	50.933,98	54,69	34.183,88	5.058,46
Tuscany	2,27	91.787,31	62.918,82	68,55	27.717,54	1.163,48
A.P. Trento	1,17	69.475,83	50.063,20	72,06	42.789,06	7.668,41
Valle d'Aosta	1,93	79.933,50	46.257,63	57,87	23.967,68	1.280,99
Veneto	1,62	162.839,55	84.356,56	51,80	52.071,95	6.467,02
The Po River Basin Authority	**1,44**	**99.002,30**	**53.235,70**	**53,77**	**36.969,24**	**4.898,68**

Source: CREA PB processing about FADN and SIGRIAN data.

values of farms included in the SIGRIAN LAWMs. The added value per working unit is about 37 thousand euros, which is very similar to the 2016 value but significantly below the 45 thousand euros for the farms using the Irrigation Water Service. Average revenues per hectare of UAA amounted to just under 5 thousand euros per hectare in 2018 (and slightly more in 2016), a value that is decidedly high and substantially comparable with farms located in SIGRIAN LAWMs, reflecting the high productivity of the farms in this area of Italy.

Therefore, on the whole, these are decidedly important farms, whose impact on the local and national agri-food economy is absolutely significant.

2.3. *Economic indicators of Livestock Farms*

The economic description of livestock in the Po River Basin District was carried out by selecting from the FADN sample only those with Livestock Units (LU) values higher than zero, and only for the year 2018. The analysis of the main economic indicators (Table 9) shows that in the District, the revenues per hectare of the farms with livestock are equal to about 6,896 euro, while the added value per hectare reaches 2,989 euro. These values can be explained using purchasing feed bought from other areas. The total revenue per LU is 1,451 euros per year, while the added value per LU is 629 euros per year. Considering the and data related only to the SIGRIAN LAWMs as representative of the revenue that can be obtained from all the animals bred in the Po River Basin District is a daring exercise that can be attempted to define an order of magnitude of the variables involved. According to this logic, it can be argued that the total revenue of all farms located in this area in 2018 amounts to about 8.1 billion euros and the added value to about 3.5 billion euros.

Table 9 - Average Value for Farms with Livestock Units (LU)>0 in The Po River Basin Authority, year 2018

Regions	**Number of Farms**	**Average Farm UAA (ha)**	**Average Farm LU**	**Average Farm TR (€)**	**Average Farm AV**
Valle d'Aosta	140	114,91	51	115.662	67.357
Piedmont	228	56,45	134	242.687	102.204
Lombardy	198	52,88	696	710.692	267.432
A.P. Trento	12	50,03	71	225.363	122.461
Veneto	78	50,54	613	609.836	312.424
Liguria	65	30,21	27	55.723	40.057
Emilia Romagna	180	54,51	264	710.667	306.217
Tuscany	15	122,21	103	291.361	220.947
Marche	7	v40,44	47	84.905	55.471
The Po River Basin Authority	**923**	**62,69**	**298**	**432.308**	**187.376**

Source: CREA PB processing about FADN and SIGRIAN data.

These values are also justified considering the high quality of the products obtained, also demonstrated by the high presence of certified products (PGI, PDO, etc.), as shown in Table 10. These certified productions – which represent 16% of the total certified productions in Italy – represent the most visible, but not unique, part of the role that breeding in the Po River Basin District has in the creation, directly or along the agri-food chains, of identity goods.

Table 10 - Certified production in the livestock sector by type and Region in The Po River Basin Authority, year 2018

Species	Type of Certification	Valle d'Aosta	Piedmont	A.P. Trento	Veneto	Liguria	Emilia Romagna	Tuscany	Marche
Cattle	Protected Geographic Indication (IGP)						1		
	Other type of certification	1	1			1	4	2	
	National Quality System	1	20	4	1	22	10	7	2
	Certified Integrated Production (Regional Quality Marks, SQNPI, Standard UNI 11233)		1						
Sheep	Protected Geographic Indication (IGP)						3		
Chickens	Other type of certification						3		
	Product life cycle (UNI EN ISO 14040 LCA)						2		
Pigs	Other type of certification						1		
The Po River Basin Authority		**2**	**22**	**4**	**1**	**23**	**24**	9	2

Source: CREA PB processing about FADN and SIGRIAN data.

Conclusions

The support of the economic analysis in drafting the WMP is fundamental to plan and program a sustainable and efficient use of water resources for agriculture. Its importance is accentuated by the possible synergy between the application of the legislation provided by the WFD and the preparation of the National Agricultural Plan, to implement the new CAP starting from 2023, as well as by the interactions with the strategies of the EU *Green Deal*.

