Evaluating Economic Policy Instruments for Sustainable Water Management in Europe

WP3 EX-POST Case studies

Water tariffs in agriculture – Emilia-Romagna case study

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Executive Summary

Definition of the analysed EPI and purpose

The Economic Policy Instrument (EPI) considered in this WP3 case study of the EPI-WATER project is related to the introduction of a volumetric water pricing system as a cost recovery measure for the delivery of irrigation water. The area analysed, Tarabina, covers 700 ha and is located in the province of Ravenna (Emilia-Romagna Region).

A pressure pipe system was built in this area in 1982, but without the use of a water metering system. An area-based contribution system was in place for cost recovery purposes. The move from an area-based water pricing system to volumetric pricing took place in 2006. This EPI implementation addresses all the farmers in the area.

The main motivations for the introduction of the EPI were the increasing M&O costs (due to high water use) and the fact that both irrigators and non-irrigators paid the same area-based tariff, (hence causing inequity problems between the two farmer groups). The motivations for the EPI implementation, while legally driven by the cost recovery obligations of the Reclamation and Irrigation Board (RIB), were a mix of efficiency (cost reduction and, indirectly, water use reduction) and equity (intended as the "right" cost distribution among farmers) concerns.

Water tariffs were considered socially "wrong" because the allocation of costs was not related to actual use. For this reason, the introduction of a volumetric water pricing system based was justified. The new pricing is trinomial and the tariff is the sum of three components:

- a fixed component (€/ha): paid only by non-irrigators and representing a payment for M&O costs;
- a volumetric component (€/m^3): representing the real water use quantified by water meters and paid only by irrigators;
- a variable component (€/ha) introduced to recover all the remaining costs (not covered by the previous two components); this part is from one year to the next and includes additional costs such as non-ordinary interventions, unmetered water use and M&O costs, and is paid only by irrigators.

The payment of each farmer, computed and paid in year t, is currently computed on the basis of real water use measured in year t-1.

The purpose of this analysis is to understand the conditions for EPI implementation related to the specific characteristics of the case study area and to provide a tentative *ex post* analysis of its impacts The bulk of the work focused on obtaining the necessary information in order to understand the effects of the EPI (in comparison to a counterfactual area) and to assess the enabling and disabling factors of the EPI design, implementation and effectiveness.

The analysis was carried out in collaboration with the Reclamation and Irrigation Board of Romagna Occidentale (RIBRO).

Introduction

The case study is located in the South-East of the Emilia-Romagna region and is part of the district managed by the RIBRO.
The focus of the study is the introduction of the EPI in a sub-area of RIBRO. The case study area, Tarabina, is located in the province of Ravenna. The Tarabina area covers about 700 ha and includes approximately 50 farms.
In the 1970s, there was debate in the area with regard to the possible construction of a pressure water system. The pressure system was eventually built using a government subsidy and was completed in 1982. Since its construction, the water pressure system has been defined as a "costs centre" system, meaning that costs for the Tarabina system are calculated separately from general RIBRO costs.
Since 1982, the water tariff has been calculated on the basis of an area-based water pricing system, but during that period the tariff increased from 20€/ha in 1983 to 155€/ha in 2005 for all farmers (irrigators and non-irrigators). Accordingly, farmers complained of the water tariff increases, and the management committee proposed to improve the water cost distribution. The solution proposed was the introduction of water metering in order to attribute payments on a "user pays principle" basis.

Legislative setting and economic background

With regard to this case study, the relevant institutions are: the Reclamation and Irrigation Board of Romagna Occidentale (RIBRO), Canale Emiliano Romagnolo (CER) and the Tarabina Management Committee (TMC).
The main objectives of the RIB are: planning reclamations and irrigation structures, participating in activities related to land protection, managing water use for irrigation and other uses. In our case study we focus on the RIBRO (www.bonificalugo.it) and its focus is: planning suggestions for hydrological harmonization, planning future programmes related to reclamation and irrigation, construction of infrastructures for reclamation and irrigation. For our purposes, the main relevant activity of the RIBRO at the local level is related to water distribution for irrigation purposes.
Another important institution is the Canale Emiliano-Romagnolo (CER) which is a second level RIB. It manages the homonymous canal, which is one of the most important hydraulic infrastructures in Italy. It takes water from the Po River to plain areas, making water available for irrigation uses in the RIBRO area.
The Tarabina Management Committee (TMC), for its part, was instituted after the construction of the pressure pipe system in 1983. The formation of the management

committee was justified by the definition of Tarabina as a "costs centre". The TMC also has its own statute. The TMC is elected by farmers located in the Tarabina area and is composed of 9 members of which 7 farmers are elected by farmers and 2 members represent the RIBRO.
The economic sector of interest is agriculture. Data on land use and the crop mix in the Tarabina area are not available from statistical sources (due to lack of information at the appropriate scale), but qualitative information was provided by the technical staff of the RIBRO by way of unstructured interviews. In their view the main specialisation in the Tarabina area is horticultural crops; heterogeneous crop mixes are also present at farm level based on combinations of other crops, such as seeds for industrial use, cereals and fruit (peaches, kiwis, apricots, and plums).

Brief description of results and impacts of the proposed EPI

The Tarabina case study investigates the implementation of a volumetric water pricing system in the agricultural sector. The EPI provided multiple impacts related to environmental, economic, and social aspects; those most evident are mainly the economic impacts such as those related to the decrease in water delivery costs and the change in the distribution of farmer contribution costs. In particular, a noteworthy cost reduction for non-irrigators occurred, due to a more efficient cost distribution based on quantity used. With regard to the environmental outcome, due to a decrease in water used, the amount of water remaining in the environment increased. Finally, regarding social aspects, the EPI increased the level of "social agreement" within the group of non-irrigators.
Even though the area examined is quite small, the EPI application could be considered significant within the Italian context. In fact, based on the authors' knowledge, the case study represents the only one of its kind related to EPI implementation.
Some specific conditions had a crucial role in the EPI implementation. Firstly, a pressure pipe system was already in use in the Tarabina area hence no costs for its construction needed to be considered. This offers a suitable case for the construction of a baseline able to isolate the effect of the EPI from other interventions (e.g. pipe construction). In addition, the definition of Tarabina as a "cost centre" allows for the measurement of (and hence potentially recovering) all costs related to it, as they are already separately identified in the RIB accounting system. Moreover, the presence of targeted institutions able to offer clear and timely solutions reduced transaction costs associated with changes in the tariff system. Finally, long-term contracts between RIBRO and CER for water supply eliminated problems related to water scarcity, hence allowing the EPI to focus only on economic aspects (as opposed to EPIs mainly driven by water saving concerns).
The EPI implementation involves the shift from an area-based system to a volumetric water pricing system for irrigation uses in the agricultural sector.

The main reason for EPI implementation was the increase in water tariffs during the period 1983-2005. Such increases also caused significant inequalities between users (irrigators and non-irrigators). Consequently, farmer representatives elected to the management committee, with the assistance of the RIBRO, sought a solution to reduce cost inequalities and potentially the overall cost.
The solution identified was the implementation of water metering and the shift to a volumetric water pricing system.

Conclusions and lessons learnt

The implementation of this EPI can be considered to have been successful with respect to its main (explicit or implicit) objectives.
One reason lies in the mechanism that generated the EPI and the fact that it was proposed by farmers themselves. The fact that the mechanism was voluntarily adopted by the effected farming community made the implementation more acceptable from a social point of view. In particular, the main objective was to address an existing inequity between irrigators and non-irrigators, and to reverse increasing cost trends. The disparity prior to the implementation of the EPI was perceived mainly by non-irrigators who paid the same area-based tariff as irrigators. Improved equity was obtained by introducing a volumetric water pricing system that applies tariffs based on differing water usage.
Due to their sense of involvement and indeed participation in the decision making process, the degree of agreement on the part of the farmers with regard to the implementation of an economic instrument was high.
The direct consequence of the EPI was a significant tariff reduction for non-irrigators. A secondary effect was a more rational use of the resource by irrigators in two ways: reduced use (water conservation) and increased awareness of the resource value. Altogether this allowed for a clear increase in the efficiency of the distribution system.

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List of Acronyms

RIBRO	Reclamation and Irrigation Board of Romagna Occidentale
TMC	Tarabina Management Committee
CER	Canale Emiliano Romagnolo. A second level RIB that manages the homonymous canal, one of the most important hydraulic infrastructures of its kind in Italy. It transfers water from the Po River to plain areas, making water available for irrigation uses in the RIBRO area
WFD	Water Framework Directive 60/2000
CAP	Common Agricultural Policy

1 EPI Background

1.1 Baseline

The case study is located in the South-East of the Emilia-Romagna region and is part of the district managed by the RIBRO.
The focus of the study is the introduction of the EPI in a sub-area of RIBRO. The case study area, Tarabina, is located in the province of Ravenna. The Tarabina area covers about 700 ha and includes approximately 50 farms (one of them is a cooperative and covers more than an half of the total surface).
An important characteristic of the area is that it does not suffer from water scarcity due to long-term contracts for water supply between RIBRO and CER (Canale Emiliano-Romagnolo). CER is one the most important infrastructures in Italy and pumps water from Po River to supply agriculture (mainly) and industrial uses in the south eastern per of Emilia Romagna.
In the 1970s, there was debate in the area with regard to the construction of a pressure water system. The pressure system was built using a government subsidy and was completed in 1982. Since the construction, the water pressure system has been defined as a "costs centre" system meaning that costs for the Tarabina system are calculated separately from general RIBRO costs.
Since 1982, the water tariff has been calculated on the basis of an area-based water pricing system, but during that period the tariff increased from 20€/ha in 1983 to 155€/ha in 2005 for all farmers (irrigators and non-irrigators).
The definition of Tarabina as a "costs centre" system involved the introduction of a management committee (farmers elect 7 members out of a total of 9). Thereafter, farmers complained of water tariff increases, and the Tarabina Management Committee (TMC) proposed to improve water costs distribution because water tariffs were considered socially "wrong" as the allocation of costs was not related to actual use. The solution was identified in the introduction of water metering in order to attribute payments based on actual use ("user pays principle") and a volumetric water pricing system was justified. The new pricing is trinomial and the tariff is the sum of three components:

- a fixed component (€/ha): paid only by non-irrigators and representing a payment quota for M&O costs;
- a volumetric component (€/m^3): representing the real water use quantified by water meters and paid only by irrigators;
- a variable component (€/ha) introduced to recover all the remaining costs (not covered by the previous two quotas); this part is from one year to the next and includes additional costs such as non-ordinary interventions, unmetered water use and M&O costs, and is paid only by irrigators.

Figure *1* represents the rationale of the *ex-post* analysis in order to clarify which were the preconditions of EPI introduction, the EPI and which are the main effects to be analysed

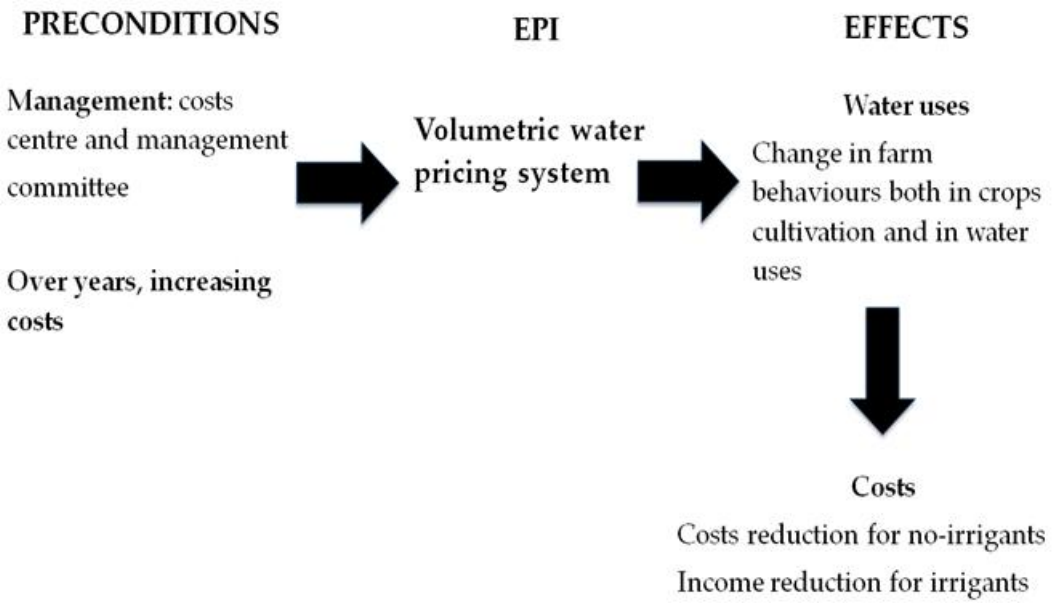


Figure 1 Rationale under the implementation of the volumetric water pricing system in Tarabina

1.2 Key features

This case study was characterized by the presence of a pressure pipe system. In 2006, water meters were introduced and the water pricing system became trinomial (three different components) in order to take into account actual usage. Since 2006 trinomial pricing has substituted the previous area-based pricing system. In Table 1 the three components of the new tariff are shown on the basis of the payment rule.

Table 1 Components of volumetric water pricing system

Volumetric Water Tariff	Non-irrigators	Irrigator
Fixed component	Paid €	Not paid
Volumetric component	Not paid	Paid €/m^3
Variable component	Not paid	Paid €/ha

Source: Own elaboration based on Regolamento per l'esercizio e la manutenzione dell'impianto pluvirriguo "Tarabina". Consorzio di Bonifica della romagna occidentale 2011

With regard to the aim of RIBRO to recover all costs, the costs were allocated on the basis of actual use. The process of identifying the three components of the tariff took the first year as a trial and was improved the following year.
The change in the pricing system has influenced both types of farmers' groups (irrigators and non-irrigators). One of the main results is the reduction in costs: approximately 70% for non-irrigators and 50% for irrigators. Another result regards the change in crops cultivated, from vegetable to seed production and industrial processing (e.g. potatoes, tomatoes and onions).
It is possible to group information before and after the EPI implementation. In the first group, information is related to water use in the whole system (yearly data available) and water tariffs paid by each farmer based on the area-based pricing system (data only for year 2005); in the second group, the information is related to water use by each farmer (if identified as an irrigator) measured using water meters and water tariffs paid by each farmer (irrigators and non-irrigators) based on the volumetric pricing system. Due to the lack of data availability, it is only possible to compare water uses at the global level.
The analysis reported in this work is the result of interviews with the technical staff of: RIB, the Basin Authority, and the regional government of Emilia-Romagna. It is important to underscore that using this source of information (though motivated by the limited availability of factual data) may involve approximation in the assessment of the cause-effect relationships.

2 Characterisation of the case study area

2.1 Geographical characterisation maps

The case study is located in the South-East of the Emilia-Romagna region (Figure 2) and is part of the district managed by the RIBRO. In the RIBRO, our focus is on EPI's implementation in a sub-area referred to the province of Ravenna province.
The RIBRO is present in five provinces: Ravenna (the predominant), Bologna, Forlì-Cesena, Ferrara, and Firenze, with a total of 35 municipalities. The surface area of the RIBRO is about 200000 ha and it is circumscribed by the Sillaro (west), Lamone (east) and Reno (north) Rivers.

Figure 2: Localition of the Reclamation and Irrigation Board of Romagna Occidentale RIBRO

The RIBRO is presented in Figure 3 and it is possible to identify two sub areas: a plain district (North-East) and a mountain district (South-West). The two sub-areas are divided by the Via Emilia, formerly one of Italy's main Roman roads and currently the main mobility axis of the region. In Figure 3, the Tarabina area (circle) is also indicated.