The economic analysis is based on information collected from different databases that must be jointly used to have a comprehensive picture. The integrated use of the SIGRIAN Web-GIS platform and the data from the FADN sample survey made it possible to carry out the analysis with an innovative approach. The current structure of the FADN database does not allow to distinguish farms based on the type of irrigation use, (Irrigation Water Service or self-supply irrigation) as required by the MEA. However, the information in the SIGRIAN database filled this gap and allowed the analysis of the Po River Basin District to be completed. The main results are summarized below.

The joint use of the two databases, italian FADN and SIGRIAN, has allowed for the collection of the necessary information to carry out the socio-economic analysis and define and compare the economic-structural indicators calculated for the farms that use the two types of irrigation. It emerges that for the two years analysed, the average farm size is larger in the farms that use the irrigation water service. Because of the greater efficiency of the collective irrigation system, it is reasonable to assume that this is used preferentially when the average farm size increases.

The same trend is followed by the more strictly economic indicators. In fact, the working units required for farms included in SIGRIAN LAWMs are, on average, higher than those in farms that use self-supply irrigation. The system managed by LAWMs records higher values of total revenues and average added value for both years. The minimum values of these two indicators are found in Valle d'Aosta for Irrigation Water Service and in Liguria for self-supply irrigation; the maximum values are recorded in Lombardy and Veneto respectively. There is a similarity between average farm size, total revenues and added value, which are always higher for farms using the Irrigation Water Service.

It is therefore clear that the management of collective irrigation, although more complex considering, for example, the higher number of working units required, is preferable because of the greater efficiency demonstrated by the higher values of income and added value.

Irrigation is essential to allow the economic sustainability of farms in the Po River Basin District. This also affects dry agriculture, given the strong interrelationships existing in the affected areas between irrigated and non-irrigated crops. The reduction in the availability of water for irrigation would lead to a loss of productivity of irrigated crops and to changes in crop arrangements, with implications for the use of labour and complementarity with animal husbandry. The importance of the agri-food chain in the examined area demonstrates that considering irrigation water only for agricultural activity is rather reductive and that it is necessary to examine the issue from a broader point of view, including the socio-economic benefits generated from industrial transformation activities. Semi-intensive agriculture in areas of medium-high altitude could hardly be maintained at an adequate level of competitiveness, in absence of the pull constituted by agricultural activity in the plains and low hills. The management of a substantial part of the irrigated areas through irrigation bodies offers considerable potential in terms of efficiency in the use of the resource. The coordination in the planning of uses by individual farms practiced in these bodies could also be extended to areas where self-supply is prevalent with important expected benefits for water saving.

From a methodological point of view, the analysis carried out demonstrates the need and opportunity to focus on the coordinated development of data collection and management systems. For example, the information on the withdrawal of water in the self-supply regime and those relating to the destination of the water withdrawn and the irrigation techniques used could be enriched. Furthermore, in the FADN database the volumes of water used for irrigation are often recorded on a farm scale (due to the methods of measurement) while the crops and relative yields are reported based on the individual plot, thus making it impossible to calculate unit water consumption.

In addition, the evaluation of positive externalities could complement the economic analysis of agro-livestock production if the necessary data were systematically included in the SIGRIAN database.

While irrigation – especially in the Po River Basin District – plays a central role in the production of wealth from agricultural production and the agri-food supply chains, the challenges posed by climate change and the green turning point of the European Union require the continuous strengthening and refinement of the methods for monitoring and managing the use of irrigation resources. To face these challenges, a better understanding is needed of context and the ways in which it reacts to the constraints and incentives posed by policies. It is certainly worth investing a portion of the public resources dedicated to water resource management to the production of statistical data that is as reliable and as complete and homogeneous as possible.

In the future, the introduction of new variables concerning irrigation systems in the FADN database and monitoring of information being constantly added to the SIGRIAN database on the one hand, and the joint use of these data on the other, would guarantee a complete and shared knowledge of the management of water resources in agriculture. This is an important concept both at the national and international level and includes social and economic sustainability as well as environmental and agronomic aspects. This could lead to the creation of a system for monitoring the sustainability of farms and evaluating the performance of sustainable and certified food systems.

References

Millennium Ecosystem Assessment (2005). *Ecosystems and human well-being* (Vol. 5, p. 563). Washington, D.C.: Island press.

Adhikari, K. & Hartemink, A.E. (2016). Linking soils to ecosystem services – A global review. *Geoderma*, *262*, 101-111.

Bellver-Domingo, A., Hernández-Sancho, F. & Molinos-Senante, M. (2016). A review of Payment for Ecosystem Services for the economic internalization of environmental externalities: A water perspective. *Geoforum*, *70*, 115-118, doi: 10.1016/j.geoforum.2016.02.018.