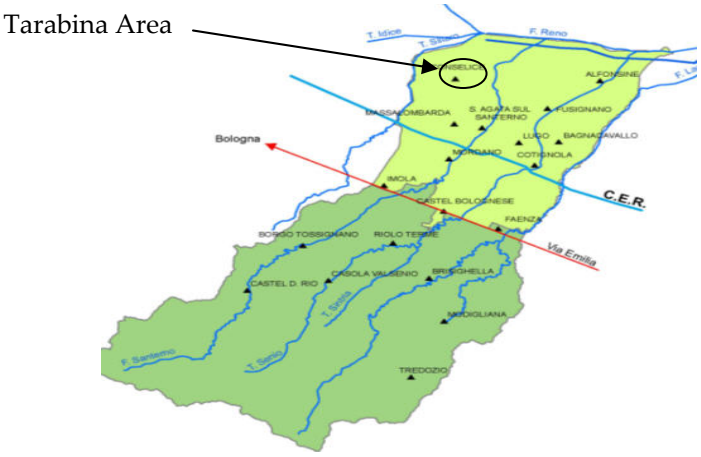


Figure 3 RIBRO map and location of Tarabina area

The plain district is about 80000ha and includes four hydraulic sectors. In the district, infrastructure related to irrigation services is very important (see section 2.2).
The mountain district covers about 120000ha, of which 70000ha are located in the Emilia-Romagna region. Due to natural drainage, the presence of irrigation infrastructures is not relevant in the mountain district. This district collects from West to East by four valleys (Santerno, Senio, Lamone and Marzeno).

Figure 4 Plain and Mountain District of the RIBRO. In the plain canals and districts presented. In the mountain valleys are shown.

The main characteristics of the RIBRO are presented in Table 2. The table shows that the number of kilometres of pressure pipes is significant.

Table 2 Main RIBRO characteristics

Main characteristics	**Unit**
Total land	200000 ha
Irrigation canals	962 Km
Drainage canals	486 Km
Mixed canals	476 Km
Pressure pipes	465 Km
Lifting water systems	19
Irrigation installations	33

Source: RIBRO web site

2.2 Environmental characterisation

Land Use

The changes in land use in Emilia Romagna are shown in Table 3. A comparison between land use in 1994 and 2003 in each sector is also presented. A noteworthy item is the increase in built-up areas and the decrease in land use for agriculture.

Table 3 : Land use in the Emilia-Romagna region (% on total surface)

Land use	**1994**	**2003**	**2003/1994**
Built-up areas	5.58	8.48	51.88
Agriculture surface	67.04	59.58	-11.15

Forest and other	25.27	28.39	12.34
Wetlands	0.98	1.12	14.85
Water related ecosystem	1.13	2.43	114.19
	100.00	100.00	

Source: Emilia Romagna 2011

The main focus of the analysis is the agricultural sector.

Table 4 presents the use of farmland area in Ravenna and the number of farms (divided by altitude).

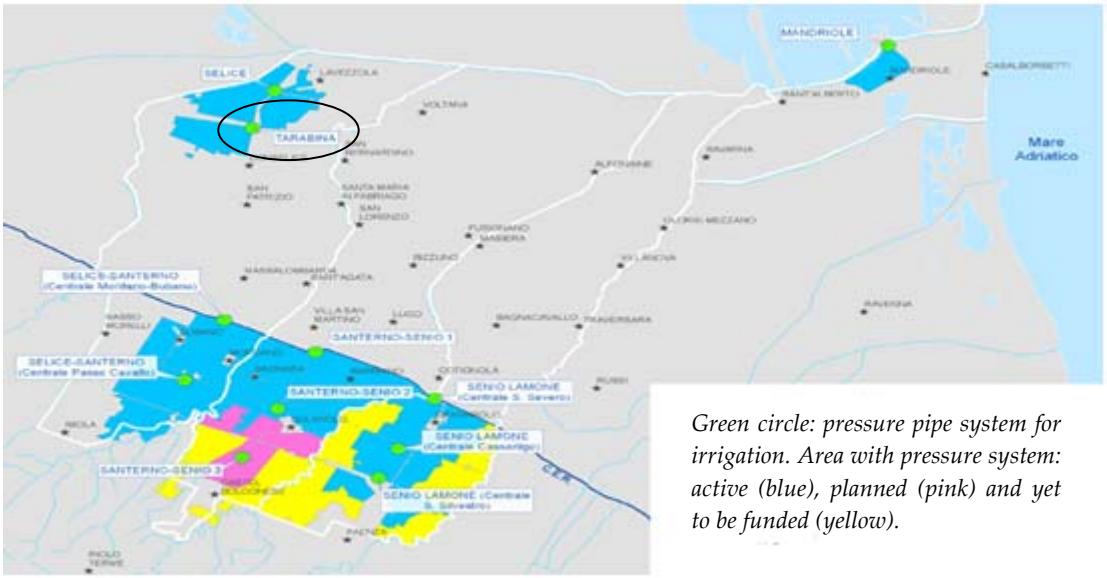
Table 4 : Province of Ravenna. Data related to the surface per altitude

Altitude	N. of farms	AAU	Total AAU	AAU average	Total AAU average
Hill	1066	12255.03	22555.65	11.50	21.16
Plain	7935	104551.83	116542.80	13.18	14.69
Prov. Ravenna	9001	116806.86	139098.45	12.98	15.45

Source: Working Census Data. Emilia Romagna 2010

Description of the hydrology

The natural hydrology of the area is characterised by rivers flowing from the Appennine Mountains (South-West) to the Adriatic Sea (North-East). Rivers have strong changes in water flow depending on the season, and water availability is low during summer. Groundwater resources are significant in the area, but affected by a noteworthy decrease in the water table, particularly in the lowland area.
The hydrology of the area is deeply affected by human interventions. Reclamation activities reshaped most of the plain's hydrographical structure, mainly in order to bring upland water directly to the sea.
The area is characterised by variable water availability; the presence of services from CER guarantees sufficient water resources, particularly during the summer. For these reasons, the area is not affected by water scarcity problems. Water from the CER is distributed to the downstream area using gravity systems, while the RIB provides water delivery upstream using its irrigation infrastructures (canals and pressure pipelines).
The RIBRO's irrigation system is presented in Figure 5. The blue areas represent those districts with pressure systems available and in use; the pink areas represent the pressure systems that are yet to be built (funding has been set aside); the yellow areas are those districts waiting for funding to build additional pressure systems.
The RIBRO manages only surface water in the area as groundwater is not measured - even in the case of wells (under permission contracts).



Green circle: pressure pipe system for irrigation. Area with pressure system: active (blue), planned (pink) and yet to be funded (yellow).

Figure 5 The RIBRO irrigation system and the Tarabina area (circled).
Source: RIBRO web site

The RIBRO's irrigation system is presented in Figure 5. The blue areas represent those districts with pressure systems available and in use; the pink areas represent the pressure systems that are yet to be built (funding has been set aside); the yellow areas are those districts waiting for funding to build additional pressure systems.
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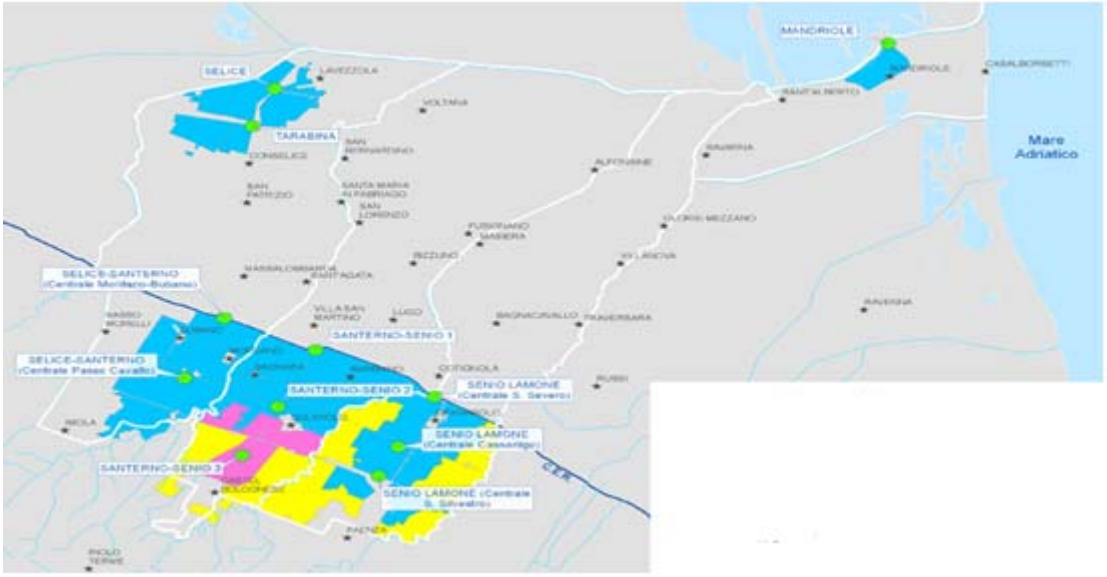

2.3 Economic characterisation

The population of the province of Ravenna is about 392458 inhabitants, and the average of population density is equal to 219.63 inhabitants per Km^2. GDP for the inhabitants was 28,938 euro in 2010.
The added values for economic activities in Ravenna are provided in Table 5. The added value of agriculture is equal to 362 million euro, a considerable amount in absolute terms, but of little relevance compared to the other sectors of the economy.

Table 5 Price *added value for each economic activity (million euro) in Ravenna (2008)*

Agriculture	**Industry**			**Services**	**Added value**
	Industry in strict sense	**Building**	**Tot Industry**		
362	2.222	677	2.899	7.012	10.273

Source: Emilia Romagna 2011

The population in Emilia-Romagna is more than 4 million (4.432.439) with an average population density of 197.5 per km^2. GDP for the inhabitants was 30,493€ in 2010. Over the years, the regional GDP has increased from 22,500 PPS per inhabitant in 1997 to 30,800 in 2008 (Eurostat).
The economic sector of interest for this study is agriculture. For this reason, changes in the number of farms and hectares related to crop distribution between 2000 and 2010 are presented in Table 6. The more relevant crops in terms of surface area are cereals, wine grapes and fruit trees; these main crops were also those that experienced the strongest decrease in terms of number of farms on which they were cultivated, though their overall area remained basically stable during this period (with the exception of fruits).
From an economic point of view, the area is mostly characterised by fruit production. The high plain and hill areas of the RIBRO represent the main areas in Italy for the production of: peaches, kiwis, as well as apricots and plums. Large areas of vineyards also exist, and are now often irrigated.

Table 6 Crops distribution in Ravenna province between 2010-2000 (number of farms and surface)

Crop	**N. of farms in 2010**	**N. of farms in 2000**	**% or variation**	**Surface in 2010**	**Surface in 2000**	**% or variation**
Cereals	4574	6101	-25.03	37127.41	36562.04	1.55
Legumes	289	271	6.64	1579.50	1432.97	10.23
Potato	152	146	4.11	886.51	391.41	126.49
Sugar beets	141	2355	-94.01	1192.86	8618.11	-86.16
Industrial crops	355	269	31.97	4312.42	3472.19	24.20
Crop for seeds	614	637	-3.61	3489.04	1966.62	77.41
Grape-wine	5425	7817	-30.60	16319.72	17054.31	-4.31
Olive	587	487	20.53	542.59	387.74	39.94

Fruit Tree	4447	6643	-33.06	20861.56	24414.80	-14.55
Total				86311.61	94300.19	

Source: Working Census Data. Emilia Romagna 2010

Data on land use and the crop mix in the Tarabina area are not available from statistical sources (due to lack of information at the appropriate scale), but qualitative information was made available by the technical staff of RIBRO, consulted through unstructured interviews. They stated that the main specialisation in the Tarabina area is horticultural crops and that heterogeneous crop mixes are present at the farm level based on combinations of other crops, such as seed for industrial uses, cereals and fruit (peaches, kiwis, apricots, plums).

3 Assessment Criteria

3.1 Environmental outcomes

Environmental Outcome A) What were the economic agents' effective responses to the EPI in terms of reduction in the quantity and quality of those water services demanded or supplied?

In the context of the environmental outcome, the main result of the EPI implementation judging by the responses of the agents involved is the reduction of the global amount of water used by farmers in the area. In the period prior to the introduction of the EPI, the water use distribution was particularly variable, as noted in Figure 6. After 2006, the distribution seems to follow a more regular trend.

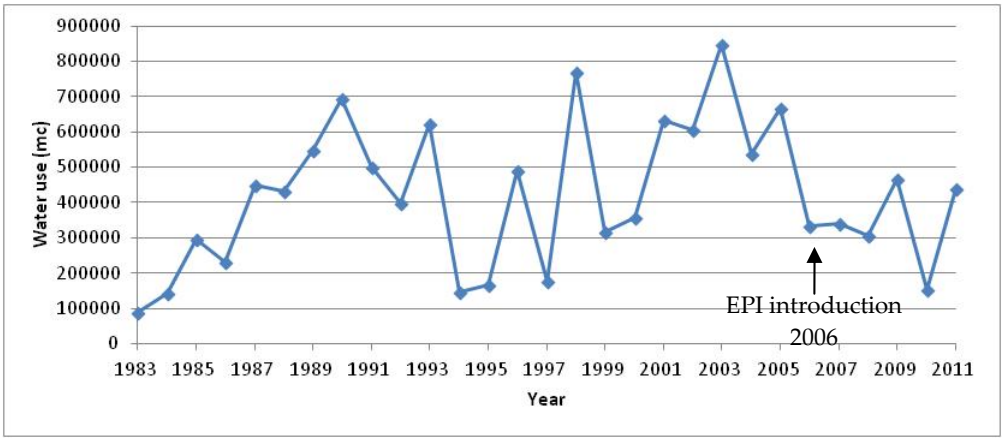

Figure 6 Water use distribution in Tarabina between 1983 and 2011
Source: Own elaboration on RIBRO data

The variability in water use is likely linked both to climatic factors (such as rainfall and temperature) and the water requirements of crops that differ from year to year.
Water quality/pollution problems were not considered in the EPI implementation, as the water in this area is good enough for irrigation; from a social perspective, the EPI is not likely to have clear effects in terms of environmental pressures, as previous studies show that they are poorly related to changes in water use (at least in the relevant use interval) (Raggi and Viaggi, 2009).

Environmental Outcome: B) How did these changes in individual behaviour translate into lower (or increased) pressures on water-related ecosystems?

After the introduction of the EPI, three main consequences related to individual behaviour have been observed with respect to pressures on water-related

ecosystems. The first is the modification of the crops grown; the second is the elimination of "chiari" (lake advocated water supply) for hunting; and the third concerns energy use.

Data on changes in the crops cultivated are not available at the farmer or area levels, so the information was provided by RIBRO technical staff on the basis of their personal knowledge. Raggi and Viaggi (2009) show that for an evaluation of pressures (impacts), a large set of characteristics must be considered (crop mix cultivated, surface of each crop, water needs, water sources, irrigation technology, etc.). In this case, a pressure (impact) evaluation based only on changes in crop cultivation is not possible because of the lack of available data.

With respect to the second aspect, the use of water meters did not encourage the non-productive (and non-profitable) uses of water such as "chiari". Before the EPI, water supply was guaranteed by "chiari" filled at least two or three times each summer by large quantities of water (up to 200000 m^3). The abandonment of this behaviour had, as direct ecosystem consequences, a significant reduction in the number of birds. Another aspect to be considered, however, is that the purpose of "chiari" is not to provide environmental improvements but rather to support hunting activities.

The third aspect concerns the variation in energy use, measured as the total costs for energy services. The data available cover the period 1983-2008, but have serious limitations in assessing the effect of the introduction of volumetric pricing in 2006 (the data covers only until 3 years after the EPI implementation and data related to 2002 and 2004 are missing). In Figure 7 the trend related to energy costs is shown. Up until 1993, the trend is that of increasing costs; in the subsequent 10 years the behaviour is rather variable and after 2006 it shows a decrease. It may be that one of the outcomes of the EPI is a reduction in energy consumption, which implies a benefit in environmental terms due to a reduced us of fossil fuel.