Benedetti, I., Branca, G. & Zucaro, R. (2019). Evaluating input use efficiency in agriculture through a stochastic frontier production: An application on a case study in Apulia (Italy). *Journal of Cleaner Production*, *236*, 117609, doi: 10.1016/j.jclepro.2019.117609.

CREA (2021). *L'agricoltura italiana conta 2020*. CREA Centro Politiche e Bioeconomia. Roma.

Columba, P. & Altamore, L. (2006). Irrigazione e sviluppo agricolo: evoluzione dell'uso dell'acqua ed effetti sul valore del prodotto. *Italian Journal of Agronomy*, *3*, 452-454.

Direttiva 2000/60/CE del Parlamento Europeo e del Consiglio. 23 ottobre 2000.

D.M. Mipaaf 31 luglio (2015). Approvazione delle linee guida per la regolamentazione da parte delle Regioni delle modalità di quantificazione dei volumi idrici ad uso irriguo.

Dominati, E., Patterson, M. & Mackay, A. (2010). A framework for classifying and quantifying the natural capital and ecosystem services of soils. *Ecological economics*, *69*(9), 1858-1868, doi: 10.1016/j.ecolecon.2010.05.002.

Dono G. & Severini S. (2006). Il recupero del costo pieno nella Direttiva Quadro delle Acque: problemi per l'agricoltura italiana. *Agriregionieuropa*, *2*(7).

FAO (2011). Climate change, water and food security. *Water report nr. 36*. Rome. -- www.fao.org/docrep/014/i2096e/i2096e.pdf.

FAO (2012). Coping with water scarcity. An action framework for agriculture and food security. *Water Report Nr. 38*. Rome. -- www.fao.org/docrep/016/i3015e/i3015e.pdf.

FAO (2017). Water for sustainable food and agriculture. Rome. -- www.fao.org/3/a-i7959e.pdf.

FAO (2019). The State of the World's Biodiversity for Food and Agriculture, J. Bélanger & D. Pilling (eds.). FAO Commission on Genetic Resources for Food and Agriculture Assessments, 572. Roma. -- (www.fao.org/3/CA3129EN/CA3129EN.pdf) Licence: CC BY-NC-SA 3.0 IGO.

Gallerani, V. & Viaggi, D. (2006). Il valore dell'acqua per il territorio e l'ambiente rurale. *Italian Journal of Agronomy*, *3*, 569-576.

INEA (2009). Uso del suolo e stima dei fabbisogni irrigui nelle aree non servite da reti collettive dei consorzi di bonifica nelle regioni meridionali. *Rapporto Irrigazione*.

Intergovernmental Panel on Climate Change IPCC (2014). *Climate Change 2014 – Impacts, Adaptation and Vulnerability: Part B: Regional Aspects: Working Group II Contribution to the IPCC Fifth Assessment Report*. Cambridge: Cambridge University Press, doi: 10.1017/CBO9781107415386.

Jandl, R. (2010). Il carbonio del suolo. *Agriregionieuropa*, 6(21).

Martin-Ortega, J., Ferrier, R.C., Gordon, I.J. & Khan, S. (2015). *Water ecosystem services: a global perspective*. UNESCO Publishing. Cambridge: Cambridge University Press, doi: 10.1017/CBO9781316178904.

Ministero dell'Ambiente e della tutela del territorio e del mare (MATTM), Manuale operativo e metodologico per l'implementazione dell'analisi economica, Decreto Direttoriale n. 574/STA del 6 dicembre 2018.

Natali, F. & Branca, G. (2020). On positive externalities from irrigated agriculture and their policy implications: An overview. *Economia Agro-Alimentare/Food Economy*, *22*(2), 1-25, doi: 10.3280/ecag2-2020oa10412.

Peter, M., Edwards, P.J., Jeanneret, P., Kampmann, D. & Luscher, A. (2008). Changes over three decades in the floristic composition of fertile permanent grasslands in the Swiss Alps. *Agriculture Ecosystems and Environment*, *125*(1-4), 204-212, doi: 10.1016/j.agee.2008.01.002.

United Nations General Assembly (2015). Transforming Our World: The 2030 Agenda for Sustainable Development. Draft resolution referred to the United Nations summit for the adoption of the post-2015 development agenda by the General Assembly at its sixty-ninth session. UN Doc. A/70/L.1 of 18 September 2015.

Van der Meulen, S. & Maring, L. (2018). Mapping and Assessment of Ecosystems and their Services: Soil ecosystems. *SOILS4EU/DGENV.*

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