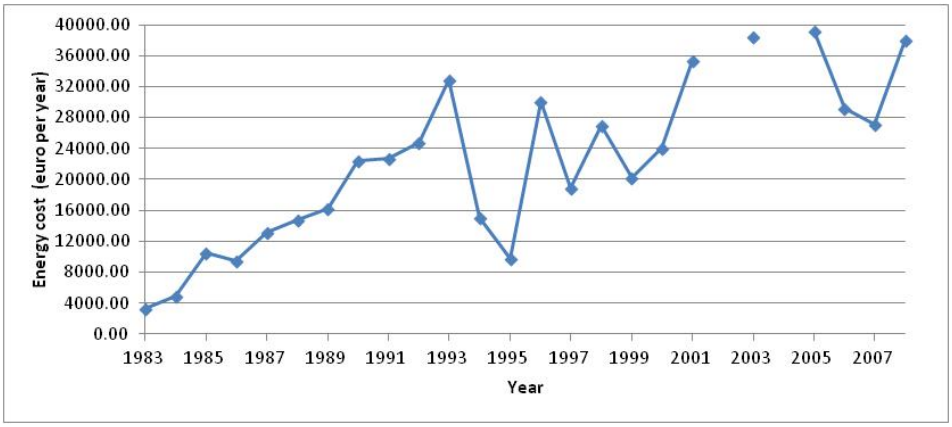

Figure 7 Energy cost in Tarabina between 1983 and 2008
Source: Own elaboration on RIBRO data

Environmental Outcome: C) What were the impacts of changes in pressures on the ecological status of the water-related ecosystems?

The impact of changes in pressure on the ecological status is not particularly relevant. In fact, according to RIBRO technical staff, crop cultivation did not change on the majority of farms..

Environmental Outcome: D) How did changes in the status of water-related ecosystems affect their potential to provide increased (or decreased) flows of environmental goods and services (or benefits)?

Because of the lack of data at the farm level, it is not possible to provide a specific analysis of water-related ecosystems. The decreased water use could suggest that the EPI contributed to a higher water flow in canals and rivers, but there is no evidence of relevant changes, also due to the small size of the area covered by the EPI compared to the source of water.

Environmental Outcome: E) Was there any (economic) valuation exercise of these benefits?

The issue was tackled exclusively from an agricultural water supply perspective. No economic analysis of environmental benefits was carried out because the environmental benefits were not a target of the EPI and there was no evidence of problems related to the environment problems. In fact, the introduction of the EPI was not justified by water scarcity (water resources are always available via linkage between RIBRO and CER).

3.2 Economic Assessment Criteria

Economic Assessment Criteria A) Was this EPI compared with other alternatives? If so, was the chosen one the least-cost alternative? Does it have disproportionate costs? Was a cost-benefit analysis performed?

The EPI in this context was not compared to alternative water pricing systems at the time of its selection, but its implementation was decided upon by implicitly comparing it to the existing area-based pricing system.
The choice of the EPI was quite obvious because of the presence of a pressure pipe system, in principle allowing easy water metering. The shift from an area-based to a volumetric water pricing system was hence identified as the 'best' solution for the users in the area. The change of water pricing system was also supported by the good characteristics of the hydraulic system and the small geographic area covered.

Economic Assessment Criteria B) Was there a command-and-control mechanism in place? Did the EPI, when compared to that regulatory alternative, make a clear contribution to increase economic efficiency?

Compared to the previous area-based system, the EPI contributed to economic efficiency both in terms of water allocation among farmers and overall water use. The shift in the pricing system resulted in water re-allocation between users in terms of quantity used, in particular providing incentives to use less water for farmers with lower marginal value of water (that would have used more water in an area-based system, in which the marginal cost of water is zero).
At the global level (whole area), the general efficiency of the system increased because the reduced water use resulted in an abatement of the cost of water provision. In fact, the total amount of water used decreased and consequently the M&O costs also decreased.
The RIBRO evidence shows that non-irrigators benefited from a cost reduction of around 70%, whereas irrigators experienced a reduction of around 50% due mainly to a water use reduction. Based on this information it is likely that the shift to the EPI translated into a prevailing reduction of revenues for the farmers. At this stage it is not possible to estimate the overall effect on profits. For non-irrigator farmers, it seems likely that the balance between reduced revenues and costs yields an increase in income. The result is more ambiguous for the other farmers.

Economic Assessment Criteria C) Was there a cost-effectiveness analysis to choose and design the EPI? Was the EPI a least-cost alternative?

A cost-effectiveness analysis was not undertaken. The main reason for the implementation of the EPI was due to the significant increase in M&O costs, which yielded an incentive to non-irrigators to push for moving away from the area-based pricing approach.
Those who were non-irrigators in the past and who maintained the same behaviour after the EPI implementation benefited from large cost reductions.
Information for the irrigators is less clear (see also section above).

Economic Assessment Criteria: D) When comparing the EPI to previous policy instruments in place, did the EPI implementation lead to specific cost savings for water users? For the economy as a whole? Did the EPI deliver additional benefits as well as cost reductions?

Cost reductions were experienced by all agents following the introduction of the EPI, but primarily by the RIBRO (i.e. the Tarabina cost centre) and, as a result, by farmers (because all costs have to be recovered by users).
In particular, costs for non-irrigators drastically decreased. On the basis of the data available, a comparison between two periods can be undertaken at the global level (on the whole infrastructure and not per individual farm). See next section. No other cost reductions were in place.

Economic Assessment Criteria: E) Who were the winners and losers of the implementation of the EPI? Who incurred costs for the EPI implementation? Describe these costs.

In the years 1982-2005, the water pricing system was area-based, with average per ha increases of up to 155€ in 2005 for all farmers in the area.
Water tariffs were considered "wrong" because the cost allocation was not related to actual use. For this reason, the introduction of EPI was easily justified. The actual implementation took place by way of the use of water meters by those farmers who planned to irrigate in the future and consequently in the shift to the volumetric water pricing system.). The volumetric water pricing system was tested in the first year (2006) and improved in the following year (2007) based on the equality principle between irrigators and non-irrigators.
The payment of each farmer computed and paid in year t is currently calculated on the basis of the real use of water measured in the year t-1.
Table 7 shows the amount of the three components of the volumetric water pricing system related to usage in 2007 .

Table 7 Volumetric water tariff system adopted in 2008 (computation based on water use in year 2007)

Trinomial tariff	**Non-irrigators**	**Irrigators**
Fixed component	29€/ha	Not paid
Volumetric component	Not paid	0.15€/m^3
Variable component	Not paid	Paid (€/ha)

A fixed component (€/ha) is only paid by non-irrigators in the year t-1 and represents the payment component for M&O costs. The volumetric component (€/m^3) represents the real water use controlled by water meters and the variable component (€/ha) that must be paid by irrigators. The latter component (variable each year) is introduced to recover all the remaining costs (not covered by the previous two components). This part could include additional costs beyond ordinary interventions, such as unmetered water and M&O costs.

Economic Assessment Criteria: F) Did the EPI contribute to reducing risk when compared with the best command-and-control alternative?

Irrigation has an important risk-reducing role in this area (reducing yield variability, preventing risks from water shortages, avoiding variability due to weather conditions). Higher water prices would likely increase risk for farmers.

Economic Assessment Criteria G) Did the EPI contribute to the recovery of costs of water services provided to the economy? What was the final use of revenues (i.e. tax revenue, auctioning proceeds from tradable allowances) raised through the implementation of the EPI? Were they earmarked?

The RIBRO is the institution that is responsible for the recovery of all costs in the area. The revenue collected is available to recover M&O activities (mainly salaries and energy costs).

Economic Assessment Criteria: H) Did the EPI provide the right incentives? (Please, define what "right" is for you in the case study).

A water pricing system based on water used represents the most common example of an instrument providing an incentive to reduce water use and to change crops cultivated in favour of crops with higher marginal productivity of water. In that sense, this EPI is "right" because it allows for cost reductions at the global level and supports the cultivation of crops with high added values.

Economic Assessment Criteria: I) Was there any evidence of asymmetric information (moral hazard, adverse selection)?

Asymmetric information is an issue in the area with respect to both individual production functions and water use. The first still remains unknown to the RIBRO. With regard to the latter, it is possible to have as a proxy the total water used in each year in the whole area only prior to EPI implementation (2006). Following the introduction of the EPI, the use per farm is known and this allows volumetric pricing which is theoretically capable of achieving first best pricing. A component of asymmetric information remains in the fact that water is "self-metered" by the farmers. As a result, a component of water cost cannot be allocated to individual farmers. This part is recovered though the third component of the tariff, which is distributed among irrigators, hence providing some additional incentives to cross-control among farmers.

3.3 Distributional Effects and Social Equity

Distributional Effect: A) Did the EPI affect productive activities? Did income from production change? Did profits change?

The productive activities in the area have changed due to the introduction of the EPI. At the moment, however, precise data are not available. Hence, the present illustration relies on information reported by RIBRO technical staff. From February 2011 to October 2011, two RIBRO technical staff members were interviewed on three separate occasions. The objective of the interviews was to collect information, data and opinions about the volumetric water pricing system, the main reasons for shifting to volumetric water tariffs and the main effects observed.

On the basis of the information collected, it is possible to identify three different groups of actors to analyse the change in income distribution due to the implementation of the EPI: 1) the first group includes non-irrigators who decreased their water costs; 2) the second includes those who ceased irrigation after the implementation of the EPI; and 3) the third group includes irrigators.
Data are not available for groups 2 and 3 therefore considerations about income changes are not provided. With regard to the first group, farmer income increased because water costs decreased following the implementation of the EPI. In Table 8 an example is shown, related to an individual farm that reported a reduction in costs related to water tariffs of more than 70%.

Table 8 Example of decreasing water tariffs for a non-irrigator

Year	ha	€/ha	Tot
2005	1.5565	123.22	191.79
2007	1.5565	29.00	45.14

Distributional Effect: B) Did the costs of production change?

Different water pricing systems change the production costs but the amount of such changes is currently unknown due to the lack of precise data. Total costs would certainly be reduced for non irrigators, while the result is ambiguous for others; marginal production costs would most likely remain unchanged for non irrigators and increase for irrigators.

Distributional Effect: C) Did the physical strain of work change to the point of affecting workers' health?

Workers' health was unchanged.

Distributional Effect: D) Was a specific level of education or level of experience required for effective implementation?

The role of education for EPI implementation is not directly evident. However, the feeling is that those who are young and who have a higher level of education are more involved in farming activities with a "business profile" and would benefit more from the shift to volumetric pricing.

Distributional Effect: E) Did the EPI implementation process provide education (or awareness) in itself?

The implementation process did not provide awareness in itself because farmers were already aware of the relevant issues. In fact, the increase in water tariffs related to the area-based water pricing system was the main reason for changing the water

pricing system. For this reason, this EPI represents a good result related to the knowledge of water quantities used and the possibility to reduce uses and costs.
This result demonstrates that farmers were already aware of costs and the "value" associated with water and the (economic) need for a more efficient use of water resources.

Distributional Effect: F) Were leisure activities (indirectly) affected?

Leisure activities were not investigated in the case study.
However, it is possible to make some considerations about labour savings derived from the cessation of irrigation activity. In fact, irrigation activities require time for management and the main consequence of stopping irrigation is likely some savings in terms of labour. The farmers saving labour are most likely to re-allocate such time to other farming activities. At this stage, we do not have any direct information about the relevance of this issue, as these considerations came from the qualitative assessments of researchers and RIBRO technical staff.

Distributional Effect: G) Were staff reductions or increases made as a result of implementation?

No information is available regarding staff reductions or increases as a result of the implementation or changes in crop mix.

Distributional Effect: H) Do stakeholders feel they have a greater or weaker say?

The role of farmers during the period did not change due to the existence of the Tarabina Management Committee (TMC) since 1982. In the TMC, farmers can vote for their representatives. It is possible that the farmers' say became stronger during the period and hypothetically that the social relationships between farmers improved, as an result of the interactions and collective decisions required for the implementation of the EPI.

Distributional Effect: I) Did social connections and relationships change?

Social connections and relationships did not change.
After the set up of the TMC, farmers were directly involved in the decision process (even in the introduction of the EPI). As a result, the TMC raised the problem and proposed a possible solution. Thereafter the RIBRO accepted the proposed solution and quantified the amount of trinomial tariffs.

3.4 Institutions

Institution: A) Describe institutions (culture, attitudes, norms, laws…) affecting the creation of the EPI

The main organizations involved in the case study are at the local level and this depends on the dimension of the area of the EPI implementation. The organizations that are relevant are at Level 4 and Level 3: the first level (Level 4) includes the Reclamation and Irrigation Board of Romagna Occidentale (RIBRO) and the Canale Emiliano Romagnolo (CER) and the second level (Level 3) includes the Tarabina Management Committee. These organizations were set up at different times: organizations at Level 3 started at the beginning of the 1900s (1933 and 1939), while the TMC is much more recent (1982).
At the national level, RIBs were introduced in 1933 (R.D. 215/1933).
The RIBs are subject to both regional laws (L.R.) and national laws. In fact, in 1984 a more complete vision of RIBs related to use, monitoring and protection was provided (L.R 42/1984). The original role of the RIBs was land reclamation. During the introduction of the Water Framework Directive (WFD 60/200) the role of RIBs, with respect to environmental aspects, was identified by Italian national law 152/2006.
For the purposes of this study, the main role of RIBs is to distribute water resources for irrigation, and to recover the costs incurred. Formally speaking the RIBs are constituted by all the building owners in a given area who are responsible for the election of the administrative council of RIBs.
More in detail, the main objectives of the RIBs are: planning reclamations and irrigation structures, participating in activities related to land protection, managing water use for irrigation and other uses. In our case study we focus on the RIBRO (www.bonificalugo.it) and its interest is in: planning suggestions for hydrological harmonization, planning future programmes related to reclamation and irrigation, construction of infrastructures for reclamation and irrigation.
Another important organization is the CER, a second level RIB. It manages the homonymous canal, which is one of the most important hydraulic infrastructures in Italy. It takes water from the Po River to plain areas of eastern Emilia-Romagna, making water available for irrigation uses in the RIBRO area.
The Tarabina Management Committee (TMC) was instituted after the construction of the pressure pipe system in 1983. The formation of the TMC was justified by the definition of Tarabina as a "costs centre". The TMC also has its own statute. It is composed of 9 members, 7 of which are farmers elected by local farmers and 2 are representatives of the RIBRO.
The relationship between these three organizations is considered to be quite good and this facilitated the EPI implementation. In fact, the long-term contracts between RIBRO and CER guarantee the water supply in the area and this avoids water scarcity problems. The water management activities proposed by the RIBRO can be supported and shared by farmers through the TMC. The sharing of water pricing amongst farmers represents one of the main points in the EPI implementation process in order to guarantee its acceptance. In addition, TMC can propose changes in the water management on the basis of farmers' needs.

With regard to culture and attitudes, the case study area is characterized by the presence of several cooperatives (Level 1) that link farmers through shared preservation, processing and selling of their products. Another aspect that highlights the level of entrepreneurship of the farmers in the area is the specificity of the crop cultivated, as industrial seeds require good relationships with market buyers and professional ability for cultivation.
The strong presence of national farmers associations helps avoid, or mediates in the case of, conflicts among farmers (Level 1).

Institution: B) How did these institutions affect the design, implementation and/or operations of the EPI?

The design, implementation and operations of the EPI involved all the organizations (see previous section) in several steps. The process was initiated as a result of the complaints from farmers who were non-irrigators and paid for irrigation on the basis of area-based water pricing system. The water tariff became too high and farmers suggested changing the water pricing system in such a way as to take into account the amount of water used. The TMC, as representative of farmers' needs, submitted a proposal to the technical staff of the RIBRO. RIBRO was in favour of change and suggested shifting to a volumetric water pricing system through water metering installation. The move to a new water pricing system benefited from the definition of the area as a "cost centre". The tariff was designed to recover all costs from farmers in the area. In addition, given the small area involved the identification of irrigators and non-irrigators was accomplished by way of a direct verification process (farm by farm).

Institution: C) Did the EPI have an impact on existing institutions or establish new ones?

The EPI did not affect the existing institutions.

Institution: D) If the EPI failed, then can that failure be traced to an existing institution?

The EPI did not fail.

3.5 Policy Implementability

Policy Implementability: A) To what extent was the EPI a flexible instrument, which could be adapted to local particularities (*ex-ante* and *ex-post* implementation)?

The flexibility of the EPI is particularly connected with some characteristics of the specific case study. In the Tarabina area, the EPI implementation can be considered simple by virtue of its nature and the existing governance system. The simplicity of the implementation depended on the small size of the area, which enabled tailoring the EPI to the local particularities: the existence of a pressure pipe system, a "cost centre" definition, and the existence of a management committee (TMC). In addition to these characteristics, the fact that the EPI implementation was voluntarily chosen by the farming community positively impacted on the EPI's implementability.
With regard to the local particularities, the presence of the pressure pipe system helped avoid major technical costs (for the implementation of a metering system). Furthermore the definition of the area as a "cost centre" had already clarified the group of users and the TMC provided a link between farmers' needs and the technical staff of RIBRO.

Policy Implementability: B) Did public participation play an important role in the choice, design and implementation of the EPI? Did the EPI match broadly held societal values? Were there powerful stakeholder groups with dominant opinions?

There was a very low level of public participation in the design and implementation of the EPI. This depended on the nature of the EPI and the agents involved in its implementation. Firstly, the EPI is a technical (water meter adoption) and economic (cost re-allocation) instrument specifically related to irrigation activity. Secondly, the EPI only affected farmers in the Tarabina area and the role of the RIBRO supported the process of the EPI implementation. For these reasons, this specific EPI does not have a role as a safeguarding mechanism to prevent adverse effects.

Policy Implementability: C) Was there cooperation and coordination between the different ministries, such as the Ministries of Finance, Agriculture etc. and within the different levels of Ministries and the central/ federal government?

EPI implementation did not involve Ministries or the Central Government.
The EPI process was promoted by the cooperation and coordination between TMC and RIBRO. These two aspects are identified in the creation of a contract in order to identify the water tariffs both for irrigators and non-irrigators.
However, the role of farmers within the TMC represents a key node in the explanation of farmers needs in order to solve problems related to cost allocations.

Policy Implementability: D) Can synergies between the EPI and sectoral policies be identified and taken advantage of? On the contrary, were there any barriers linked to other policies that impeded the successful implementation of the EPI?

In the area, synergies between EPI and sectoral policies are identified. In particular, it is possible to identify two main aspects:

- EPI is coherent with the needs of the farmers who claim the need for cost reductions in general and, specifically, related to water use;
- the decoupling of payments introduced in 2005 by the Common Agriculture Policy reform (CAP) likely helped in the reduction of the quantity of water used (at the least the CAP reform was not in conflict with it).

Other policies are not relevant for the case study. In particular, in the context of the EPI implementation, the aspects related to WFD were not important in the process of the implementation, even if the technical staff of RIBRO knew the WFD. The interactions between EPI and the other policies are shown in Table 9.

Table 9 Interaction between the EPI with other relevant policies

EPI Policy Objective: Equity costs distributions		
Other sectoral policies (examples below)	Objectives of sectoral policies	Synergies and Barriers
Common Agricultural Policy (CAP)	The decoupling of payments introduced in 2005 by the Common Agriculture Policy reform (CAP) could help in the reduction of the quantity of water used (at the least the CAP is not in conflict with it).	+
EU Energy policy	Not related to the EPI	0
EU Nature Conservation Policies	Not related to the EPI	0
Water Framework Directive (WFD 60/200)	Not related to the EPI	0 When the process for the EPI implementation started, the WFD was already present but EPI was not related to it

Notes: + represents a positive synergy between the objectives of the EPI and the other policy; 3 levels: + (low positive interaction),++ (medium),+++ (high positive interaction)
0 represents no discernible interaction
- represents a negative effect between the objectives of the EPI and the other policy; 3 levels: - (low negative interaction),-- (medium),--- (high negative interaction)

3.6 Transaction Costs

Transaction Costs: A) How were transaction costs defined in the available literature for the case study?

On the basis of our knowledge, there are no existing studies in this area that analyse transaction costs. However, it is possible to hypothesize that transaction costs are highly correlated with: a) the purchase of water meters, b) a system to control and identify non-irrigator farmers; and c) data collection related to water use.

The cost of water meters is equal to 193€ + VAT and is funded by farmers wanting to irrigate. Information about b) and c) is missing. In addition, the infrastructure was not modified, so this did not imply any transaction costs.
Another point to consider is that transaction costs are correlated to the ability of institutions to deal with administrative and negotiation matters. In our case the good collaboration between the TMC and the RIBRO likely kept transaction costs low.

Transaction Costs: B) What was the number and role of actors involved? How many authorities are involved in the EPI design, implementation, monitoring and enforcement? Did they have clear roles or did these overlap?

Two authorities were involved in the EPI implementation process: the RIBRO and the TMC. Their roles did not overlap because the TMC represents farmers' needs and the RIBRO manages and allocates water for irrigation uses.
The role of the RIBRO was to find a solution in line with farmers' expectations and M&O costs.

Transaction Costs: C) What was the methodology to choose the EPI? How long did it take to select the EPI? And to implement it? What administrative procedures were involved in these steps?

The selection is described in the EPI Background section; there was not a specific "methodology" in place.

Transaction Costs: D) Was any guidance provided to decision makers? Were any decision-support tools (i.e. models) or studies used to understand the EPI? Did these planning instruments consider and/or minimize TCs?

The role of guidance for decision makers still remains residual. If RIBRO is considered as a decision maker, its role was in the identification of components related to the volumetric water pricing system. In fact, on the basis of the M&O cost recovery principle and without any decision support tool, RIBRO made decisions regarding the pricing structure and quantified the related tariff components.

Transaction Costs: E) Was the EPI subject to asymmetric information problems? How were these integrated into its design and operation?

The way asymmetric information affected the EPI design is described in the economic section. It is likely that information asymmetries contributed to transaction costs; however the amounts do not appear to be particularly relevant.

Transaction Costs: F) Was the EPI applied in combination with other EPIs or other water policy instruments, i.e., existing institutions that would raise or lower TCs in the course of changing the EPI's economic, environmental or social impacts?

RIBRO recovers costs and manages activities both for reclamation and irrigation services. Reclamation service costs are recovered using other tariffs paid by all building owners located in the area.
Without RIBRO occupying both roles, another institution would be required with as a result, a significant increase in transaction costs.

Transaction Costs: G) What monitoring and enforcement costs existed? How large were they?

Monitoring costs increased after the EPI implementation. In fact, data collection concerning use is undertaken directly on the farm by the RIBRO technical staff who download water meter information. In addition, the time spent in the calculation of water tariffs increased and so did the related costs.

Transaction Costs: H) What TCs can be attributed to formal meetings and negotiations over the form or operation of the EPI?

These activities certainly involved some costs, but it is not possible to estimate their amount at this stage.

3.7 Uncertainty

Uncertainty: A) Was the objective of the EPI clearly specified and quantitatively measurable?

The core EPI objective was to re-allocate water cost distribution on the basis of the "user pays principle" between non-irrigators and irrigators. This aspect was clearly measurable because the water was already measured prior and was measured after the change in the pricing system.

Uncertainty: B) Could the fulfilment of the objective be quantitatively or qualitatively determined with sufficient precision?

The fulfilment of the objective was well determinate. The outcomes identified are specified with sufficient precision (see pedigree matrix Table A2 in Annex I). The main outcomes are overall cost reductions related to: cost re-allocations, water-saving and energy-saving.
Cost re-allocations were determined with sufficient precision because farmers are classified as either irrigators or non-irrigators. However, not all costs are recovered because RIBRO recovers only the financial and M&O costs. This means that the

environmental and resource costs (Art. 9 WFD 60/2000) are not considered in the RIBRO's calculation of costs.
The total water-saving is measured effectively; the individual water use computation suffers from the uncorrected behaviour of those farmers who can use a greater amount of water than can be measured by the water meters.
There are no relevant uncertainty issues in the measurement of energy-saving.
In all cases, there are some difficulties in identifying an appropriate baseline (see below).

Uncertainty: C) Could the fulfilment (or its part) of the objective be attributed to the EPI? Would the objective have been fulfilled if the EPI had not been introduced? In other words, what was the difference between the baseline scenario (without EPI) and the empirically ascertained outcomes of the EPI?

It is possible to evaluate the difference between a baseline scenario and the empirically ascertained outcomes of the EPI. In fact, within the RIBRO area, a comparable area can be identified to be used as a baseline. Even if a baseline is present in this case study, it is not clearly possible to isolate the EPI contribution to the water saving with certainty. In fact, water use is affected by several variables: seasonality, market prices, and CAP reforms (Common Agriculture Policy).
With regard to seasonality, water use depends on rainfall and temperature. For example, in 2003 there was lower than usual precipitation and higher temperatures in the summer months hence the water amount use increased in that year. Moreover, water use uncertainty depends on crop production., Crop production in the area is influenced by the possibility of farmers to have production contracts with downstream firms. Furthermore, the CAP reforms may influence water use.
The comparable area, known as Selice, covers a surface area of around 1400ha and has a pressure pipe system without metering. Selice and Tarabina are neighbours and the farmers' characteristics are quite similar, both in terms of the crops grown and socio-demographic aspects. These characteristics allow us to consider the comparability of the two areas as a meaningful way to assess differential effects of the EPI.
Figure 8 reports the water use in the two areas. The amount of water use is standardized which means that the standard score (new value) is a dimensionless quantity derived by subtracting the population mean from an individual raw score and then dividing the difference by the population standard deviation. In other words, using the standardization, problems related to order of magnitude are deleted.

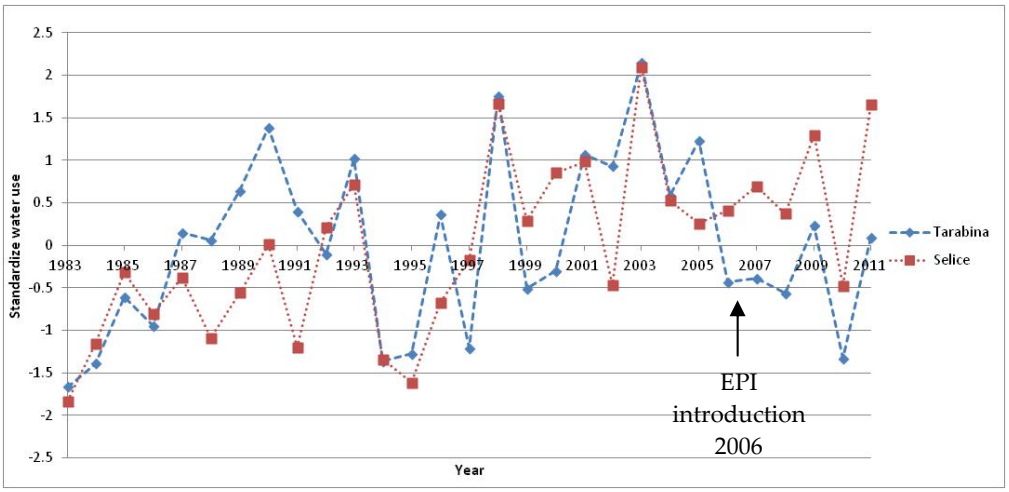

Figure 8 Comparison between standardized water use in Tarabina (blue line) and Selice (red line) in the period 1983-2010.
Source: Our elaboration on RIBRO data

The graph shows that water use is quite variable. Water use before the EPI and the trend of the two time series seems to be similar. After the implementation of the EPI (2006), water use decreases in Tarabina while in Selice it remains the same . It is possible to deduce that the volumetric water pricing system has reduced water use in Tarabina.

Uncertainty: D) To what extent was the EPI felt to be an appropriate tool at the time of introduction?

EPI was considered to be an appropriate tool.

4 Conclusions

The Tarabina case study investigates the adoption of a volumetric water pricing system in the agricultural sector. Even though the area examined is quite small, the EPI application can be considered significant within the Italian context. In fact, based on the authors' knowledge, the case study represents the only one of its kind related to EPI implementation.
Some specific conditions have a crucial role in the mechanism about the implementation of EPI. Firstly, a pressure pipe system had already been used in the Tarabina area; no costs for its construction had to be considered and this offered a suitable case for the construction of a baseline able to isolate the effect of the EPI from other interventions (e.g. pipe construction). In addition, the identification of Tarabina as a "cost centre" allows for measuring (and hence potentially recovering) all costs related to it, as they are already separately identified in the RIB accounting system.

Moreover, the presence of targeted institutions able to offer clear and timely solutions reduced transaction costs of changes in the tariff system. Finally, long- term contracts between RIBRO and CER for water supply eliminate problems related to water scarcity, hence allowing EPI to focus only on economic aspects (as compared to EPIs mainly driven by water savings concerns).
The main reason for the introduction of the EPI was the increase in water tariffs during the period 1983-2005. Such increases also caused high inequalities between users (irrigators and non-irrigators). Accordingly, farmers representatives elected to the TMC, with the assistance of the RIBRO, sought a solution to reduce inequality and overall costs.
The solution identified was the implementation of water metering and the shift to a volumetric water pricing system.
The EPI provided multiple impacts related to economic, environment and social aspects. The economic impacts are most evident, in particular those related to the decrease in water delivery costs and the change in the distribution of contribution costs among farmers. In particular, a noteworthy cost reduction for non-irrigators occurred, due to a more efficient cost distribution based on quantity used. With regard to the environment, due to a decrease in water used, the amount of water remaining in the environment increased. Finally, regarding social aspects, the EPI increased the level of 'social agreement' within the group of non-irrigators.

4.1 Lessons learned

The implementation of this EPI can be considered to have been successful with respect to its main (explicit or implicit) objectives.
The main reason can be found in the nature of the mechanism that generated the EPI: it was voluntarily adopted by the whole farming community and this made the implementation more acceptable from a social point of view. In particular, the main objective was to address an existing inequity between irrigators and non-irrigators, and to reverse increasing cost trends. The disparity prior to the implementation of the EPI was perceived mainly by non-irrigators who paid the same area-based tariff as irrigators. Improved equity was obtained by introducing a volumetric water pricing system that applies tariffs based on differing water use.
Due to their sense of involvement and indeed participation in the decision making process, the degree of agreement on the part of the farmers with regard to the implementation of an economic instrument was high.
The direct consequence of the EPI was a significant tariff reduction for non-irrigators.
A secondary effect was a more rational use of the resource by irrigators in two ways: reduction of use (water conservation) and increased awareness of the resource value.
Altogether this allowed for a clear increase in the efficiency of the distribution system.

4.2 Enabling / Disabling Factors

Characteristics that positively influenced the implementation of the EPI include the following:

- the small size of the area made control and management easier;
- the area is defined as a "cost centre" therefore it is possible to calculate the amount of all costs, and costs must be recovered from farmers. These characteristics define users who are required to pay and the amount of costs to recover;
- the direct role of farmers in the TMC helped the implementation of the EPI;
- the role of the institution is important because it translates farmers' needs into operative instruments;
- the implementation of EPI was not an imposition by the institutions. because alternative water pricing respect to area-based was proposed by farmers through TMC.

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Eurostat: http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/
Working Census Data. Emilia Romagna 2010:
http://censimentoagricoltura.istat.it/index.php?id=73
Italian WFD 60/2000 web site: http://www.direttivaacque.minambiente.it/index.html

6 Data Sources

Regolamento per l'esercizio e la manutenzione dell'impianto pluvirriguo "Tarabina". Consorzio di Bonifica della Romagna Occidentale 2011

Water use by the Consorzio di Bonifica Romagna Occidentale (RIBRO)

7 Annexes

Table A1 Distributional Effects and Social Equity (RIBRO technical staff)

Criteria	**Direction of change**				
	--	**-**	**0**	**+**	**++**
Material Living Standards				X	
Health			X		
Education			X		
Personal Activities			X		
Employment			X		
Environment			X		
Security			x		
Political Voice				X	
Social connections and relationships				X	

Table A2 Pedigree matrix

	Cost distribution allocated	Water Use	Energy costs
EPI to be assessed	-70% for non-irrigators -50% for irrigators	reduction	reduction
Proxy	4	4	4
Empirical	2	2	2
Method	1	1	1

Annex II: Contributors to the report/Acknowledgments

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